

**BRAD STURTEVANT
1933 – 2000**

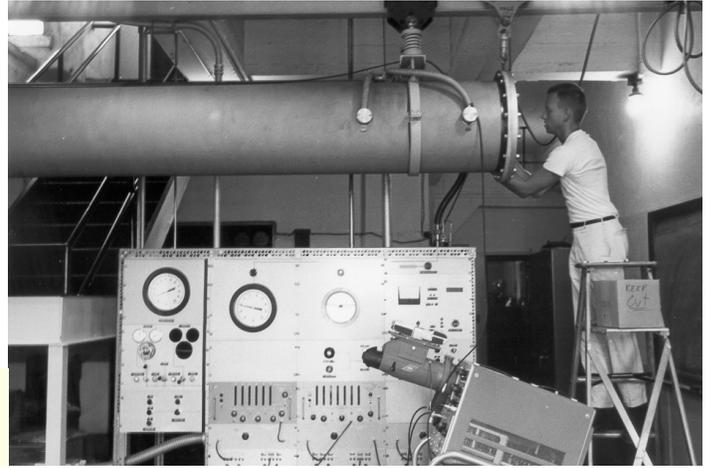


“Brad made a magical connection, not only between aeronautical engineering and geology and geophysics, but between engineering and science.”

Bradford (Brad) Sturtevant, the Hans W. Liepmann Professor of Aeronautics, died October 20, of pancreatic cancer at the age of 66.

Arriving at Caltech as a graduate student in 1955, with a bachelor's in engineering from Yale, Sturtevant earned his PhD in 1960 and stayed on at GALCIT (Caltech's Graduate Aeronautical Laboratory) for the rest of his career. He was preceded by his great uncle, Alfred Sturtevant, who, with Thomas Hunt Morgan, was among the founders of the Division of Biology in 1928. But while the elder Sturtevant studied the genetics of fruit flies (and irises), Brad's research was in fluid dynamics, particularly shock waves and nonsteady gas dynamics. He was named associate professor in 1966, full professor in 1971, and appointed to the Liepmann chair in 1995.

A memorial gathering in remembrance and celebration of Sturtevant's life was held Saturday, February 24, following a reception and buffet and Scott Joplin piano music. Hans Hornung, the C. L. “Kelly” Johnson Professor of Aeronautics and director of GALCIT, surveyed the large crowd in Dabney Lounge and declared that if Sturtevant could see this, he would say,



Sturtevant with GALCIT's 17-inch shock tube in the early 1960s.

“Why don't you all go back to your labs and do an honest day's work?” (Sturtevant was well known for working on Saturdays.) But everyone stayed, and the memorial continued.

Victoria Sturtevant stated three things she had learned from her father: “If it hurts, it's good for you”; “think about it and work it in your head to figure out how it works before you break it”; and “choose a career where you'll constantly learn.” Brad Sturtevant took these tenets extremely seriously himself, as his colleagues, students, and friends proceeded to attest.

Hans Liepmann, the Theodore von Kármán Professor of Aeronautics, Emeritus, and former GALCIT director, recalled Sturtevant's style in designing experiments: “very prepared. He thought he could design an experiment that would work the first time,” whereas others, including Liepmann, had a different approach: “We would first do it lousy and then a little better and then a little better.”

Liepmann noted that Sturtevant exemplified GALCIT's mission: “We do not want to produce specialists but we want to produce people who can specialize wherever they want to.” From the molecu-

lar beam that he built for his PhD thesis under Liepmann, Sturtevant became interested in kinetic theory and then in shock wave structure. He went on to apply his shock wave research to motorcycle noise and sonic booms and to fields as disparate as geology and medicine. With Hornung, he built the T5 Hypervelocity Shock Tunnel in 1988. Hornung joked that, throughout construction, “Brad wanted everything to be done *right*,” even the cleaning up. (A slide showed Sturtevant directing his boss at the vacuum cleaner.)

Representing colleagues from the Indiana University School of Medicine, Andy Evan spoke of Sturtevant's work with a group interested in shock wave lithotripsy. The Indiana group had met him in 1988, when both were seeking other investigators. “Brad was very interested in how shock waves break up kidney stones,” said Evan. “We were interested in how shock waves caused damage to tissue. It seemed a perfect match for collaboration.” Despite initial disappointment in attracting NIH funding, it was Brad's optimism and contagious enthusiasm that kept the project going, said Evan. “I don't need to remind you how

incredibly bright Brad really was, how gifted he was at analysis, and what a fertile flow of original ideas he generated.”

