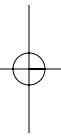
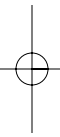
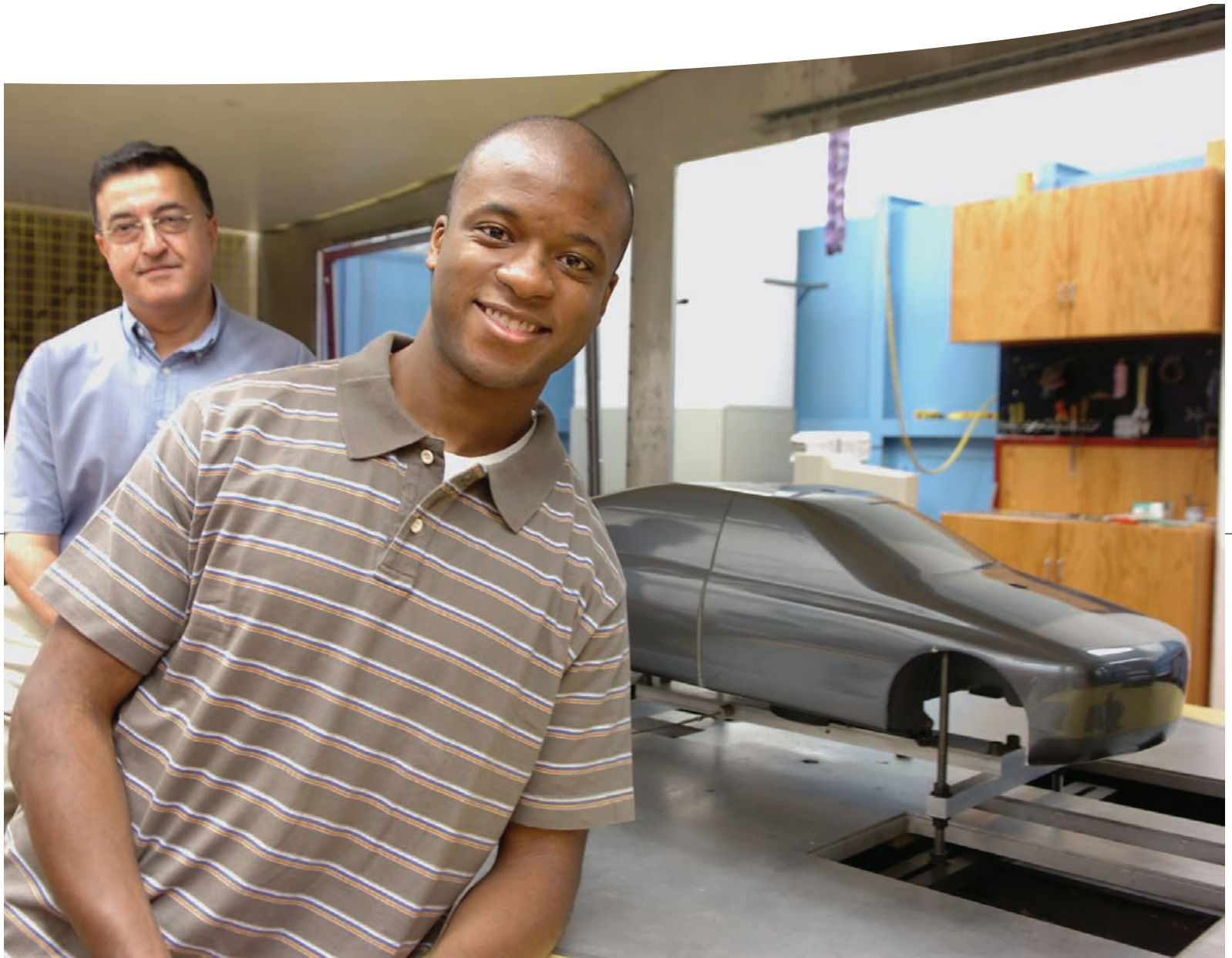


SURF 2006

California Institute of Technology



President's Message

As I commence my tenure as president of Caltech, I am being introduced to the wealth of programs and activities that set the Institute apart as a leader in research and education. SURF is one of Caltech's most outstanding programs. Through SURF our creative students are introduced to research under the guidance of experienced mentors working at the frontiers of their fields. SURF's reputation and influence extend across the country and around the world. I look forward to working with such an enthusiastic and dedicated group of faculty, students, alumni, donors, friends, and staff and to helping nurture this significant enterprise.

— JEAN-LOU CHAMEAU

The Wasserman Legacy

Dedication of SURF 2006 to Lew and Edie Wasserman

by FRED SHAIR

SURF 2006 was dedicated to Lew and Edie Wasserman at the annual Kickoff Dinner at the Athenaeum on April 20, 2006, in honor of their extraordinary gift to Caltech in 1977 that stimulated the founding of the SURF program. Casey Wasserman, Lew and Edie Wasserman's grandson, and his wife, Laura, were present. Casey spoke eloquently of his grandfather, noting that although Lew had no formal college education, he was very successful and wanted to help motivated young people at Caltech achieve their dreams.

Lew Wasserman and Edith Beckman were married on July 5, 1936, and they were a dynamic couple for 66 years, until he passed away on June 3, 2002. He had a truly legendary career, serving as president of MCA from 1946-1995. Throughout his long career, he avoided the limelight and rarely sat for interviews. He often reminded the MCA staff that "publicity is for clients, not for us."

