science@sfsu.edu

spring 2002

STATE OF THE COLLEGE
NEW DEVELOPMENTS AND NEW FACES

By Sheldon Axler, Dean,
College of Science & Engineering

Greetings! I am delighted to welcome you to our alumni newsletter as I finish up my first semester as Dean of the College of Science and Engineering at SFSU. My predecessor Jim Kelley served twenty-six years as Dean of this College, an astonishing record that surely will never be surpassed. Thanks to Jim, I inherited a terrific College with an outstanding faculty and staff.

In the next several years we will be replacing many faculty who retire; in addition, we will be adding several new tenure-track faculty positions beyond retirement replacements. This semester I interviewed almost thirty candidates for tenure-track positions in six different departments in the College. These potential faculty were the top candidates from among, in some cases, hundreds of applicants.

As a campus in the California State University system, our primary responsibility is to provide excellent teachers for our students. But as I explained to the finalists for our faculty positions, the SFSU College of Science and Engineering seeks faculty who will be both excellent teachers and excellent researchers. We require excellent research as well as excellent teaching because we cannot easily separate these two activities. To be a good teacher, one must be intellectually alive; in the sciences the best way to be intellectually alive is to have an active research program.

What distinguishes our College is the extent to which we encourage faculty to integrate teaching and research.

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A New Dean of the College of Science and Engineering

Sheldon Axler became Dean of the College of Science and Engineering at SFSU in January 2002. Jim Kelley retired in Fall 2001 after serving as Dean for twenty-six years. Dan Buttlaire, who had been Associate Dean for the four previous years, served as Interim Dean for the Fall 2001 semester. Dan is now the Dean of Undergraduate Studies at SFSU.

Sheldon received an AB degree with highest honors from Princeton University in 1971 and a PhD in Mathematics from UC Berkeley in 1975. He held a postdoctoral position at MIT before joining the faculty of Michigan State University. In 1991 Sheldon received the Distinguished Faculty Award from Michigan State University. Sheldon has also held visiting or sabbatical positions at Indiana University, the Mathematical Sciences Research Institute, and UC Berkeley. In 1997 Sheldon was hired as Chair of the Mathematics Department at SFSU, a position he held until becoming Dean.

Sheldon's paper *Down with Determinants!* received the Lester Ford Award for expository writing from the Mathematical Association of America in 1996. That paper proposed a radical revision of linear algebra based upon simpler, cleaner proofs that avoid determinants. These ideas formed the basis for Sheldon's book *Linear Algebra Done Right*, which has been adopted as a textbook at over 125 universities and colleges, including eight CSU campuses, four UC campuses, and five Big Ten campuses.

Sheldon's research focuses on the connection between functional analysis and complex analysis. His research papers have received over 750 citations in the publications of other mathematicians and have led to a steady stream of research grants from the National Science Foundation. The second edition of Sheldon's graduate/research-level book *Harmonic Function Theory* (jointly written with Paul Bourdon and Wade Ramey), was published last year.

Sheldon has served as Associate Editor of the American *Mathematical Monthly* and as Editor-in-Chief of the *Mathematical Intelligencer.* Currently he serves on the Editorial Board for the main series of mathematics textbooks published by Springer, by far the largest publisher of mathematics at the upper-division, graduate, and research levels.

Sheldon bicycles to SFSU most days from the West Portal section of San Francisco, where he shares his home with two Bengal cats and his partner Carrie. Sheldon can occasionally be seen running around SFSU's track or to the top of Twin Peaks.

The 4th Annual Student Project Showcase & Alumni Reception

As the contestants started to set up their displays at 3 p.m. on May 8th, they turned the quiet 3rd floor hallway of Thornton Hall into an amazing Science Showcase. Because of generous support from alumni and friends, we were able to offer our students six prizes for a total of $2,000 (**THANK YOU!**). Over forty individuals and teams from all departments in the College joined the competition. Judges, alumni, faculty, students, and guests were impressed with the high quality of the projects. Everyone enjoyed listening to presentations from this exceptional and diverse group of students.

"This annual event at the College of Science and Engineering features a variety of exciting student projects on display highlighting our faculty's commitment to providing SFSU students with hands-on experience in the discovery of new knowledge" Dean Axler said, adding that "our high-quality faculty will continue to educate and involve students in solving real-world problems."

Our next Student Project Showcase and Alumni Reception will be in May 2003. Please let us know if you and your company can help sponsor of this wonderful event.

