




For remembrances and information on memorial services and gifts, go to <http://www.cds.caltech.edu/~marsden/remembrances/>.

## OBITUARIES

research, led to stricter regulations targeting hydrocarbon burning. Thanks to their work and the efforts of many others, the L.A. basin now has much cleaner air and bluer skies, even though the population has more than tripled since 1940.

But above all, the book is a cautionary tale. It's taken more than 60 years of political battles and, to a lesser degree, scientific research to achieve the relatively clean air we have. The authors warn that the same story is repeating itself—but now with greenhouse gases, whose short-term impact is much less immediate and tangible than the effects of that toxic haze of 1943. In the end, they argue, the only solution to the problems of climate change is to revamp our values and lifestyles. The question, then, is whether we can learn from history—or whether we're doomed to repeat it. —MW 

## JERROLD E. MARS DEN

1942–2010

Jerrold Eldon Marsden, the Braun Professor of Engineering, Control and Dynamical Systems, and Applied and Computational Mathematics, passed away on the evening of September 21, 2010, with his wife and daughter by his side. He was 68.

Marsden was one of the leading world experts in mathematical and theoretical mechanics. His work spanned a variety of fields, including fluid mechanics, geometric mechanics, elasticity, control theory, dynamical systems, and numerical methods. By focusing on geometric foundations, he was able to unite different disciplines, connecting mathematical theory with physical models and practical applications. His work has, consequently, influenced geometers and physicists alike. His research has led to advances in many areas, including spacecraft mission design, turbulence modeling, and the design of underwater vehicles. Marsden's influence was felt around the globe, in no small part because of his countless international collaborations.

Born in British Columbia, Marsden graduated from the University of Toronto in 1965 with a BSc in mathematics. He received his PhD in applied mathematics in 1968 from Princeton. He then joined the faculty at UC Berkeley before coming to Caltech in 1992 as a Fairchild Distinguished Scholar. He was appointed professor of control and dynamical systems in 1995, and in 2003, he was named the Braun Professor. In


1992, he helped found the Fields Institute, a mathematical research institute at the University of Toronto, where he was a director until 1994.

Marsden was an accomplished educator and mentor, having written six undergraduate math textbooks, which are used worldwide, and 14 monographs, many of which are the definitive references in their fields. He has had more than 40 PhD students and postdocs. In 2006, Caltech's Graduate Student Council awarded him its Teaching and Mentoring Award.

He received numerous other awards that recognized his contributions as a researcher and educator: the Jeffrey-Williams Prize, the AMS-SIAM Norbert Wiener Prize, two Humboldt Prizes, a Fairchild Fellowship, the Max Planck Research Award, the SIAM von Neumann Prize, and the United Technologies Research Award. In 2006, he received an honorary doctorate from the University of Surrey. He was posthumously awarded the 2010 Thomas K. Caughey Award in November in Vancouver.

He was elected a Foreign Member of the Royal Society in 2006 and was a fellow of the Royal Society of Canada and the American Academy of Arts and Sciences.

He is survived by his wife, Barbara; his children, Christopher and Alison; grandchildren Eliza and Isaac; and a sister, Judy.

The family has requested that, in lieu of flowers, contributions be made to the [Jerrold E. Marsden Scholarship Fund](#). Alternatively, contributions can be made to the Pasadena dog rescue, [Mutts and Moms](#). A memorial service is planned for January 28, 2011. —MW/JW 

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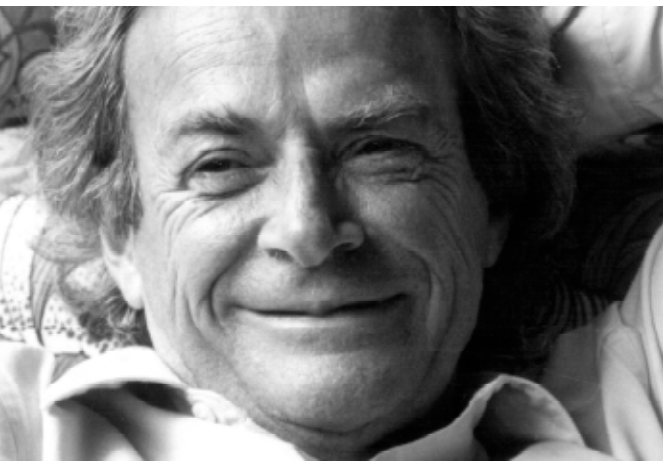
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## RALPH W. KAVANAGH

1924–2010

Ralph W. Kavanagh (PhD '56), professor of physics, emeritus, passed away on August 16 in Pasadena, California. He was 86.