The Wassermans were highly admired for their philanthropy and for their involvement in promoting civil rights. Lew was a generous contributor to Jewish causes, and he gave so much to Catholic charities that Pope John Paul II asked to meet him in 1987. Later in life, Lew donated liberally to higher education. In 1995, he was awarded the Presidential Medal of Freedom, this country's highest civilian honor, by President Bill Clinton at a White House ceremony.

This year we celebrate the remarkable legacy Lew and Edie Wasserman left to Caltech through the SURF program. SURF survived an interesting birth, an impetuous youth, and turbulent teenage years before coming of age, now celebrating its 28th birthday. In 1978, I was 42 years old, Carolyn Ash was a "spring chicken," none of the current SURFers had yet been born, and Lew Wasserman had turned 65.

LET'S TAKE A SHORT WALK down SURF memory lane. The film *Jaws*, released on June 20, 1975, by Universal Pictures, had been the most financially successful movie up to that time, grossing over \$220 million. Caltech Trustee Lew Wasserman wanted to make a donation to Caltech, and in 1977, he asked then Caltech President Harold Brown to use a portion of his donation for the "direct benefit of undergraduates." He also requested that the gift be anonymous, and it remained so until after his passing, when the family agreed to allow us to reveal the donor's identity.

President Brown asked the Scholarships and Financial Aid Committee, of which I was a member, to suggest how best to use this money. Almost immediately, the committee divided along philosophical lines. One group wanted to split the money among students with the highest grade point average. The other group wanted to divide the money among students with the most financial need. It was not surprising that the members of the committee thought first of simply awarding the money and immediately moved to develop a consensus regarding the basis for the awards.

When I returned to my office after one somewhat contentious meeting, a student was waiting to ask me if I knew of any opportunities for summer work in his field of interest. The faculty member with whom he wanted to work (and who wanted to work with him) did not have financial support because NSF had decided, for one year, not to award grants to support students while it revamped its fledgling undergraduate research program. At that moment, I wondered if Caltech might be ready to start its own formal summer undergraduate research program.

That evening I considered acronyms. SURP, patterned after the NSF Undergraduate Research Program, didn't work. SURE, for Summer Undergraduate Research Experience, seemed bland. By changing "Experience" to "Fellowship," SURF was born. I liked the word "fellowship" because it has two meanings: the idea of awarding a stipend to young enthusiastic students and the welcoming of those persons into the community of world-class researchers and scholars.

This year we celebrate Lew and Edie Wasserman's remarkable gift to Caltech that created the SURF program and an extraordinary legacy.

UNDERGRADUATE RESEARCH AT CALTECH did not begin with SURF. Almost from the start, Caltech undergraduates had been involved in research. Each spring in the 1920s, Professor Ernest Swift encouraged about a dozen students in the top half of his freshman chemistry class to spend their summer at Caltech's marine biology station at Corona del Mar. They received free room and board and a stipend of \$50 for the summer. In between some wet surfing, they conducted research. Some assisted Professor Swift in the preparation of his world famous textbook on qualitative analysis. From time to time, other chemistry faculty became involved. One such investigation led to a joint ACS publication between Edwin McMillan and faculty member Linus Pauling. Both authors continued their research careers, and both later won Nobel prizes in Chemistry.

Over the ensuing years, many Caltech faculty took the time to help undergraduates define and conduct research projects. An excellent example is Professor Tom Tombrello who involved undergraduates in research from the time he arrived on the campus. Caltech's culture was fertile ground for the growth of the SURF program.

I once asked Professor Swift why his early undergraduate research program terminated, and he responded that the stock market crash of 1929 made it impossible to continue. Asked what advice he could give for the modern SURF program, he responded without hesitation that we should develop an institute-wide program that permits, even encourages, students in one discipline to work with a faculty member in a different discipline, and get it endowed! We have taken his advice!

The Administrative Committee (AdCom) was formed to institutionalize the program and to set academic policies for SURF, to oversee the intellectual standards, and to advise the Caltech administration on long-range plans for the development of SURF and programs related to SURF.

In 1981, senior development officers Ed Baum and Elba Smith became involved with SURF and began to identify potential supporters of SURF. The SURF Board was born with Samuel Krown serving as its first chair. Samuel and Frances Krown became founding donors, creating the first SURF endowment. The purpose of the SURF Board was and is to build strong relationships between SURF and various constituencies comprising the Caltech/JPL community. In 1982, SURF Board member Betty Nickerson organized the first SURF Kickoff Dinner at the Athenaeum. The leadership of the SURF Board has been nothing short of spectacular!

In 1983, with the insight and enthusiastic support of Terry Cole, then Chief Technologist of JPL, and Lew Allen, then Director of JPL, SURF expanded to the Lab and was welcomed by a variety of brilliant and enthusiastic mentors. JPL's involvement has continued to grow and prosper under the leadership of subsequent JPL Directors Ed Stone and Charles Elachi. Guided by Bill Whitney, JPL's contribution to SURF has indeed been unique, sustained, and vital. Bill also developed the professional development workshops, now named in his honor. These workshops help students understand key issues regarding their evolving careers and the decisions they will need to make in the near future.