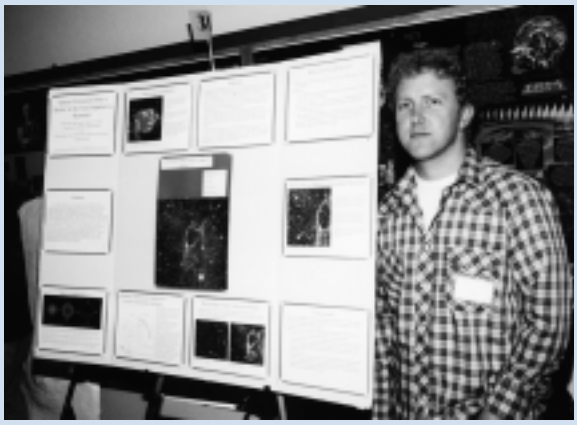
***Dr. Pete Palmer**, Associate Professor of Chemistry and Biochemistry, gave a fascinating talk on detective work he has done with museum artifacts (see page 4 for a summary of Dr. Palmer's research).*

*Dean Sheldon Axler congratulates **Tandis Bidgolis** for winning the **undergraduate-level first place award of $600**. Her senior thesis was on "Determining Uplift Rates and Patterns from Quaternary Marine Terraces of the Point Reyes Peninsula, California."*

Left to right: Faculty Judge Andrew Ichimura, Assistant Professor of Chemistry & Biochemistry, Sergio Aragon, Professor of Chemistry & Biochemistry, and ***Diana Shem****, Chemistry graduate student. Diana won the* ***graduate-level first place award of $600*** *for her research on "A Computational Model of DNA Birefringence."*

Sandra Larkin*, a Biomedical Laboratory Science student, received the* ***graduate-level second place award of $300*** *for her project entitled "Secretory Phospholipase A2 Is a Key Player in Acute Chest Syndrome in Sickle Cell Disease."Sandra is also a Staff Research Associate at Children's Hospital Oakland Research Institute.*

Left to right: ***Laura Peschke****, Staff Judge Dr. Carina Anttila (Genetic Engineering Lab Manager for the Biology Department),* ***Ha-Nam Nguyen****,* ***Guillermo Godinez****, and Dr. John Hafernik, Chair of the Biology Department. Ha-Nam, Guillermo, and Laura are Cell, Molecular and Developmental Biology students. They received the* ***undergraduate-level second place award of $300*** *for their poster on "The Fate of Kaehn Cells in Early Epaxial Myotome Formation in the Chicken Embryo."*



Jefferey Carlin*, an Astrophysics undergraduate student, presented his research on "Optical Emission From A 'Bullet' In The Vela Supernova Remnant."*

Faculty Judge William Bigler, Director of the Center for Biomedical Laboratory Science, is listening to ***Adria Lassiter****, a Marine Biology graduate student, present her research on "Inter and Intra Annual Patterns of Phytoplankton Assemblages During Upwelling Events off the Coast of Northern California (Coop West Study)." Adria and her teammates won the* ***graduate-level third place award of $100****.*

Winston Wu *(left) and* ***Ray Hung*** *(right), Electrical Engineering students, won the* ***undergraduate-level third place award of $100*** *for their senior project "Pinky, The Micromouse."*

DR. PETER T. PALMER
DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

A Forensic Research Experience for Undergraduate Science Majors

In the past, it was common practice for museum professionals and private collectors to apply a variety of pesticide agents to objects in their collections to preserve them from depredations by microorganisms, fungi, and other pests. The earliest preservation agents were various forms of arsenic and mercury salts. As pesticide technology evolved, organic pesticides, such as p-dichlorobenzene, naphthalene, lindane, thymol, dieldrin, and DDT, found wider use for preservation of museum objects. It is highly likely that some of the objects may have been treated with several applications and/or mixtures of different pesticides. Although many museum professionals are aware of what may be extensive chemical contamination in their collections, there are surprisingly few references in the literature that provide data on the types and levels of pesticides on objects in museum collections. Given that poor records were kept on the treatment of individual objects, it is unknown whether or not specific objects are contaminated with these pesticide agents, and hence chemical analysis represents the only reliable means to determine the types and levels of pesticides on these objects.

