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Remembering James Weaver, acclaimed researcher on bioelectric phenomena

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In his experimental and theoretical work Jim addressed the effects of strong and weak electric fields on biological systems, leading to findings with far-reaching implications.

James Weaver, 83, an acclaimed researcher and retired Senior Scientist in the Massachusetts Institute of Technology (MIT) Institute for Medical Engineering & Science, passed away on Nov. 3, 2023. Most of Weaver's 53 years at MIT was at the Division of Health Sciences and Technology (HST), which he joined at its inception.

A resident of Sudbury, Massachusetts, Weaver was originally from Faribault, Minnesota. As a youngster, he was passionate about building electrical and mechanical contraptions.

He received a BA in Physics from Carleton College, followed by a MS and PhD in Physics from Yale University. His affiliation with MIT started as a post-doc in John King's group in 1969. Weaver's early research was focused on scattering of low-temperature helium beams and scanning pinhole molecule microscopes. His transition into biophysics led to his early work on electrical properties of bilayer membranes and on the use of gel microdrops to separate cells by function and composition.

Weaver spent most of his career studying biological effects of electric fields, ubiquitous in modern society.

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In the midst of public debate on potential adverse effects of electrical power lines, Weaver and colleagues showed that straightforward thermodynamic analysis indicates such effects are unlikely. Weaver also developed one of the early theoretical frameworks describing cell and artificial bilayer membrane electroporation, a phenomenon that uses short, high-voltage pulses to transiently open cell membranes for intracellular delivery of molecules like DNA and has found widespread use in biology, biotechnology and medicine over the last 40 years. His more-recent work focused on understanding the intracellular effects caused by strong electrical pulses of nano- to micro-second duration.

Weaver also investigated several approaches to transdermal drug delivery. This led to new methods of creating openings in the stratum corneum barrier of the skin using electrical pulses, keratolytic molecules, and high-velocity streams of abrasive particles.

For his contribution to bioelectrochemistry research, Weaver was awarded the 2015 d'Arsonval Award by the Bioelectromagnetics Society and the 2013 Giulio Milazzo Prize for excellent achievements in bioelectrochemistry by the Bioelectrochemical Society. Weaver was elected a Fellow of the American Institute for Medical and Biological Engineering (AIMBE) in 2000 and served as president of the Bioelectrochemical Society from 1996 to 2003. He served as Chairman of the Gordon Conference on Biochemistry in 1996. Weaver was an inspiring mentor to many graduate students, post-docs and research scientists. He was also interested in biomedical technology transfer and headed HST's Biomedical Engineering Internship Program at MIT.

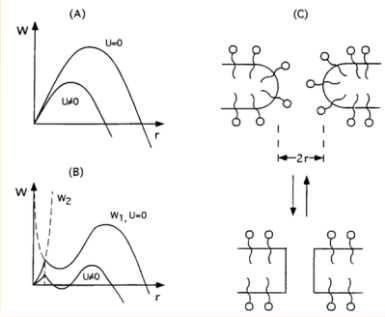
An avid cross-country skier, Weaver built a ski trail around his house. He designed and built his home, actively researching the materials and methods; a project he proclaimed 'ongoing' even after 40 years! Weaver is survived by Melanie, his wife of 57 years; daughter Valerie Grosso of New York City, NY; son Kenneth Weaver of Boylston, MA and four grandchildren.

Forthcoming events

XXVIII International Symposium on Bioelectrochemistry and Bioenergetics of the Bioelectrochemical Society
Madrid, May 19 – 23, 2024
https://congresosalcala.fgua.es/bes2024

9th European Medical and Biological Engineering Conference
Portorož, June 9 – 13, 2024
https://embec2024.org/

18th interdisciplinary postgraduate course and international workshop Electroporation Based Technologies and Treatments (EBTT)
Ljubljana, November 11 – 16, 2024 (*on-site* and *on-line* event)
https://ebtt.org/



Free energy change from pore creation reproduced from an early work by Weaver. He hypothesized a transition from hydrophobic pores to hydrophilic pores, with a strong, nonlinear dependence on the local TMV (Bioelectrochem. Bioenerget., 41:135–160, 1996). Licensed.

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