His forays into volcanology were described by geologist Sue Kieffer, PhD '71, who, although she had audited one of Sturtevant's courses, didn't run into him again until Seminar Day 1981, when she gave a talk on the Mount St. Helen's eruption. Sturtevant challenged her conclusions, and the encounter led to a “fruitful collaboration resulting in two papers that proved a number of things about the destructive forces of the supersonic nature of the blast of 1980.”

“Brad made a magical connection, not only between aeronautical engineering and geology and geophysics, but between engineering and science,” said Kieffer. “Neither of these is a mean feat given the vastly different content and training of the researchers in the different fields.”

Interdisciplinary research may have its downside, however. Added Liepmann, “I, for one, firmly believe that it actually reduced the number of Brad's honors and the extent of his support. When it comes to voting for an award, the tendency to keep it within your own narrow group is widespread.”

Half of the 28 students who received their PhDs under Sturtevant returned to attend the memorial, some traveling long distances. Several, including Willie Behrens ('66), Martin Brouillette ('85), and Bert Hesselink ('77), offered affectionate reminiscences of the man as adviser—his “enormously high standards” and demanding presence, his energy, enthusiasm, and his insistence on the proper use of the English language (even semicolons). But “the most important thing I learned

from Brad is what it is to be a scientist, and I thank him for that,” said Brouillette.

Another of those PhD students, Joe Shepherd ('81), professor of aeronautics, who served as master of ceremonies at the memorial and also produced the slide show, said, “We all learned, I believe, an enormous amount from Brad, both on the personal and scientific level.” Shepherd also led into Sturtevant's “other life” as a vigorous athlete. “When I described Brad Sturtevant to the local newspaper recently,” said Shepherd, “I found that I had almost completely omitted the fact that he was also a scientist, and so the headline came out that he was a ‘sportsman.’” His “perfectly healthy” life was regarded with awe. “On one thing I disagree with him after the fact,” said Liepmann. “He died so early; you probably should not believe in doing everything to remain healthy.”

But health wasn't what it was all about. “He loved the mountains and the oceans and everything outdoors,” said Anatol Roshko (PhD '52), the Theodore von Kármán Professor of Aeronautics, Emeritus. Roshko described and showed slides of a 1957 hike in the Sierra to the Ionian Basin, which illustrated Sturtevant's penchant for planning and organization. “Along the way, he seemed to know every feature, every elevation, every contour, and the hike worked out exactly the way he planned it,” said Roshko. “Whatever he undertook, whether it was in his science, or swimming, or hiking, or whatever, he did it all thoroughly.”

He had hiked and sailed since boyhood, and when he came to California, he also took up surfing. In the '60s, he and his wife, Carol, whom he had met at the Caltech pool, “bought a boat instead

of a house” and competed in many ocean sailing races together.

Sturtevant was especially renowned for swimming, open-water swimming races in particular, for which he won numerous prizes and honors. He was a regular lap swimmer at the Caltech pool as well. During the early '80s, he worked out three times a day, said Michael Hoffmann, the James Irvine Professor of Environmental Science and a fellow member of the faculty athletic committee for many years. “He swam in the morning, lifted weights and ran at noontime, and then swam again in the evening. And each workout lasted 90 minutes or so. He also would brag that up until about two years ago, every year he bested his benchmark time from his days on the Yale swim team, which is a remarkable accomplishment.” But Hoffmann punctured the image of Sturtevant's perfectly healthy life: “I used to see him in the morning after his workouts, eating doughnuts over at the Greasy.”

And he drank wine too, said Tim Downes, director of athletics, who was pleased to see that wine was served at the memorial buffet. “Some of my fondest memories of Brad are of sitting next to him at endless athletic conference meetings after we had had a couple of glasses of wine,” said Downes. Sturtevant, as well as Hoffmann and Downes, represented Caltech over the years at the Southern California Intercollegiate Athletic Conference; Sturtevant also served several terms as chairman.

He was also a key figure in the planning and construction of the Braun Athletic Center. And when that was completed, he “re-upped for a second tour of duty,” on the Sherman Fairchild Library of Engineering and Applied Science, according to Kim-



berly Douglas, director of that library. “He was not a limelight guy; his name does not appear in the library nor on the gym,” said Douglas, but “these buildings are certainly testimony to his willingness to give up his time and considerable talent to make the Institute a better place for all.” Added Shepherd, “He had a profound sense of responsibility to the community here at Caltech.”

