LARRY L. HENCH

1938–2015

Elected in 2000

"For the development of bioactive glasses for human prostheses and fundamental studies of glass corrosion."

BY MARTIN E. GLICKSMAN AND MICHAEL FENN

LARRY L. HENCH passed away at the age of 77, on December 16, 2015, at his home in Ft. Myers, Florida.

He was born November 21, 1938, to Clarence and Mary Hench and raised on their farm in the rural town of Tiro, Ohio, where he graduated from high school with a few dozen fellow students. He received his bachelor's degree in 1961 and his doctoral degree in 1964, both in ceramic engineering, from the Ohio State University, and began his academic career in 1964 as a young professor of materials science and engineering at the University of Florida.

His ceramics research was focused initially on structural ceramics for radiation and nuclear waste applications. It was a casual conversation in 1967 with an Army colonel seated next to him on a bus ride from a conference that changed the course of biomaterials history.

The colonel explained to Larry the pressing need for a material that could help regenerate or repair the lost limbs of injured soldiers returning home from the Vietnam War. It was that serendipitous conversation that convinced Larry to redirect his efforts to the development of a new bioactive material capable of mimicking the properties of human mineralized bone. His decision prompted a series of events leading to a monumental discovery.

Although he lacked medical training, he understood that bone was fundamentally a living ceramic and fell within the scope of his scientific interests. With that intellectual stimulus, he set out to create a compatible inorganic material suited for implantation and regeneration of human bone tissue.

After expanding his understanding of ceramics with knowledge garnered from several textbooks familiar at the time to first-year medical students, Larry successfully applied for and received a small research grant from the US Army Medical R&D Command. That funding was the second in a series of three decisive events that led to the discovery of Bioglass.

Through the intense efforts of Larry and his graduate students, the first manmade material to bond to living tissue was invented in 1969, Bioglass 45S5. This was the third critical step, in which Larry determined the compositional "sweet spot" for the first synthesis of glassy biomaterials, which his research team proved to be a success: bonding with living bone without inflammatory rejection.

The story of the creation of Bioglass is one that many might call a series of fortunate coincidences, pure chance, or just plain luck, but Larry often referred to the chronology as "a series of three miracles."

These early experiments were the foundation of the subfield of bioactive materials and led to the coining of the term *bioactive glass*. They established a benchmark, still in use, to characterize the bioactivity of an inorganic material.

Bioglass led to successes throughout the 1980s and 1990s, many resulting in patent filings and Food and Drug Administration (FDA) approvals. Of particular importance to the hearing impaired was the FDA's approval in the mid-1980s of the use of bioactive glass devices as ossicular chain implants for the reconstruction of the minuscule bones of the middle ear to restore hearing.

Subsequent FDA approval allowed bioactive glass implants to replace missing teeth, enabling maintenance of jaw stability and repair of maxillofacial bone defects. In the 1990s the FDA approved the use of a particulate form of bioactive glass to support new bone growth to repair damage from periodontal

disease. Other FDA-approved applications followed for Bioglass applications in orthopaedic surgery, including repair of bone lesions and spinal defects, and for revision surgeries of failed hip and knee prostheses. Bioglass 45S5 and related compositions in clinical use throughout the world have helped to repair bones, joints, and teeth for millions of people.

Additionally, twelve companies, including US Biomaterials Corp. and NovaBone Products LLC, were founded on technologies fundamentally created in Professor Hench's laboratories. These entrepreneurial endeavors produced a host of useful medical products that led to technology awards, created jobs, and provided significant economic gains. As just one example, a formulation of particulate Bioglass called NovaMin® (acquired by GlaxoSmithKline) is one of the active ingredients in Sensodyne® Repair and Protect toothpaste (not available in the United States).

Larry Hench held a number of academic positions and advised and mentored over a hundred graduate students and postdoctoral scholars. After serving 32 years on the faculty of the University of Florida, he "retired" as emeritus professor and in 1996 joined Imperial College London as chair of its Ceramic Materials Department.