In 1989, when I left Caltech to become the Dean of Natural Sciences and Mathematics at Cal State Long Beach, Carolyn Ash took over the responsibilities as SURF Director. Two more important events took place: Harry Gray gave SURF much-needed office space in the Beckman Institute. The organizational structure of SURF was formalized by the director's reporting directly to Caltech's Vice Provost.

These events produced a melodious chime indicating that SURF had become an integral part of the academic program at Caltech. This music was a welcomed message to potential donors who were interested in providing long-term support for enthusiastic bright young people. Looking back, it is clear that these changes proved immensely important to the continued evolution and development of SURF.

Lee DuBridgE once told me that he thought SURF was helping to recapture the deeper sense of purpose and fellowship between our undergraduates and the greater Caltech community. Today he would be very impressed. Whereas academic programs are bound to evolve and may even give way to new ones, as long as highly motivated young people with dreams wish to work with visionary mentors, SURF should continue to flourish. In a real sense, each SURFer begins a new chapter in the book of SURF. Because of the Caltech/JPL culture, and because of the many dedicated people who have gone before us, new chapters will continue to be added for the foreseeable future.

The anonymous donation made in 1977 has indeed developed into another remarkable legacy for the Wassermans and for Caltech.

Lew and Edie Wasserman join the following SURF dedicatees:

1985	Dr. Ernest Swift
1986	Dr. Lee A. DuBridgE
1987	Dr. Robert P. Sharp
1988	Dr. Ray D. Owen
1989	Dr. Hans W. Liepmann
1990	Dr. Fredrick H. Shair
1991	Dr. Lew Allen, Jr.
1992	Dr. John D. Roberts
1993	Dr. Robert E. Bacher
1994	Dr. Edward C. Posner
1995	Mr. Samuel P. Krown
1996	Dr. Edward B. Lewis
1997	Dr. Harold Brown
1998	Dr. Thomas E. Everhart
1999	Dr. Ward Whaling
2000	Dr. Terry Cole
2001	Dr. William M. Whitney
2002	Dr. Edward C. Stone
2003	Dr. Thomas A. Tombrello, Jr.
2004	Dr. Harry B. Gray
2005	Paul K. Richter and Evalyn E. Cook Richter Memorial Funds
2006	Lew and Edie Wasserman

SURF Board Report

by JOHN GEE, *Chair*



CONGRATULATIONS to the 2006 SURF students and mentors on another terrific summer! Students learned a lot, contributed to the formation of new knowledge, and experienced joy and frustration as their projects unfolded. SURF celebrates student achievement!

We welcome Caltech's new president, Jean-Lou Chameau, and his wife, Dr. Carol Carmichael, and we look forward to introducing them to the SURF community. As Dr. Baltimore steps down as president, we offer our heartfelt best wishes to him and Alice Huang. Dr. Baltimore had 13 SURF students in his laboratory over the past seven years. We extend our deep thanks for his enthusiastic and unwavering support throughout his presidency.

The Board has pursued its mission in significant ways in the past year. Through the extraordinary generosity and leadership of an alumnus and his wife, we have reached 72% of the goal to increase the SURF endowment by \$10 million. This couple created an innovative program to match up to \$50,000 toward the \$125,000 cost for a SURF endowment, allowing donors to create named SURF endowments for \$75,000. We greatly value their partnership with SURF and Caltech in ensuring that our talented students will always benefit from the research advantage of SURF. If you would like information about endowing a SURF fellowship in perpetuity, please contact Mark Reinecke, Senior Development Officer, at mreinecke@caltech.edu, or call him at (626) 395-3707.

We heartily thank all the donors who established SURF endowments this year. Your significant gifts have ensured the future of the SURF program and are important investments in the futures of Caltech's talented students. The list of endowments,

and the students supported by them, may be found on page 20 of the annual report.

We depend upon the gifts of all sizes from all donors! Together, you provide an impressive funding foundation to annually support SURF students. Thank you for your alliance with Caltech in providing rich opportunities for our students.

We thank the following Board members for their exceptional service to SURF, the program administration, and the students. These five people have completed two three-year terms. We deeply appreciate their dedication and loyalty to the program and the students: John H. Glanville (John served as SURF Board Chair from 2001-2003, and will continue to serve as Immediate Past Chair); Robert A. R. Parker; Robert C. Ritchie; David P. Rossum; and Ward Whaling.

I welcome five newly elected Board members, and I look forward to working together to strengthen and support the SURF program. They are H. Kent Frewing, Heather S. Haaga, Catherine Jurca, Don M. Pinkerton, and Gary W. Stupian. In addition, Debra Dison Hall is the new representative of the Alumni Association Board.

Carolyn Ash will retire at the end of 2006 as Director of Student-Faculty Programs, better known as SURF. Carolyn's superb leadership from SURF's early years through its 28th year in 2006 has been a major contribution to the success of the program at Caltech. We thank Carolyn and her staff for another fine SURF year and wish her well in her retirement. The Search Committee under Fred Shair expects to make recommendations to the Vice Provost for the new director in October. Thanks again, Carolyn!

2006 SURF Administrative Committee Report

by FRED SHAIR, *Chair*



Highlights of SURF 2006

This summer, 346 students were engaged in research with 188 faculty and JPL technical staff. We have come a long way since SURF 1979 when 18 students conducted research with 17 faculty members. The Caltech faculty now has four former SURFers: Ken Libbrecht, who was in the first SURF class; Julie Kornfield; Mark Richardson; and John Dabiri.