While Sturtevant’s colleagues, friends, and students had described him as exacting, rigorous, creative, imaginative, energetic, competitive, intense, and great fun, the Rev. Douglas Vest, his next-door neighbor in Rubio Canyon for 25 years, thought one attribute had been left out. He remembered “the tender side of Brad.” When he left the house at 5 a.m. for the pool, he would roll his car down the hill before turning on the ignition so as not to wake the neighbors. Vest, who ended the program, also told of sitting in silence with his longtime neighbor last summer after his disease had been diagnosed, “and I realized he was comfortable about his life; he was comfortable about his family; he was comfortable about the unknown.”

An intercollegiate varsity swimming award has been established in Sturtevant’s honor, but, like his great uncle, he will also have a physical tribute on campus that is uniquely associated with his life at Caltech. The iris garden north of Gates Annex, planted in memory of Alfred Sturtevant, is populated with descendants of the irises he bred in his later genetic studies. In Brad Sturtevant’s memory, a Jacuzzi will be constructed at Braun Athletic Center so that “he will always have a place on the pool deck.” □



J. HAROLD WAYLAND 1909 – 2000

“Harold was a great man in applying classical physics to biology. He had a vision of the new field of bioengineering long before the word was coined.”

J. Harold Wayland, professor of engineering science, emeritus, and a pioneer of bioengineering, died October 10, 2000, at the age of 91. At a memorial service held January 29 in Dabney Lounge, friends and colleagues remembered his contributions to science and to the Caltech community.

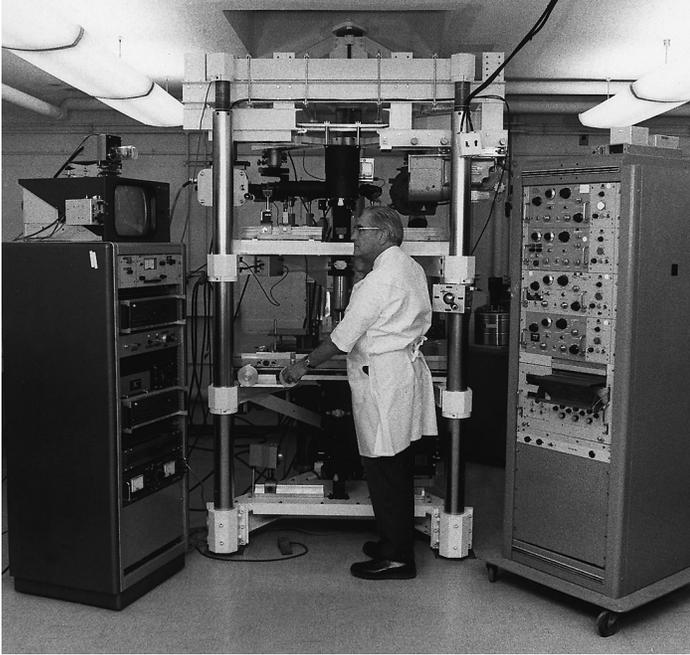
Wayland’s long membership in that community dates back to 1931, when he arrived at Caltech as a graduate student after earning his BS from the University of Idaho. He earned his MS in 1935 and his PhD in physics and mathematics in 1937—with Robert A. Millikan as his thesis adviser, according to George Housner, the Braun Professor of Engineering, Emeritus, who spoke of his 50-year-long friendship with Wayland.

Bill Pickering had known him even longer. Pickering, professor of electrical engineering, emeritus, and former director of the Jet Propulsion Laboratory, met Wayland in the mid ’30s, when both were graduate students. “If I remember rightly, I think the first time I met Harold was

on the trail to Mount Baldy, when we were doing what young graduate students frequently did—exploring the local mountains,” said Pickering. Their two families remained close over the following decades, and Pickering recalled fondly a visit to the Waylands in Strasbourg in 1953. “They started the tradition of globetrotting very early.”

As early as 1936, in fact, when Wayland left for a year’s fellowship to Niels Bohr’s Institute for Theoretical Physics in Copenhagen. Then, after a year as assistant professor of physics at the University of Redlands, he returned to Caltech as a research fellow from 1938 to 1941. He spent the years 1941–1944 degaussing ships for the Navy in Long Beach, and then joined Caltech’s project for the Navy’s Underwater Ordnance Division, where he was involved with other Caltech faculty in designing the torpedo launcher at Morris Dam.