Arsenic and mercury determinations on these objects have been commonly been achieved through the use of spot tests, atomic spectroscopy, and XES. Spot tests are perhaps the simplest means for the semiquantitative analysis of heavy metals. These typically involve swabbing a spot on a sample, adding reagents, and observing a color change that is proportional to the analyte concentration. The reliability of these tests has been called into question on several occasions, and several studies have shown that they can yield erroneous results, false positives, and false negatives. Atomic spectroscopy is a more reliable method for determination of arsenic and mercury a due to its inherently greater selectivity. Flame Atomic Absorption Spectrophotometry (FAAS) provides adequate detection limits for this application and was the method of choice in this study. Compared to spot tests, FAAS provides much better accuracy and precision, but requires expensive instrumentation and significant operator training. Graphite furnace AAS (GFAAS), cold vapor mercury or hydride generation AAS, inductively coupled plasma atomic emission spectroscopy (ICP-AES), and inductively coupled plasma mass spectrometry (ICP-MS) techniques represent alternate methods for this type of analysis. They provide much lower detection limits than FAAS and hence are more appropriate when using micro-sampling techniques, but pose the additional constraints of higher capital equipment costs and longer analysis times. XES has been routinely employed for this application by several investigators. Its most salient advantages include its sensitivity, speed, and the fact that it requires minimal sample preparation. Although it is semi-quantitative and cannot distinguish between external and internal contamination, it can be used to rapidly screen a collection for the presence of these metals.

The determination of organic pesticides is more problematic, and given the possibility that several such species may be present on an object and the volatility of these species, GC is an obvious choice as an analytical method. Glastrup was the first to report the use of GC in conjunction with a flame ionization detector (FID) for this application. GC/MS is an even more powerful method, as the combination of both retention time match with an authentic standard and a correct library search against a database of reference mass spectra provides a high degree of certainty for identification of individual pesticides. Few museum laboratories have access to such instrumentation and its proper use requires significant operator training and expertise.

Sample Workup, Analysis, and Results

The focus of this study was the determination of arsenic, mercury, and several organic pesticides on 17 objects that were recently repatriated to the Hoopa tribe in northern California from the Peabody Museum at Harvard University. These items were taken from the Hoopa tribe around 1904 and most likely were treated with a variety of pesticide agents between that time and the present. David Hostler, curator of the Hoopa Tribal Museum in Hoopa CA, took advantage of the Native American Graves Repatriation and Protection Act (NAGPRA) to request that the Peabody Museum return these objects to the Hoopa. Mr. Hostler arranged for subsequent chemical analyses of these objects at SFSU to determine the types and levels of pesticide contamination on these objects. The sampling and analyses were executed by a group of researchers that included undergraduate chemistry majors (**Greg Wentworth**, BS Chemistry, 2002 and **Matt Martin**, BA Chemistry, 2000), an analytical chemistry professor (Dr. **Pete Palmer**, Department of Chemistry and Biochemistry), and anthropology and museum professionals (Dr. **Lee Davis**, Department of California Studies, and Niccolo Caldararo, Department of Anthropology).

Samples were removed from each object, stored in vials, and transported to SFSU for workup and analysis. Sample weights were very small, ranging from 0.2 to 55.4 milligrams. For arsenic and mercury analyses, samples were weighed, digested in nitric acid, filtered, diluted to volume using deionized water, and then analyzed by FAAS on a Solaar 929 atomic spectrometer. For organic pesticide analyses, samples were weighed, extracted three times with methylene chloride, filtered, diluted to volume, and then analyzed on a Finnigan Magnum GC/MS instrument.

Arsenic was not detected in any of the 28 samples. Mercury was detected in 9 of the 28 samples, with levels ranging from ND (not detected) to 16.6% (wt/wt). A histogram plotting the number of samples where mercury

