Thomas Hartwig Wolff
1954 – 2000

As *E&S* was going to press, Caltech lost two more faculty members. J. Harold Wayland (MS '35, PhD '37), professor of engineering science, emeritus, died on October 10 after a heart attack. And Bradford Sturtevant (MS '56, PhD '60), Liepmann Professor of Aeronautics, died October 20 of pancreatic cancer. Memorial services are pending; the dates have not yet been announced.

Thomas Hartwig Wolff, professor of mathematics, was killed in a car crash on the night of July 31 on SR 14 in Kern County, some 90 miles north of Pasadena. At a memorial service in Dabney Lounge on October 19, Steven Koonin (BS '72), provost and professor of theoretical physics, described him as "brilliant. Intense. Respected. The brilliance of his work has been well documented by people who understand it much better than I. The intensity is obvious to all who saw his famous random walks with a coffee cup somewhere to the southeast of Millikan Library. And the respect was shown by his colleagues, who nominated him to the Caltech faculty three times—I believe an Institute record." Wolff earned his AB in 1975 at Harvard and his PhD at Berkeley in 1979. After stints as an acting assistant professor at the University of Washington and a postdoc at the University of Chicago, he came to Caltech as an assistant professor in 1982. He was promoted to associate professor in 1985 and full professor in 1986, but left for NYU's Courant Institute of Mathematics. Caltech got him back from 1988 to 1992, when he joined the faculty at Berkeley, and recaptured him for good in 1995.

A Manhattan native, Wolff grew up steeped in math. His uncle, Clifford Gardner, had also been at the Courant Institute, and his mother Lucile was a technical editor for Volume 1 of the English translation of Courant and Hilbert's *Methods of Mathematical Physics*. The result was a sort of prodigy. In the words of Peter Jones, a collaborator since Wolff's postdoc days in Chicago, "It was like having Mozart around."

Wolff's specialty was analysis, in particular Fourier analysis. Fourier analysis is based on Jean-Baptiste Fourier's 1807 discovery that many differential equations could be solved by representing the unknown function as the sum (typically an infinite one) of simple periodic functions, including sine waves, called harmonics. The method is the key to understanding some of the most fundamental equations of classical physics—including Laplace wave, and diffusion equations—so an extensive body of work has grown up around it. In one dimension, the field is closely related to complex analysis, which is based on complex numbers (the square root-of-minus-one kind, that is, not the kind used by crooked bookkeepers) and provides a wealth of analytic tools that are not available in higher dimensions. Wolff started in one-dimensional Fourier analysis, where he demonstrated remarkable technical skills, but quickly moved to higher dimensions where he revealed a geometric intuition that allowed him to create tools that have no one-dimensional equivalent. In the words of Caltech Professor of Mathematics Nikolai Makarov, "He had a talent for explaining his constructions so you could actually visualize them, and what a beautiful world it was."

Wolff's virtuosity first became apparent while a grad student at Berkeley, where he bested the Corona Theorem. The Corona Theorem is a fundamental result about the existence of analytic functions of complex variables; it gets its name from a mathematical structure that pictorially (although not scientifically) resembles the sun's corona. The original proof, worked out in the 1960s by Lennart Carleson of Sweden, was quite long and very complicated but no alternative had been found. Wolff's version is very clear and only a few pages long.

Wolff didn't write up the

In a contemplative moment, Wolff takes a breather before tackling the east face of Mount Whitney with wife Carol Shubin and CSUN math professor John Dye in 1993.

proof, but he took it on the road and talked about it, which is more than Fermat ever did. UCLA's John Garnett recalled: "I first met Tom in 1978. I had gotten a letter from [Don] Sarason [his thesis advisor], saying he had this grad student who had gotten some good results and who was a little shy, but would like to visit. Tom came down to UCLA three times that year, and on his last visit he gave his new proof of the Corona Theorem. Paul Koosis and I were separately writing books on Hardy spaces at the time, and we each had to rewrite an entire chapter because of him. T. W. Gamelin then wrote a short journal article containing a further simplification, so we had the academic anomaly of three UCLA professors publishing independent accounts of a Berkeley student's work!"

It was typical of Wolff that he moved on without writing a Corona paper himself. "His approach was to pinpoint the most difficult problem and then quickly work a miracle," said Makarov, but lingering to exploit the advance didn't appeal to him.

Wolff "took on all the biggest, long-standing, open problems in analysis and made impressive results," said Makarov. He wrote about 50 papers—"not a world record, but enough for several mathematicians to have been recognized as leaders in the field." And he may just have been hitting his stride—"the last five years were the most productive in his career." For example, he wrote two papers on the Kakeya problem, which has to do with measuring the space occupied by sets of line segments that point in all directions. Wolff made the problem easier to handle by giving the segments a wee bit of thickness and bundling them into n-dimensional Koosh balls, if you will, which could then be combined in various ways to explore the space. While he didn't solve the problem, the tools he developed while working on it will inform all of mathematical physics. And that's really what it's all about—the problem itself is just a vehicle to spur one's ingenuity.

Wolff's works in progress won't be lost, said his wife Carol Shubin, herself a professor of mathematics at Cal State Northridge. She is sorting through his manuscripts and farming the most promising ones out to some half-dozen of his collaborators. Meanwhile, mathematicians around the world are building the edifices he sketched out in his papers.