In 1949, he returned permanently to academia as associate professor of applied mechanics at Caltech. He



With his microscope (at one time referred to as a “megascope”), Wayland, shown here in 1971, could observe blood flow in a living animal’s tiniest blood vessels.

was named full professor in 1957, professor of engineering science in 1963, and retired as emeritus professor in 1979.

From the early '50s, Wayland studied streaming birefringence, or double refraction, as a means of visualizing complex fluid flows, in particular large molecules in fluids. When Wallace Frasher and Sidney Sobin started a cardiovascular research laboratory, specializing in small blood vessels, at USC's medical school in 1957, they looked around Los Angeles for some assistance in mathematics and physics. They found no one at USC or UCLA, “so we looked up the hill to Caltech,” recalled Sobin. “I knew one person here, told him we wanted someone from the physical sciences who would work with us. He said, ‘Your man’s Harold Wayland.’”

So Wayland, working with Frasher and Sobin, began to focus on microcirculation, the flow of blood through the tiny capillaries. Wayland supplied the knowledge of optics, mathematics, engineering, and fluid dynamics. His particular contribution was in devising quantitative methods and building instruments to observe and measure blood flow in living animals.

To accomplish this, he built a huge microscope, seven and a half feet tall, weighing a couple of tons (“big enough to hold a goat,” according to Sobin). Wayland also conducted research on the impact of diabetes mellitus on blood flow and on the molecular exchanges between blood and tissues that occur at the level of the smallest vessels in the body.

In the early '60s, a Caltech aeronautics professor, Yuan-Cheng Bertram Fung (PhD '48), became interested in the possibilities of analyzing the forces and stresses of the human body as thoroughly as those of airplanes, and joined the group working on microcirculation. In 1966, Fung left for UC San Diego, where he subsequently laid the framework for the new field of bioengineering. Many of the original Caltech group joined him, including Sobin, now professor of bioengineering, emeritus, at UCSD, who credits Wayland with starting the spin-off. In December 2000, Fung was awarded the National Medal of Science. (See *Caltech News*, No. 4, 2000.)

“Harold was a great man in applying classical physics to biology,” said Fung at the memorial service. “He had a vision of the new field of bio-

engineering long before the word was coined, and he was evangelical in bringing the message of the importance of physical optics to biology and medicine.” Taking his cue from George Ellery Hale, said Fung, Wayland preached the establishment of international “intravital observatories,” which would do for biology what Mount Wilson and Palomar had done for astronomy. This may be Wayland’s greatest legacy, claimed Fung. “I think the idea is still alive and will probably wait for future people to come”—most likely in Japan and China, where Wayland had many “disciples” and was very well known, according to Fung.

In later years Wayland’s work was recognized at home and abroad. The U.S. Microcirculatory Society gave him its highest honor, the Landis Award, in 1981. And in 1988, he was awarded the Malpighi Award of the European Society for Microcirculation (Malpighi, in 17th-century Italy, was the first to observe blood cells in capillaries through a microscope). The gold Malpighi medal was presented to him at the University of Maastricht, which Wayland had helped develop into one of the leading institutions in the world for

studies of microcirculation.

Two other professors of bioengineering at UC San Diego also remarked on their early experience working with Wayland. Paul Johnson, now emeritus, came to Caltech for a year in 1965 to work on developing quantitative techniques for measuring blood flow. “Harold had an enormous influence on my life and career. But I think what I’ve described in my own experience you could duplicate for dozens of other people who came and spent time in his laboratory. He was absolutely focused on making the very best research experience for anyone who came to work with him.”

And Marcos Intaglietta, PhD '63, who was a student of Wayland’s, noted that, “in my cosmology Harold remains the archetype of the professor. He is a rigorous person, unyielding on principles, but vastly human in education and hospitality.” Intaglietta also remarked on Wayland’s vision: “He envisioned the contribution that engineering was poised to make in the life sciences and acted upon it. . . . His laboratory became the host to technicians and physiologists, a pioneering initiative when ‘interdisciplinary’ was not a household word. . . . He saw the future and caused it to start.”