Kavanagh was an expert in nuclear physics, primarily focusing on nuclear energy generation within the sun. As a member of Caltech's Kellogg Radiation Laboratory, he performed experiments looking at the fundamental interactions of light nuclei. He helped test some of the first models of evolving stars, which were based on his efforts to measure nuclear reactions thought to occur in the core of the sun.

Kavanagh focused on the steps in the chain that lead to the production of beryllium-7 and ultimately to the emission of neutrinos, the only particles that can escape unscathed from the center of the sun. These neutrinos carry information about the solar interior and detecting them has become an active branch of astrophysics. Kavanagh played a prominent role in this subfield through his careful studies of the properties of chlorine-37 and argon-37, the two nuclei involved in the detection of solar neutrinos that reach the earth.

In addition to the usual handful of graduate students he mentored, Kavanagh also taught the Advanced Physics Lab, beginning in the early 1970s and continuing until his retirement in 2000. This two-term course was required of all seniors majoring in physics; the few students committed to a theoretical career were permitted

to substitute a thesis instead. In this lab, Kavanagh followed the pattern established by Caltech physicist Victor Neher (PhD '31), with all exams being a private oral grilling at the conclusion of each experiment. In this fashion, Kavanagh came to know his physics students well and served them as a graduate-school advisor.

Born in 1924 in Seattle, Washington, Kavanagh served in the U.S. Navy from 1942 to 1946 before receiving his BA from Oregon's Reed College in 1950, followed by his MA from the University of Oregon. Upon receiving his PhD, he continued at Caltech as a research fellow from 1956 to 1958, eventually becoming full professor in 1970. He became emeritus in 2000.

He was a fellow of the American Physical Society and the American Association for the Advancement of Science.

Outside the classroom, Kavanagh was an ardent classical pianist who was also fond of playing Ping-Pong. He enjoyed sailing and completing crossword puzzles, which he often could do in his head. An avid outdoorsman, he enjoyed camping and hiking.

His family says he will be remembered for his sharp wit and wry sense of humor, for his high standard of ethics and his compassion for those less fortunate, and for his love of nature.

"Above all, science was not only his career, but his passion and hobby," says his wife, Joyce.

He is also survived by daughters Kathleen Kavanagh, Janet Kavanagh, Stephanie Kavanagh Harlan, and Linda Kavanagh; eight grandchildren; and one great-grandson. His son, William Kavanagh, predeceased him.

—JW



## THAD VREELAND, JR.

1924–2010

Thad Vreeland Jr., professor of materials science, emeritus, passed away August 9 in San Gabriel, California. He was 85 years old.

Vreeland—a member of Caltech's materials science program from its earliest days—was best known for his studies of the mechanical properties of materials, with an emphasis on how severely stressed materials deform plastically and permanently.

“His specialty was defects in materials—specifically dislocations, which are the agents of plastic deformation,” says Brent Fultz, professor of materials science and applied physics, and one of Vreeland's colleagues.

In the 1960s and '70s, Fultz says, Vreeland performed challenging experiments to measure how fast dislocations move in metal crystals; in the '80s, he studied how defects in thin layers of semiconductor materials are generated by ion bombardment or stresses. Vreeland's work in the 1990s included studies of how powders can be consolidated into bulk materials by subjecting them to strong mechanical shocks.

“Thad Vreeland took pride in laboratory technique and had both skill and style in building his own equipment, often frugally,” says Fultz. “With his graduate student David Pope [MS '62, PhD '67], he designed and built a device for subjecting large crystals to pulsed torsional loads, and he built several X-ray diffractometers of unique design. Thad Vreeland's shock-wave consolidation facility


used the barrel of a field gun that he reinforced for even higher velocities.”

Vreeland worked as a consultant for organizations such as Union Carbide, and collaborated on varied materials projects with corporations and research institutions such as the McDonnell Douglas Research Laboratory.

In 1965, Vreeland coauthored *The Analysis of Stress and Deformation* with engineering professor George W. Housner (MS '34, PhD '41), who passed away in 2008.

Vreeland was born in 1924 and was a lifelong member of the Caltech community, receiving his BS in 1949, his MS in 1950, and his PhD in 1952. That same year, he was named a research fellow in engineering; he subsequently joined the Caltech faculty in 1954 as an assistant professor of mechanical engineering. Vreeland was a professor of materials science from 1968 until his retirement in 1991, whereupon he was named professor emeritus.

After his retirement, Vreeland spent a great deal of time in his Montana home—most of which he designed himself, says his wife, Mary Vreeland. “It was near West Yellowstone, which is the trout fishing center of the west,” she adds. “Lots of Caltech faculty and students came up to fish with him.”

In addition to Mary, Vreeland is survived by his children—Michael, Terry, and Janet—and two grandchildren, Theresa and Johanna. —LO 



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