This year's SURF class included 14 students from local community colleges through the JPL Undergraduate Scholars (JPLUS) program; 14 participants in the Asian Exchange programs with the Indian Institute of Technology at Kanpur, National University of Singapore, and the Hong Kong Universities; 4 students in the Axline SURF program (select incoming freshmen); 7 students from the University of Cambridge in the Caltech-Cambridge Exchange program; and 3 students in special Howard Hughes Medical Institute programs. In addition, 152 students participated in other programs coordinated by the Student-Faculty Programs office.

SUMMER Undergraduate RESEARCH Fellowships

1979: 18 SURF students

2006: 346 SURF students

1979: 17 SURF mentors

2006: 188 SURF mentors

SURF facts:

- > There have been a total of 5,753 SURF students since the program's inception.
- > Almost 28% of the living Caltech undergraduate alumni have been SURF participants.
- > About 20% of SURF participants have become authors or coauthors of articles in the refereed literature, contributed to significant reports, or presented their work at conferences.
- > Over a recent four year period, 75% of Caltech faculty worked with undergraduates.
- > Forty-four SURFers have been mentored by one of the 14 Caltech Nobel prize recipients. Nobel laureates currently on campus—Professors Baltimore, Grubbs, Marcus, Politzer, and Zewail—have mentored 38 SURF students.
- > Including those mentored by Nobel prize winners, a total of 53 students were mentored by members of the National Academy of Engineering and the National Academy of Sciences this summer.
- > The teacher/scholar who has mentored the highest number of SURFers is retired Provost and Professor of Chemistry Jack Roberts. At last count, he had mentored 98 SURFers and is still going strong!

A salute to Carolyn Ash:

Although many have made stunning and sustained contributions to SURF, it is clear that the person most responsible for the shape that SURF is in today is Carolyn Ash, who will be retiring on December 31, 2006. Carolyn has been a “player-coach” and has directed SURF with a very small staff. Through her work and the work of her staff—Carol Casey, Fiona Tindall, and Jason Casey—and former members of the SURF team—Joan Spears, Susan Clark, Jeanie Cass, Mary Ann Ahart, and Ryan Tischler—Carolyn has added to the lives of all SURFers past, present, and future. Because of her integrity, ingenuity, tenacity, and sensitivity to the cultures of Caltech and JPL, she has long enjoyed the trust of students, faculty, staff, alumni, donors, and volunteers. Because of this trust, her positive attitude, and dedication, SURF is now thoroughly embedded within the fabric of Caltech/ JPL, and is widely recognized to be the premier program of undergraduate research.

Although there is little hope of finding a “Carolyn-clone,” the search committee is charged with finding at least one person who has enough of the “right stuff.” That is, we seek candidates who have the attitude, experience, and management style to be successful in guiding the Student-Faculty Programs in ways so that they (both the new director and the programs) shall continue to evolve and flourish.



The Shair Legacy

This year we celebrate the important contributions of many individuals to the creation and development of the SURF program. The SURF story began with Fred Shair, who knit together ideas gathered from his observations of student learning, structures from an NSF undergraduate research program, knowledge of Caltech's culture, and assessment of the Institute's readiness for such a program. Although the program has grown and changed over the years since Fred left Caltech, the core aspects he established remain constant and sacrosanct. Students collaborate with mentors prior to writing and submitting research proposals for review. Fellows work on their projects over a ten-week summer period and give oral presentations and write technical papers at the conclusion. The essence of the SURF experience is the mentor-protégé interaction. Each program element enhances pedagogy, simulates a professional experience, and introduces students to research.

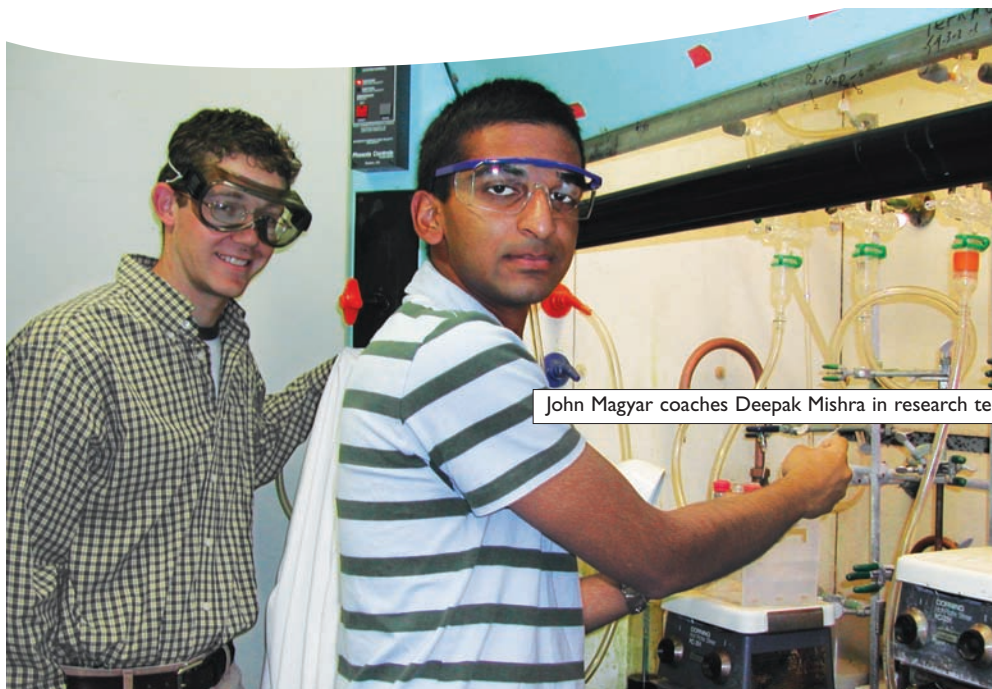
The benefits of SURF are legion. The program fosters collegiality between students, mentors, and other members of a research group. Often the interaction continues long after a student has graduated. Students learn what it takes to create new knowledge, and about 20% of them become authors or co-authors of articles in science or engineering publications or present their work at conferences. Participants gain self-knowledge about the careers they want to pursue. They develop self-confidence.

