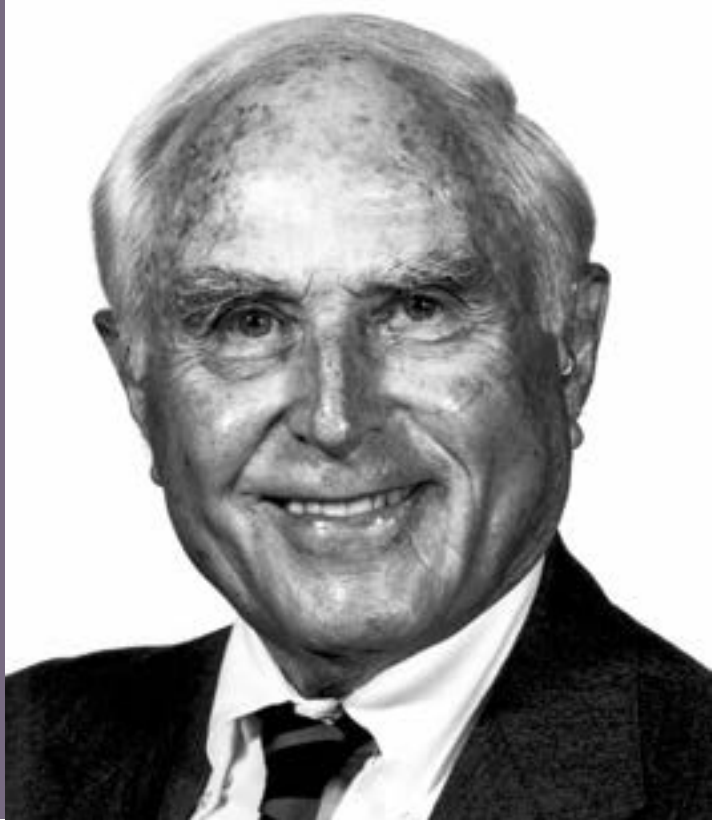
Ascher H. Shapiro

1916–2004

BIOGRAPHICAL *Memoirs*



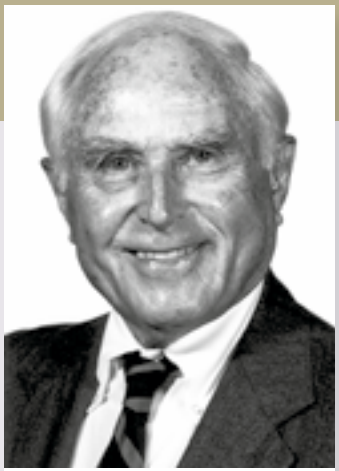
A Biographical Memoir by
Ronald F. Probstein

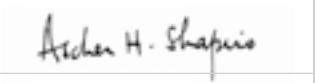
NATIONAL ACADEMY OF SCIENCES

ASCHER HERMAN **SHAPIRO**

May 20, 1916–November 26, 2004

Elected to the NAS, 1967





By Ronald F. Probstein

Ascher H. Shapiro was a pioneer in the field of biomedical engineering and one of the twentieth century's leading authorities in fluid mechanics research and education. Among his many research contributions, Ascher was best known for his recognition in the early 1960s that problems of physiology and medicine could profit from applying the knowledge of mechanics, together with the methods, concepts, and skills of engineering. Biomedical engineering was virtually an unknown entity when Ascher turned his research activities in that direction. He subsequently made major contributions in applications of engineering to diagnosis and therapy for disorders of the cardiovascular system, the urinary system, and the respiratory system.

Early life

Ascher Shapiro was a native of New York City, raised in Brooklyn. His father, Bernard Shapiro, emigrated from Lithuania to the United States as a teenager in about 1898, and later developed a career dealing in paper goods. His mother, Jenny Kaplan Shapiro, emigrated with her parents from Lithuania in about 1892, when she was five.

As a young boy, Ascher was very active in athletics, and remained so for the better part of his life. He entered the College of Arts & Sciences of the City College of New York in 1932 at the age of 16. There, he was on the boxing team, a very popular sport in the thirties. I don't know what winnings he might have earned, other than a broken nose. Ascher's training as a fighter was ideal for someone who chose to spend his life at M.I.T.

By 1935 he felt he wasn't getting much value from his coursework at City College, and he dropped out. This was during the Great Depression, and one day he found himself standing in a long line applying for a job as a shoe salesman. The owner realized he knew nothing about shoes, but his charm and quick learning ability got him hired. After a short while, he decided to return to school. He transferred what City College credits

he could, and went to M.I.T. to study mechanical engineering. To the credit of City College, they never held his departure against him, for in 1976 they awarded him their prestigious Townsend Harris Medal. His family and friends do not recall how his interest in science developed.