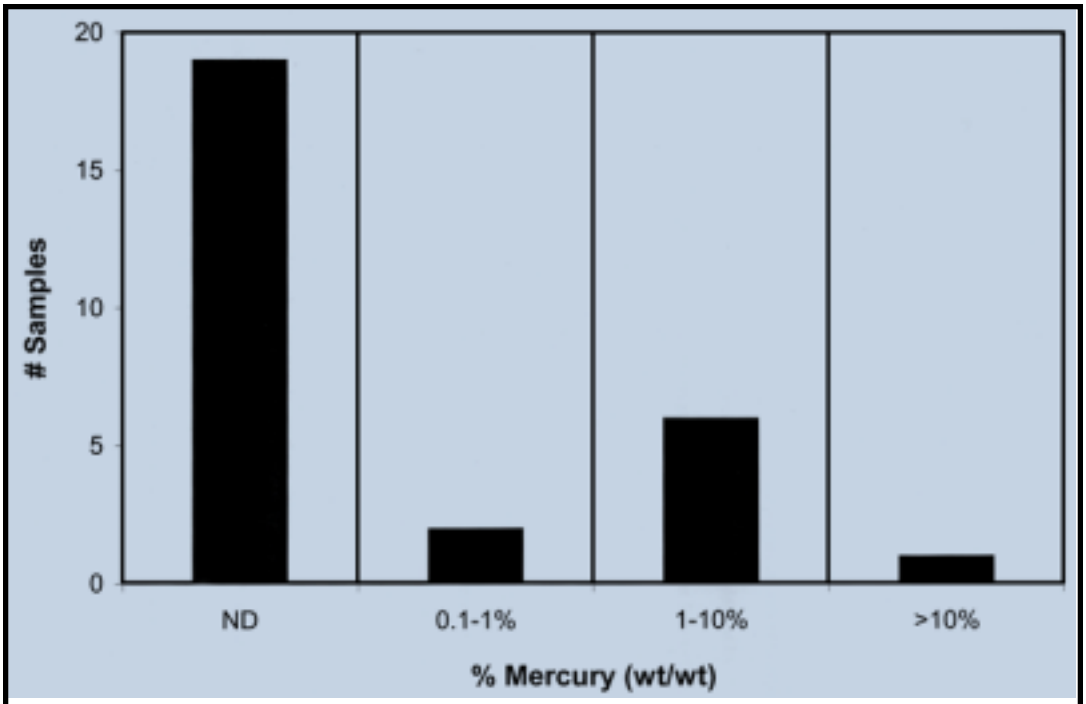


Figure 1. *Histogram showing order of magnitude levels of mercury contamination detected on the Hoopa objects.*

was detected for several order-of-magnitude concentration ranges is provided in Figure 1. This plot appears to show a Gaussian distribution, which is indicative of the inhomogeneity of the pesticide application process. Five of the six targeted organic pesticides were detected in the samples. Naphthalene was detected at the highest frequency (79% of the samples) and at the highest concentrations, with levels ranging from ND to 0.183% (wt/wt). DDT was detected at the second highest frequency (41% of the sample) at levels ranging from ND to 0.013% (wt/wt). p-dichlorobenzene was detected in 17% of the samples, with levels in the range of ND to 0.003% (wt/wt). Lindane and thymol were only detected in two and one of the 17 samples, with the highest concentrations detected being 0.003 and 0.001% (wt/wt), respectively. Dieldrin was not detected in any of the samples.

Conclusions

From the standpoint of undergraduate science majors, this project is an example of how "real world"applications are included as part of SFSU's undergraduate curricula. This particular case study was executed by two undergraduates, Greg Wentworth and Matt Martin, as part of their undergraduate research experience in the Department of Chemistry and Biochemistry. Four additional case studies on artifacts from other local museums and objects repatriated to other California tribes have been executed by other undergraduate chemistry and environmental studies majors, and by students in CHEM 420, an upper-level elective course for chemistry and biochemistry majors. Such experiences give SFSU students valuable training in chemical instrumentation, and provide an excellent example of how SFSU can serve the community in providing reliable analytical results that might not otherwise be available.

Although a rigorous toxicological evaluation of these results is not the focus of this study, some discussion of the significance of these results is certainly appropriate. Mercury was detected at percent levels on many of the objects, and given that it was present at concentrations several orders of magnitude higher than the other pesticides and its toxicity, it represents the most serious potential human health risk with respect to these objects. Naphthalene was detected at the highest frequency, indicating that it is likely that most of the objects were treated with this pesticide. DDT was also frequently detected, and given its toxicity, represents a potential human health risk. The types and concentrations of pesticide agents detected on these objects have important implications for the Hoopa tribe. Historically, the hides, headbands, head nets, and other items were meant to be worn by tribal members in various tribal ceremonies. Given this intended use, it is possible that individuals could be exposed to pesticide agents and that these could be adsorbed through contact with their skin, could drip into their eyes, or be inhaled as particulates or as volatiles. Hence, it has been recommended that Hoopa tribal members that they should not handle these objects without taking proper safety precautions.