Fred left a legacy that has benefited over 5,000 students over the program's 28 years. Because of his imagination and persistence, undergraduate research is deeply rooted in Caltech's culture. Through SURF, Fred Shair reached far and touched many.

SURFers 2006

<i>Class Level</i>	<i>Percent</i>
Pre-Freshman	2%
Freshman	28%
Sophomore	35%
Junior	32%
Senior	3%
Women	37%
Minorities	9%
Average GPA*	3.45

**Caltech students only, excluding pre-freshmen and freshmen*



John Magyar coaches Deepak Mishra in research techniques for the project.

THE PROFESSOR FREDRICK H. SHAIR SURF ENDOWMENT was created in 1989 by Hugh Colvin to recognize and honor Fred for his vision and spirit in creating SURF at Caltech.

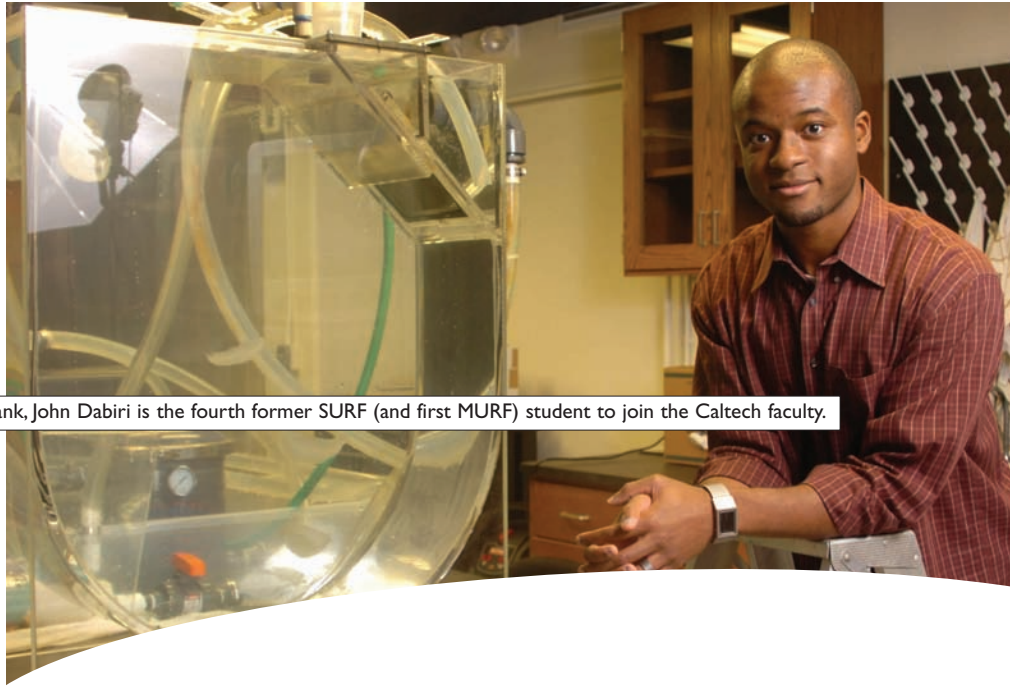
Deepak Mishra, this year's Shair fellow, is a sophomore majoring in chemical engineering, who worked with Arnold O. Beckman Professor of Chemistry Harry Gray on a project titled "Ultrafast Electron Transfer in Cytochrome *c*." "He is trying to break the speed limit on electron transfer in proteins, and he is getting some good results," says Harry.

Deepak works with co-mentors Crystal Shih, a graduate student in synthetic inorganic chemistry, and John Magyar, a postdoctoral scholar in biological chemistry. Deepak's interdisciplinary project allows him to gain outstanding experience in two disparate

fields of chemistry. He worked with Crystal on the synthesis during the spring term, and once he had accomplished that part, he worked with John on the biology.

John says that Deepak's project is really his own; it is not a part of either his or Crystal's research. They both taught him the techniques necessary to do the work, and Deepak took ownership of the project. They will probably publish this work. John says, "Deepak asks a lot of good questions. He has a lot of initiative, he is very interested in working on this project, and he is self-motivated."

Deepak plans to pursue a career in academic research, and believes that this SURF experience has helped him develop as a young scientist.



Minding his jellyfish tank, John Dabiri is the fourth former SURF (and first MURF) student to join the Caltech faculty.

JOHAN DABIRI, Assistant Professor of Aeronautics and Bioengineering, is the fourth former SURF (and first MURF) student to become a Caltech faculty member!