Massachusetts Institute of Technology

Ascher received his Sc.B. and Sc.D. degrees from M.I.T. in 1938 and 1946 respectively. Starting as a laboratory assistant in mechanical engineering in 1938, he was appointed instructor in 1940, promoted to assistant professor in 1943, associate professor in 1947, and professor in 1952. In 1962 he was named to the chair of Ford Professor of Engineering. He was appointed to the rank of institute professor in 1975, the highest rank at M.I.T., awarded to only a few sterling professors of the highest distinction. He served as chairman of the M.I.T. faculty in 1964-1965, resigning that post to become head of the department of mechanical engineering. He remained department head until 1974, at which time he joyfully returned to teaching and more active research. In 1955-56, he was a visiting professor at Cambridge University, England. He retired from the active faculty in 1986 with 48 years of service behind him.

After joining the M.I.T. faculty, Ascher's research and professional activities were for twenty-five years related principally to power production, high-speed flight, turbomachinery, and propulsion by jet engines and rockets. During World War II, he directed a U.S. Navy laboratory charged with the development of turbine propulsion engines. This work culminated in the publication of his classic two-volume text *The Dynamics and Thermodynamics of Compressible Fluid Flow* (Vol. I, 1953; Vol. II, 1954), which was the most widely used and cited text on the subject in the second half of the twentieth century and remains in use to the present.

He was a member of the Lexington Project, which in 1948 evaluated the technical feasibility of nuclear powered aircraft, in the course of which he invented a nuclear-aircraft-propulsion system. In 1953 he directed Project Dynamo, which evaluated for the Atomic Energy Commission the technology and economics of nuclear power for civilian electricity production.

I joined the faculty of the M.I.T. department of mechanical engineering in 1962, at about the time that Ascher turned his activities to biomedical engineering, a field that he pioneered. He and his group collaborated with physiologists, physicians and surgeons at several institutions in Boston: the Massachusetts General Hospital, Brigham

and Women's Hospital, Beth Israel Hospital, Harvard School of Public Health, and Massachusetts Eye and Ear Infirmary. Their efforts were directed toward intra-aortic balloon counter pulsation for patients in heart failure; post-surgical external pneumatic compression of legs for the prevention of deep vein thrombosis; intermittent compression of the lower body for non-invasive cardiac assist; and pulmonary therapy using high frequency ventilation. He and his group also applied fundamental fluid mechanical knowledge to gain a better understanding of asthma, emphysema, and glaucoma.

Ascher was not only a brilliant researcher but also an outstanding teacher, revered by students who took his courses and those who studied with him. On his 80th birthday, dozens of his former students came from far and wide to attend a party held in his honor. They wrote letters to him on this occasion, which I subsequently bound into a volume that I gave to Ascher. The letters on Ascher's teaching were uniform in their praise: "the clear presentation and excellent content of your courses have continued to be a source of inspiration to me;" "you have been the ablest and most influential teacher of fluid mechanics over the past generation;" "you set an example of teaching effectiveness in your courses that I have never seen surpassed." These comments reflect the enthusiasm for Ascher's teaching prowess exuded in every letter.

Fluid mechanics films

As a teacher, Ascher became concerned by students' lack of awareness of the experimental phenomena addressed in their classroom lectures. In the early 1960s, he came up with the idea of producing films that would make the important experimental phenomena of fluid mechanics easily visible. To carry this out, he founded the National Committee for Fluid Mechanics Films, of which he was the first chairman. Largely through force of will he corralled the best experts in the world on the diverse range of areas that constituted fluid mechanics, and with the sponsorship of the National Science Foundation the Committee produced more than twenty major films and over one hundred short subjects, making the important experimental phenomena of fluid mechanics visible. More than forty-five years after their release, the films, which are still widely used, can now be streamed directly from the Internet. Ascher himself was the writer and principal of three films in the series. He received international recognition for his development of motion pictures as a significant component of engineering education.

Ascher was a man for all seasons; when his efforts to make and produce his fluid mechanics films brought him into contact with movie making he confided to me that he really would have loved to have been a filmmaker. But that was only one of his many

facets, for as his work in biomedical studies expanded he also told me that if he had to start it all over again he would have chosen to be a doctor. When he was on the squash court, where his athleticism showed itself at a high level, he always said that he should have devoted himself more to athletics. He was just good at many things, and whatever he tackled he did with an energy and wholeheartedness that led to expertise.

Ascher loved to have a good time; he was always good-humored, and great fun to be with. We were close friends for over forty years and went out together regularly. Ascher had a wide circle of friends outside academia, and brought my wife Irène and me together with many of them at dinners, parties, and social events where, despite his quiet demeanor, he was invariably the most sought after individual. It was not uncommon to see his smiling face at a social event pictured in the Boston Globe, although it is only fair to say that the beauty of his wife Kay (née Kathleen) contributed much to the interest of the press. But Kay's contributions were much more than beauty. Her devotion and attention to Ascher, especially in his later years, were visible to all and mentioned frequently to me by Ascher in the most thankful of ways.

Ascher's brilliant technical career could not be separated from M.I.T. He was devoted to the institute for which throughout his life he had the highest regard and respect and which he served loyally and in many academic and administrative positions. He also provided broad support for some thirty years to the development of the Technion—Israel Institute of Technology. For twenty years he served on Technion's Board of Governors and chaired the Academic Development Committee of the Board. He introduced a modern curriculum and research programs into both mechanical engineering and biomedical engineering. In 1985 Technion awarded him an honorary doctorate "in recognition of his outstanding achievements in the field of fluid mechanics, for his contributions to engineering education, and in appreciation of his devoted efforts to the advancement of the Technion."