This complex problem and its ramifications touches on many disciplines, such as individual tribes' experience with this problem; toxicological significance and risk assessment of the resulting data; legal, ethical, and regulatory issues; communication and outreach to potentially affected people; and potential methods for removal of pesticides from contaminated objects. These issues were recently the focus of a "working conference"on the NAGPRA issue at SFSU (http://bss.sfsu.edu/calstudies/arttest/conf.htm) and a special issue of the periodical Collection Forum. Native American tribes are rightfully concerned with the state of their repatriated objects, as the NAGPRA Act includes no provisions for the testing of objects, museums are not required to test them, and most tribes do not have the financial resources to arrange for testing. Certainly, this problem is not only a matter of concern to Native Americans, but represents a significant and troubling issue for museums and private collectors.

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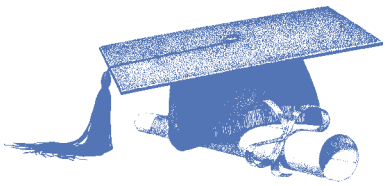

Please consider supporting your College financially by contributing to our annual giving program. Your gift can be designated for use wherever your interest and/or loyalty lies. For example, you could designate your gift to support a specific department, or the Student Project Fund, or student scholarships. Or you could direct your contribution to the Dean's Fund, where it will be funneled to wherever it can do the most good within the College of Science and Engineering.

We ask you to help the College give our students a cutting-edge education. To do this, we need advanced technology in our classrooms and labs, scholarships for our students in need, and the resources to attract and retain top-notch faculty who are committed to excellence in education, research, and community involvement.

Please make your gift today by simply filling out the enclosed reply card and returning your check (made payable to the SFSU Foundation) or credit card instructions in the enclosed envelope.

Many thanks for your support, which greatly benefits our students.

November '02 Science & Engineering Career Fair

Following a successful March Science and Engineering Career Fair attended by more than 600 SFSU science and engineering students, the SFSU Career Center, in collaboration with the College of Science and Engineering Cooperative Education Program, will host a November Science and Engineering Career Fair. Employers will be looking for SFSU candidates for employment and internships and have requested an earlier event to accommodate their internship deadlines.

Employers expressed great satisfaction with the event and with the quality and preparation of the candidates. Many of the participating employers were SFSU alumni and were delighted with their "gator" alumni pin, given in recognition of their participation.

If you would like to like to receive additional information or an invitation to the November Science and Engineering Career Fair, please contact Science & Engineering Career Counselor, Laura Carter (415/338-1762; lcarter@sfsu.edu).

If you are interested in participating on Alumni Panel either on the day of the event or at another time, please contact Lannie at science@sfsu.edu; 415/338-7662.

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Visit our **cyberhome at http://www.sfsu.edu/~science/**

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Our faculty bring cutting-edge work to our students, in the form of student-faculty collaboration on projects in exciting areas of engineering, mathematics, and science. Thus our students receive valuable hands-on experience with nationally recognized leaders in their area, rather than trying to learn simply from lectures and books. The results of our College's emphasis on students actually doing science could be seen at the end of this academic year in our spectacular Student Project Showcase, which you can read about elsewhere in this newsletter.

So far five extraordinary people have accepted offers this year to join the College faculty. The process is still incomplete, as we are hoping to fill one additional position before the Fall semester. A complete report on our new faculty will appear in our next newsletter.

As a new Dean I will be looking at everything the College does with a fresh eye. The university exists to serve our students, so advice from you, our former students, is most welcome. Please send me (axler@sfsu.edu) your comments and suggestions about what we do right

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ACKNOWLEDGEMENTS

Faculty Judges:

Dr. Carina Anttila, Genetic Engineering Lab Manager, Department of Biology
Dr. William Bigler, Director, Center for Biomedical Laboratory Science
Dr. Eric Hsu, Assistant Professor, Department of Mathematics
Dr. Andrew Ichimura, Assistant Professor, Dept. of Chemistry & Biochemistry
Dr. Edward Lank, Assistant Professor, Department of Computer Science
Dr. Nilgun Ozer, Director of MEP, School of Engineering & Computer Science
Dr. James Lockhart, Chair, Department of Physics & Astronomy
Dr. Matthew LaForce, Assistant Professor, Department of Geosciences

Graduate Student Judges:

Julian Herdon (Marine Biology), Romberg Tiburon Center/Biology
Geeta Hompanur, Center for Biomedical Laboratory Science
Jennifer Kreft (Physics), Department of Physics & Astronomy
Thomas Long, Department of Mathematics
Susan OíNeil (Conservation Biology), Department of Biology
Dean Sedlacheck (Engineering), School of Engineering &Computer Science

Erica Elford (left), a Physiology student, presents her research on "The Effects of Photothermal Exposure on the Growth Rate of Juvenile Slider Turtles, Pseudemys scripta elegans*" to Student Judges Geeta Hompanur (middle), a Biomedical Laboratory Science student, and Susan O'Neil (right), a Conservation Biology graduate student.*

Faculty Judge Matthew LaForce (left) was talking to teammates Mark Galicia. (middle) and Mike Putnam. Electrical and mechanical engineering students designed a "Solar Powered Vehicle" for their senior project.