In the summer of 2000, John worked with Morteza (Mory) Gharib, Hans W. Liepmann Professor of Aeronautics and Professor of Bioengineering, on ejection mechanisms and vortex dynamics of jellyfish locomotion. He came to SURF from Princeton as a rising senior majoring in mechanical and aerospace engineering. As he considered his future career options, John thought a research experience would be important, and his advisor had recommended several prospective academic and industrial mentors for a summer position. John applied to, and was offered, all of them, including a very high paying industrial internship. He chose SURF.

John and Mory had discussed a SURF project involving small scale aeronautic problems involving helicopters. This suited John well given his academic

major and interests. He submitted his proposal, which was highly rated, to work on that project. Although he applied to and was awarded a SURF, his fellowship was funded by the MURF program.

A few days after John arrived to start his project, Mory took his group on an outing to the Long Beach Aquarium of the Pacific, in part because he was becoming interested in the biometrics of how fish swim. In one tank they observed jellyfish propel themselves and wondered how vortex theory applied to the motion. John held the camera and videotaped the action. He became so interested in the question, he switched projects.

John applied to graduate school to work with Mory. As an east coaster, he would not have considered Caltech if he had not spent the summer here. His graduate research continued his investigations of biological propulsion exhibited by jellyfish.

John says he benefited from Mory's mentoring during his SURF/MURF summer and throughout

graduate school. Mory allowed John independence and freedom to explore open-ended problems and to explore the things of greatest personal interest. "Mory intellectually engages students, encourages them to challenge him, and builds their self-confidence," says John. Mory rejoins, "John is intellectually energetic and curious. He grabs a project and delves into it."

John received his PhD in 2005. As graduation drew close, he received several offers for faculty positions. He chose to stay at Caltech where he enjoys the interaction among his colleagues and the ease of collaboration with faculty in various fields. John and Mory continue to collaborate. They obviously work well together, enjoying an easy repartee. They now teach two sections of a class on biological flows. John teaches the external flows of jellyfish, and Mory, the internal flows of the circulatory system. They plan to write a book together.

John and Mory, student and mentor, the essence of SURF. The legacy continues.

You can see John's work on his web page at <http://dabiri.caltech.edu/index.html>.

PO-LING LOH, the Associates SURF Fellow, won the 2005 Doris S. Perpall SURF Speaking Competition. She is the youngest student and first mathematician to win this prize! She is off to a great start towards her career goal of becoming a professor of mathematics.

Now a sophomore, Po-Ling worked with professor of mathematics Dinakar Ramakrishnan this summer on a project in Galois theory. Dinakar says this project is hard for a young student like Po-Ling. "She has had to learn a lot of stuff, and the relevant references are not clearly written," he says. He notes that although there is no direct application of this work which would enthrall a non-mathematician, chemists are often interested in symmetry groups. The study of "Galois groups" is intimately tied up with prime numbers and factorization, which creep up unexpectedly, and effectively, in coding and cryptography. "Even the mundane ATMs these days use number theory to encrypt things and enable better security," he says.

This is Po-Ling's third research project. She started her research experiences as a high school participant in the Research Science Institute located at Caltech the summer of 2004. She worked with mathematics professor Michael Aschbacher in group theory. Po-Ling continued her work with him in 2005 as an Axline SURF student, one of a select group of

SURFers 2006

<i>Division</i>	<i>Total # of Students</i>	<i>CIT Students</i>	<i>Non-CIT Students</i>	<i>Mentors</i>
Biology	48	37	11	22
Chemistry and Chemical Engineering	63	51	12	27
Engineering and Applied Science	70	58	12	29
Geological and Planetary Sciences	18	14	4	10
Humanities and Social Sciences	23	18	5	13
Physics, Mathematics, and Astronomy	48	39	9	28
Jet Propulsion Laboratory	55	20	35	38
Off Campus	12	11	1	12
International	9	9	0	9
TOTAL	346	257	89	188



Jonathan Gardner, Po-Ling Loh, and Todd Gingrich discuss their SURF projects.

incoming freshmen who have the opportunity to do a SURF project prior to matriculation. Her final presentation qualified her for the Perpall prize.

For this summer's project, Po-Ling spent much time gathering background information and searching for an appropriate problem. (Math SURF fellows generally select their own problems, unlike the science or engineering students whose projects are usually suggested by the mentor.) "As a result, I gained an appreciation for the vastness of mathematical research. There were so many different topics to learn about, and each one seemed to branch off into lots of different subtopics," she says.

Po-Ling works independently on her project, as mathematicians do. While she meets weekly with Professor Ramakrishnan, he encourages her to find her own books and papers to read for relevant background material. She admits that though she struggles through a few paragraphs of a paper or tries to implement a technique that she thought up by herself, she finds it satisfying to know she can work inde-

pendently. "That's what research ultimately needs to be—independent work," she says. "So I am grateful to Professor Ramakrishnan for leaving many of my assignments open-ended, giving me opportunities to become frustrated with my research and then make some progress in the end."

She continues, "SURF has provided amazing research opportunities for me during the last two years. It's opened up doors for me to work with world-class math professors and attend research conferences—far more than I could have imagined from ten weeks' worth of undergraduate research! After speaking to students from other universities, I've realized that the SURF program at Caltech is truly like no other."