Engineering education

Besides his teaching and research Ascher was particularly active in revising and improving engineering education. A curriculum study of the engineering sciences which he headed in 1958 strongly influenced departments of the School of Engineering at M.I.T. and ultimately had a national impact. In the post-World War II years the goals and methods of engineering education underwent radical change, a process to which his study contributed greatly.

Ascher understood the importance of providing young engineers with the flexibility to be effective professionally over a working lifetime in the face of rapidly accelerating advances in technology. He felt this required a strong understanding of the engineering sciences upon which engineering practice is based. Also during his tenure as head of the Department of Mechanical Engineering he encouraged the growth of biomedical research and teaching, and made it a major focus of activity.

Ascher served on many advisory groups to government agencies, including the National Advisory Committee for Aeronautics (predecessor to NASA), the Atomic Energy Commission, the Office of Defense, and the National Institutes of Health. He served as a member of the Scientific Advisory Board of the U.S. Air Force, the Committee on Science and Public Policy of the National Academy of Sciences and on professional committees of the American Society of Mechanical Engineers. He also acted as a consultant to many industrial firms.

The scope of Ascher's work is illustrated by his extensive technical publications. These included 139 journal articles in areas of thermodynamics, fluid dynamics, propulsion, engineering education, and biomedical engineering, two books and contributions to eight books, ten patents, three motion pictures, and thirty-nine color videocassette lectures on fluid dynamics accompanied by a three-volume study guide. Though he didn't mention it to me, around 1986 Ascher also published a charming children's book. Such a massive output would normally leave the impression that Ascher had little time for anything else. This was far from the case. In particular, he loved to hear and play classical music.

At the age of 20, while an undergraduate at M.I.T., he ordered a flute from the world famous Verne Q. Powell in Boston. It took him a year to receive the flute. Among his teachers at the time was a flutist of the Boston Symphony. He played the flute at home as often as he could, but most frequently on Saturdays and Sundays, when he would spend six hours practicing. He played until he was more than 60 years old, at which point he fractured his upper arm, became unable to raise it comfortably to play, and had to give up the instrument. He gave the flute to his granddaughter Valery Handel, who played a Mozart piece in G major for solo flute on it at Ascher's M.I.T. memorial service in 2005. Apples don't fall far from the tree, and music seemed to run in Ascher's family: his son Peter Shapiro is a professional rhythm and blues musician and his daughter Mary Handel was a ballet dancer. His other daughter, Martha Margowsky, was the jock of he family, a professional cyclist who preferred athletics to music.

Honors and awards

Ascher received many honors and awards. In 1947, he was recognized by the War and Navy Departments for his outstanding contributions. In 1952, he was honored by election to the American Academy of Arts & Sciences. In 1960, he received the Richards Memorial Award of the American Society of Mechanical Engineers, and in 1965 the same society bestowed upon him the Worcester Reed Warner Medal for contributions to the permanent literature of engineering. In 1977, he received the Lamme Medal, the principal award of the American Society for Engineering Education, "In recognition of distinguished achievements which contribute to the advancement of engineering education."

In 1978, he received an honorary doctorate from the University of Salford, England. He received the 1981 Fluids Engineering Award of the American Society of Mechanical Engineers, "in recognition of his worldwide contribution to fluid mechanics though his articles, books and teaching films; for his well-known and extensive research in propulsion, turbomachinery and biological systems, and for organizational achievements in the teaching of fluid mechanics." In 1984, he was the recipient of the J. P. DenHartog Distinguished Educator Award, conferred for excellence in teaching; he was cited as "an inspiration to students…[and for] the development of engineering insight and engineering judgment."

I believe the honors that meant most to him were his election to the National Academy of Sciences in 1967 and his election to the National Academy of Engineering in 1974, since these were the only two he had hanging on his office wall.

Ascher Shapiro will be remembered as a pioneer of the field of biomedical engineering, in which he was one of the first individuals to recognize the importance of mechanics to understanding problems in physiology and medicine. He will also be remembered for introducing the field into university education, and for the idea of making films for use in the classroom that show the important experimental phenomena of fluid mechanics, which led to the development of educational films used across the spectrum of engineering education worldwide.

Ascher died at age 88 of liver cancer. He was survived by his third wife Kay, who died in 2011. His earlier marriages to Sylvia Charm (deceased 1981) and Regina Julia Lee (deceased 2012) ended in divorce. Ascher had three children by his first wife Sylvia: Peter

Shapiro, Martha Margowsky, and Mary Handel. Mary lives in Israel and is the mother of Ascher's two grandchildren, Jonathan Barlev and Valery Handel.

ACKNOWLEDGEMENTS

I wish to conclude by most sincerely thanking Peter, Martha, and Mary for all the information and help they gave me in the preparation of this memoir of their father.

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