Many of the memorial speakers commented on Wayland’s enthusiasm for his work and for his many interests outside the lab, especially music and the history of playing cards, on which he and his wife, Virginia, wrote several books. Ward Whaling, Caltech professor of physics, emeritus, described another enthusiasm of his: “On this campus, Harold was known first and foremost for his interest in food and wine.” Back in the early '60s, when the Athenaeum had no bar, recounted

Whaling, and the dining room served plain, inexpensive food to postdocs and grad students, Wayland recruited the manager, trained as a chef in France, to collaborate on elegant, "private" dinners, for which Wayland would bring the wines, pour them, and discuss them. He had become a connoisseur of wine on his early jaunts to Europe and had struck up acquaintance with some of the patriarchs of the California wine industry. Other members of the group, called the Apicians, soon began to take turns planning "private" dinners. "And that," said Whaling, who along with his wife was one of the original members, "is the way fine food and wine first made its way into the Athenaeum, which is now judged to be one of the most elegant dining rooms in Pasadena. I think Harold would count that as one of his worthy accomplishments, and one that his colleagues recognize as a notable contribution to the campus."

Virginia Wayland died January 7, 2001, and on January 26, Whaling and Noel Corngold, professor of applied physics, organized one last Apicians dinner (there had been 146 of them in all) in honor of Harold and Virginia Wayland. □

Professor of Political Science Jeffrey Scot Banks, PhD '86, died of complications of a bone marrow transplant on December 21. He was 42. A memorial service will be held April 7 at 3 p.m. in Dabney Lounge. Excerpts from that service will appear in the next E&S.

HONORS AND AWARDS

Clarence Allen, professor of geology and geophysics, emeritus, has been selected to receive the 2001 George W. Housner Medal, awarded at the annual Earthquake Engineering Research Institute meeting, February 9, in Monterey, California. The award recognizes his "sustained and significant contributions to earthquake safety."

Tom Apostol, professor of mathematics, emeritus, has been elected a corresponding member of the Academy of Athens. The academy is the most prestigious scientific organization in Greece.

Frances H. Arnold, Dick and Barbara Dickinson Professor of Chemical Engineering and Biochemistry, has been elected a fellow of the American Institute for Medical and Biological Engineering.

David Baltimore, president of Caltech, has been awarded the 2000 Warren Alpert Foundation Prize for his work "in the development of Abl kinase inhibitors for use in the treatment of chronic myelogenous leukemia." Baltimore will share the \$150,000 prize with four other scientists.

Seymour Benzer, Boswell Professor of Neuroscience, Emeritus, has received the

International Prize for Biology. Awarded annually since 1985 by the Committee on the International Prize for Biology, the prize was presented to Benzer on November 26 at the Japan Academy, in the presence of the emperor and empress.

Michael Brown, assistant professor of planetary astronomy, has been selected by the American Astronomical Society's Division for Planetary Sciences to receive the Harold C. Urey Prize in Planetary Science.

Richard Ellis, professor of astronomy and director of Palomar Observatory, has been appointed the Lansdowne Lecturer at the University of Victoria, Canada. He will deliver three lectures there later in the year.

Sunil Golwala, Millikan Postdoctoral Scholar, has received the American Physical Society's Mitsuyoshi Tanaka Dissertation Award in Experimental Particle Physics "for his versatile and extensive contributions to the detectors, hardware, electronics, software, and analysis of the results of the Cryogenic Dark Matter Search (CDMS) experiment."

Sossina Haile, assistant professor of materials science, has been selected to receive the American Ceramic

Society's 2001 Robert L. Coble Award for Young Scholars.

Janet Hering, associate professor of environmental engineering science, has received a grant of \$100,000 from the Alice C. Tyler Perpetual Trust. The grant will fund Hering's project, "Environmental Quality Near Large Urban Areas," which will examine the effects of a growing population and the impact of human interaction on land and aquatic ecosystems in the San Gabriel Valley and San Gabriel River watershed.

Alice Huang, senior counselor for external relations and faculty associate in biology, has been selected to receive the 2001 Alice C. Evans Award, which is sponsored by the ASM (American Society for Microbiology) Committee on the Status of Women in Microbiology.

Tracy Johnson, postdoctoral scholar in biology, will be honored at the Roy Campanella Humanitarian Award Dinner, on March 29 at the Pasadena Hilton Hotel. The award honors "outstanding leaders who have distinguished themselves in their fields."

Jonas Peters, assistant professor of chemistry, is one of 59 young researchers