JANET HERING, Professor of Environmental Science and Engineering; third-year graduate student Richard Wildman; and Michael Easler, Ernest R. Roberts SURF Fellow, sit at a conference table discussing global climate change. They recently saw the movie *An Inconvenient Truth* together, and as environmental engineers, they have opinions! Mike is glad the documentary “got the facts right.” Rich thinks the movie provides compelling images of changes on the earth. “As scientists, we know these things are happening,” he says, “and the movie helps to tell the story.”

Professor Hering and her research group study many aspects of environmental science from large scales of global climate studies to the local scales of engineering solutions to environmental problems. Over the past ten years, she has mentored twenty SURF and MURF students.

Mike, a junior majoring in environmental science and engineering (ESE), has been interested in environmental issues since he was a six-year old boy living in

the Midwest. One evening as the family watched a brilliant sunset, his father explained that air pollution helped create the spectacular display. Mike has always been interested in building things, playing with Legos when he was very young and building a hot rod car to drive to school when he was older. He became team leader for his high school electric car competition. He says that ESE brings together his interests in unique ways, and he applied for a SURF this summer to learn whether he wants to do research for a career. He has discovered he does not want to become an academic research scientist. Rather than diagnosing environmental problems, he prefers to work on the solutions to the problems with focus on his engineering interests.

Mike’s project measures sediment deposition and trace metals in the Lake Powell delta in Utah to see whether the drought has had consequences for the delta’s biogeochemistry. Collecting samples at Lake Powell has provided excellent opportunities to enjoy



Rich Wildman, Mike Easler, and Janet Hering confer about an article.

beautiful nature while striving to discover its secrets.

Rich is Mike's co-mentor. They work closely together. Rich notes that, unlike Mike, the required research experience when he was an undergraduate at Yale recruited him to the life of a research scientist. Like Mike, he became interested in environmental matters as a child growing up in the Bay Area where drought occurred, and water resources were sometimes scarce. He became interested in the chemistry of water and water quality and realized he could combine his interests in chemistry and the environment in Caltech's ESE graduate program.

Janet says, "Undergraduate research is terrific preparation for students who want to attend graduate school. They have a sense of what they will be getting themselves into. They also get a sense of what it takes to develop knowledge." Rich adds that before his first experience he thought research would be like the cookbook labs associated with his chemistry classes. He discovered he loved research, because no one knew the answers to the questions he asked. He had to figure them out. "I had ownership of my academic experience. Up until then, I was in a class,

doing what someone else told me to do."

In the Hering lab, SURF fellows attend group meetings and make presentations on their work just like the graduate students do. They practice their final SURF talks for the group before they give them on Seminar Day. The group has lunch together on Fridays, and sometimes they plan an outing, like going to see the movie.

Rich likes his mentoring role but admits he has ulterior motives. "Caltech students are really smart, so bringing them in on my project is really great for me. They contribute a lot! It benefits my research. It just makes sense."

Mentoring is the key to the SURF experience. Undergraduates are guided by more experienced researchers as they are introduced to research. Graduate students and postdoctoral scholars gain their first mentoring experiences as they work with undergrads. Faculty mentors coach all the students. The legacy continues.

Statistics From the 2006 Graduating Class

Total number graduating:	247	
Number of SURFers:	173	70%
Total number of graduates receiving honors:	141	57% of the graduating class
SURFers receiving honors:	108	77% of the students receiving honors
Total number of prizes awarded:	151	
Prizes received by SURF students:	126	83%

Highlights of the 2006 Summer Program

Allied Programs

The Student-Faculty Programs Office administers an array of undergraduate research programs: MURF, Laser Interferometer Gravitational-Wave Observatory, NASA Undergraduate Student Research Program, NASA Space Grant, and NASA Planetary Geology and Geophysics Undergraduate Research Program. All programs have similar requirements. Students must write a research proposal or project plan, conduct their research over the ten-week summer period, give an oral presentation, and submit a technical paper. They receive \$5,000. Participants may attend all summer activities coordinated by the SFPO and the SURF Student Advisory Council. The total number of students in all SFP programs for 2006 was 498.

Caltech Wednesday Seminars

MICHAEL E. BROWN

Professor of Planetary Astronomy

Beyond Pluto: Discovery of the 10th Planet

JOHN O. DABIRI

Assistant Professor of Aeronautics and Bioengineering

Bio-Inspired Engineering: Learning From Nature

SOSSINA M. HAILE

Professor of Materials Science and Chemical Engineering

Fuel Cells: On the Road to a Sustainable Energy Future

JANET G. HERING

Professor of Environmental Science and Engineering

The Mighty Colorado: Water Supply and Quality in the American Southwest

JERROLD E. MARSDEN

Carl F Braun Professor of Engineering and Control and Dynamical Systems

Invariant Manifolds: From Jellyfish to Spacecraft

R. PRESTON McAFEE

J. Stanley Johnson Professor of Business Economics and Management

Why Are Prices So Bizarre?

PAUL H. PATTERSON

Anne P. and Benjamin F. Biaggini Professor of Biological Sciences

Neuroimmune Interactions in Schizophrenia and Autism: An Animal Model

KIP S. THORNE

Richard P. Feynman Professor of Theoretical Physics

Gravitational Waves: A New Window Onto the Universe

JPL Friday Seminars

CHRISTOPHER BOXE

ORAU-NASA-JPL Postdoctoral Scholar

Global Warming: Fact, Hypothesis, or Myth?