Wolff "had a passion for whatever he wanted to do," Carleson recalled. "Nobody met Tom without feeling it." Jones agreed, "When you asked him where his ideas came from, it was like opening the door of a furnace and looking in." Not surprisingly, he worked by total immersion, making it a point to understand everything anyone had ever done on a topic, and how it all fit together—down to the minutest detail—before diving in. A period of intense concentration followed, during which he was so uncommunicative, said Jones, that even his colleagues couldn't tell what he was working on. "He was always seen with a cup of coffee and a cigarette, hunched over in his special body language," which said that "he was thinking at a million miles an hour, and mathematicians knew better than to disturb him." Eventually the breakthrough would come, and "pads and pads of scribbles would appear in his office, and you could creep in there and try to divine what he had done."

The passion proved stronger than the shyness, and Wolff metamorphosed into a teacher *par exellance.* Wilhelm Schlag (PhD '96), now at Princeton, said, "The most remarkable features of his teaching only became clear later, when I had to teach classes myself. His teaching was fresh and original—most of the proofs were his own, even if they were of well-known theorems. Of course, he was far too modest to mention this." Outside of class, "he was always available to offer his opinions and insights. He enjoyed talking mathematics with anyone, even if they didn't know much about the subject. He inspired with his enthusiasm for research and teaching."

Added Markus Keel, Caltech's Olga Taussky-John Todd Instructor in Mathematics, "Tom's unflinching honesty and bracing lack of self-consciousness set his classes far, far apart. Tom would speed into the room, looking for all the world like he'd just wrestled about 300 alley cats, half of whom were wielding squirt guns loaded with coffee. He'd distribute six or seven pages of immaculate notes which he had typed up, and apologize for a typo or two while handing them around. The lecture that would follow is impossible for me to describe in concrete terms—I really don't know how he did what he did, but it made me realize the courses I'd taken (and taught) up until then were, at their best, a lot like taxidermy: the stuffing of a slain, beautiful animal to make it look real. As in those little scenes you see in outdoor stores, a glass-eyed grizzly would stand menacingly on its rear legs with a salmon impaled on its claws. If the instructor was really good, it seemed as though the bear was looking at the student while simultaneously chomping into the fish. In Tom's hands, the grizzly would rumble into full life, drop the plastic fish some fool had pasted to its paws, and wreak havoc on the yuppie Patagonia displays in the menswear department… There was something both terrific and terrifying about Tom's course."

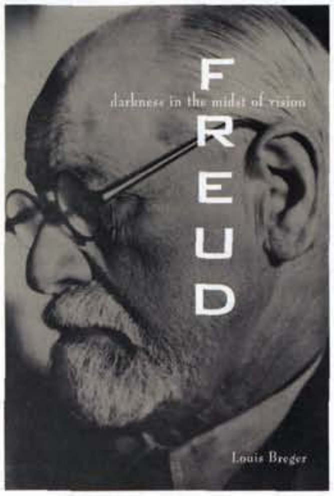
Wolff's drive to share and his intellectual honesty made him an ideal colleague as well, said Garnett. He was always generous with his advice, but when you told him your ideas on a problem, the problem remained yours. You could be sure he would not go home and try to solve the problem for himself.

Among Wolff's professional honors were the 1999 Bocher Prize, the 1985 Salem Prize, a Sloan Fellowship, invited named lecture series at the University of Chicago and Stanford, and invited addresses at what Makarov calls "the Olympics of mathematics," the International Conference of Mathematicians in 1986 in Berkeley and 1998 in Berlin.

On the personal side, Wolff was a skilled mountaineer who climbed many peaks in the eastern Sierra solo, or with Shubin and CSUN math professor John Dye. "Some of the best times we had were while climbing," she said. He was also an enthusiastic, if less skilled, cellist. Colin Carr, his brother-in-law, told about his mom going up to Berkeley to visit him at grad school. "As you know, Tom wasn't very concerned about the comforts of home, and his room was a horrible mess. There was a sleeping bag on the floor, and on the bed was his cello."

In addition to his wife, he is survived by sons James, 3, and Richard, 5; parents Frank and Lucile; and sisters Virginia and Caroline. A fund has been established for the boys' education; for more information contact Cherie Galvez in the math department office at (626) 395-3744 or cgalvez@its.caltech.edu. □

Books



Freud: Darkness in the Midst of Vision
by Louis Breger
John Wiley & Sons, Inc., 2000
472 pages

by Leslie Brothers, MD,
Associate Research Neurobiologist,
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Sigmund Freud inspires mixed feelings, sometimes strong ones. Within recent memory such notions as the Oedipus complex, repression, and the tripartite model of the mind (id, ego, superego) have been embraced as hallowed truths—not only by psychologists, but also by social scientists, humanities scholars, and others. At the same time, however, psychoanalysis was and is ridiculed as pretentious mumbo-jumbo practiced by cultish head-shrinkers. The coarser kinds of lampooning have been complemented by sober, rigorous debunking on the part of skeptical philosophers and sociologists. Citing flaws of logic and evidence, they have successfully demolished Freudian theory's claims to scientific status.

Debunked or not, Freudian ideas persist in everyday conversations about people and their motives. Common examples include the idea that it is healthy to "release"