Matthew Horigan (left), an Applied Geosciences graduate student, shows Faculty Judge James Lockhart (right) his Web site called "The Etymological Dictionary of Geology."

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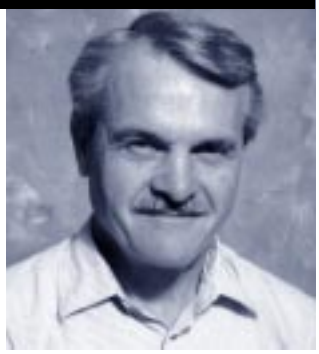
and what we could do better. To find out more about me, take a look at my web site: www.axler.net

The College of Science and Engineering can make good use of financial contributions. Your education at SFSU was heavily subsidized by the state of California. Unfortunately the state can no longer provide all the resources needed for a top-rate education. SFSU increasingly needs private contributions, especially in the coming years of state budget difficulties. For many economically disadvantaged students, SFSU provides the only opportunity for affordable, high-quality undergraduate education. Please help us offer the education that our students deserve. Contributions to the SFSU College of Science and Engineering are tax deductible and can make a serious difference in the lives of our faculty and students.

In Memoriam: Mechanical Engineering Professor Wolf Stadler



Dr. Wolfram Stadler passed away October 20, 2001 as a result of severe head and bodily injuries in a head-on collision with a drunk driver a month earlier. Stadler, a professor of engineering at San Francisco State University, had remained semi-comatose at Stanford Medical Center until his death. Born in Straubing, Germany on July 4, 1937, Stadler grew up in West Germany and Austria, emigrating to the U.S. as a teen. After serving in the U.S. Air Force, he earned a B.S. and M.S. in Aerospace Engineering and an M.S. and Ph.D. in Engineering Mechanics from Georgia Tech.

After teaching at his alma mater, Stadler was a visiting professor and researcher at various universities in the U.S. and abroad, including a six-year stint as a research associate in optimization and control theory at the University of California, Berkeley. He joined SFSU's School of Engineering in 1978 and enjoyed teaching classes in optimal design, systems, and mechanics. Stadler also developed SFSU's Robotics program and taught the core upper-division and graduate courses on the subject. His primary interest was "multicriteria optimization"—a methodology for designing systems that optimize several features— simultaneously.

"I know that the passing of Professor Stadler has hit the School of Engineering particularly hard, but I, too, want to express my sorrow for this sudden loss to the University," said SFSU President Robert A. Corrigan. "While we will miss Wolf terribly, the impact of his demanding teaching, substantial research, and tough but fair personality will live on in the students and faculty whose lives he touched."

In 1995 McGraw-Hill published Stadler's textbook *Analytical Robotics and Mechatronics*, a work that combines principles of mechanical engineering, electronic engineering, control engineering, and information sciences. Stadler also authored and co-authored numerous articles, which have appeared in books, professional journals, and conference proceedings. A member of the American Academy of Mechanics, Stadler was an associate editor for the *Journal of Optimization Theory and Applications*, and the journals *Structural and Multidisciplinary Optimization* and *Dynamics and Control*.

Dr. Stadler was an enthusiastic runner, averaging 30 miles a week, his regular course taking him from SFSU to Ocean Beach, via Lake Merced, and back. He also enjoyed running along the bluffs near his home and playing golf with his sons and friends. A favorite hobby was pastry-sampling at local bakeries while traveling, and at home, preferably with plenty of tea and music played by family members.

Dr. Stadler is survived by his wife of 27 years, Leila, his daughter Verike (20) and sons Peter (17) and Ben (13), numerous members of the Stadler-Reyes family and friends in many countries.

Dr. Stadler's ashes will be scattered at sea.

The Wolf Stadler Memorial Scholarship was established to honor Dr. Stadler. Please use the enclosed reply card and envelope to send in your contribution today.