At Imperial College his contributions to the fields of science, engineering, and medicine flourished and expanded, as he cofounded, with Julia Polak, the Tissue Engineering and Regenerative Medicine Centre and was its codirector. In 2008 he established, through the London Materials Society, the annual June Wilson Memorial Award to commemorate his late wife's achievements in the field of biomedical materials research. In 2011 Imperial College London established the Larry Hench Award for best PhD in Biomaterials and Tissue Engineering.

Larry returned to the United States after a decade at Imperial College. He was invited to assist in the development of the new Biomedical Engineering Department at the Florida Institute of Technology, Melbourne. For almost three years, even as his health deteriorated, he continued to make contributions in the materials science and engineering community,

while pursuing his lifelong passion for mentoring young faculty and teaching students. He helped to establish a thriving new research center that performs innovative research on bioactive materials and biophotonics.

In the 1980s he also served on national and international committees overseeing critical research on the problem of nuclear waste storage. His pioneering work in sponge fixation of nuclear wastes in glasses remains relevant today.

At the time of his death Larry was the University Professor of Biomedical Engineering in the Florida Institute of Technology's College of Engineering, and director of the Technology Center for Medical Materials and Photonics.

Larry published over 800 research papers and 30 books, including several textbooks with his wife June Wilson (e.g., *An Introduction to Bioceramics*, World Scientific Press, 1993; *Bioceramics*, Pergamon Press, 1995; *Clinical Performance of Skeletal Prostheses*, Springer, 1996). He gave expression to more wide-ranging thoughts in *Science, Faith and Ethics* (Imperial College Press, 2001), in which he explored the costs of an increasing reliance on and faith in science and technology to extend health and life. His last book, *A Biography of Bioglass*, came out in 2015 (Imperial College Press). He is also credited with 32 US patents.

His seminal contributions to the field of bioceramics throughout his career of more than 45 years earned him numerous honors. He was elected to the National Academy of Engineering in 2000. He was a member of the World Academy of Ceramics and a fellow of the American Ceramic Society (ACerS), Society of Glass Technology, and Institute of Materials. He was a founder and past president of the Society for Biomaterials (1979–80) and received its Clemson Award for Basic Research in 1977 and its Founders Award in 1998. Notably, he was a Distinguished Life Member ACerS, the society's highest award, and was awarded an honorary doctorate of engineering by the Rose Hulman Institute of Technology. In 2014 he was awarded the international Acta Biomaterialia Gold Medal Award, which recognizes lifetime excellence in research and development in the field of biomaterials.

Renowned for his influence in science and engineering, he was also a writer, philosopher, poet, admirer of fine art, first-rate chef, and talented raconteur. One of his gifts was his ability to relate science to general audiences.

His exceptional capacity to convey science in a funny yet highly educational manner is best embodied by the series of children's books he authored, featuring Boing-Boing the Bionic Cat. Inspired by experiences with his grandchildren, the series provides educational materials such as workbooks, experiment guides, and hands-on kits to stimulate youthful interest in science, technology, engineering, and mathematics (STEM). The legacy of Boing-Boing the Bionic Cat, as well as many of Larry's other achievements, will be memorialized at the Cade Museum for Creativity and Invention, under construction in Gainesville, FL.

Larry was also an extraordinarily giving man. He loved teaching students of all ages and was beloved by his students. He was an influential mentor to a number of individuals who have themselves become distinguished scientists. He forged many personal and professional relationships throughout his life, and touched many more. Although he appeared larger than life, he was a kind, humble, passionate, and caring man, with an infectious sense of humor and a deeply empathetic heart. He will be dearly missed, but never forgotten.

Larry L. Hench was laid to rest at the Forest Meadows Central Cemetery in Gainesville, beside his father. He is survived by his son Alan Hench (Oak Park, Texas); brother David Hench (Okeechobee, FL); stepchildren Martin Wilson (Merritt Island, FL), Sally Erickson (Birmingham, Michigan), Joanna Wilson (Epsom, Surrey, UK); nine grandchildren; and one great-grandchild. His companion for many years, Margaret Saunders, died shortly after his passing. He was predeceased by his wives Suzanne Hench and June Wilson-Hench and son Steven Hench.