PAMELA GALES CONRAD

Research Scientist; Acting Group Supervisor; Astrobiology; Investigation Scientist, Mars Science Laboratory

Exploration, Science, and Engineering: How You Will Make it Happen?

AMANDA K. MAINZER

Widefield Infrared Survey Explorer (WISE) Deputy Project Scientist.

Wilder Skies: Brown Dwarfs Young and Old

ROBERT MANNING

Mars Program Chief Engineer

Mars or Bust: The History and Challenges of Getting to Mars

HARISH MANOHARA

Technical Group Supervisor, Nano and Micro Systems Group, In Situ Instruments Section

Talking About Small Things: Micro and Nanotechnologies for Future Space Exploration

WILLIAM OWEN

Principal Engineer, Optical Navigation Group

How We Hit That Sucker: Engineering Deep Impact's Collision With Tempel 1

TRINA RAY

Cassini Science Planning Team

Mysterious Titan

ASHLEY W. STROUPE

Staff Engineer and "Rover Driver"

Planetary and Space Robotics: The Mars Exploration Rovers and Beyond

RANDII R. WESSEN

Navigation Program Engineer

The Future of U.S. Robotic Planetary Exploration

The William Whitney Workshops on Professional Development

INVENTING YOUR FUTURE:
WHAT ARE YOUR OPTIONS?

Dr. William Whitney

Deputy Manager, Education Office, JPL

Dr. Jerry Houser

Director, Caltech Career Development Center

SECRETS OF THE POLISHED
PROFESSIONAL: TIPS AND TACTICS
FOR NETWORKING, RELATION-
SHIP BUILDING, AND SOCIAL
ETIQUETTE

Ms. Yvonne Banzali

Career Counselor, Career Development Center

COMMUNICATION IN CAREERS

Ms. Kathryn Bikle

*Lecturer in Oral Presentations, Chemistry
and Geology*

Dr. Steven Youra

Director, Hixon Writing Center

WHAT CAN YOU DO WITH A
TECHNICAL BACKGROUND?

Caltech Alumni: Dr. John F. Davis,
Dr. Phoebe Dea, Ms. Debra Dison
Hall, Dr. Thomas Lloyd, Dr. William
Royea, Dr. William M. Whitney

GRADUATE SCHOOL:
THE NUTS AND BOLTS OF THE
APPLICATION PROCESS

Ms. Jonie Watanabe Tsuji

Career Counselor, Career Development Center

SCIENTISTS AS SPEAKERS

Dr. Scott Fraser

*Anna L. Rosen Professor of Biology
and Professor of Bioengineering*

SPECIAL EVENTS

Huntington Tour

We thank Dr. and Mrs. George Boone for arranging the annual behind-the-scenes tour of the Huntington Library and Conservatory and for hosting a reception for our students in the beautiful sculpture garden at their home.

JPL Mission Life-Cycle Tour

Mr. David Seidel led an educational tour of the Jet Propulsion Laboratory this summer. His enthusiasm and knowledge of the history of JPL and its space missions inspired participants.

JPL Picnic

The JPL Education Office hosted fun and food for students at Caltech's Tournament Park on what turned out to be the hottest Sunday of the summer. Over eighty students enjoyed all-American grilled burgers, sports, and a dip in the pool.

SURFSAC Events

The SURF Student Advisory Council coordinated many social activities including cool ice cream socials on hot evenings, rousing games of capture the flag, a casino night, excursions to Old Pasadena, and a beach trip followed by a barbecue on campus.

Caleb Ng, Parvathy Menon, and Noah Rahman coordinated weekly SURFSAC Suppers bringing mentors and students together for informal conversation at nearby California Skewers. We thank Dr. Catherine Jurca, Master of Student Houses, for her generous subsidy of these dinners.

Rob Barish and Aditya Rajagopal showed movies in Moore on Thursday evenings.

Conferences

SURF Seminar Days – An important requirement of SURF is the communication of results. We held four seminar days, August 15, 16, 17, and October 21, to provide opportunities for all students to give oral or poster presentations to audiences of peers, mentors, faculty, alumni, donors, and families.

Southern California Conference on Undergraduate Research is a one-day conference held each November on the campus of a college or university in the Los Angeles area. SCCUR, which draws over 500 participants, provides a forum for presentation and discussion of the best research, scholarship, and creative work of undergraduates in the region. The 2005 conference was held at the University of California at Riverside; the 2006 SCCUR will be held at Occidental. SCCUR was started at Caltech in 1993.

We send the Doris S. Perpall Speaking Competition finalists to the National Conference on Undergraduate Research each year. The 2006 NCUR was held at the University of North Carolina at Asheville. Po-Ling Loh and Elah Bozorg-Grayeli attended.

Awards and Prizes

Robert C. Perpall (BS '52, MS '56) endowed a prize in memory of his late wife, Doris Perpall, to encourage students to prepare excellent SURF presentations. The 2005 winners were: Po-Ling Loh, Paul Nagami, Hatem Helal, and Elah Bozorg-Grayeli.

Funding SURF

2006 SURF Wage: \$5,000

Total wage budget: \$1.7 million

Funds for student wages are raised from a variety of sources, including gifts from individuals; foundations and corporations; faculty grants and other Institute sources; and NASA funds (for students working with JPL mentors).

Faculty generally pay half the student award from their grants, and SURF matches the amount with funds raised from external sources.

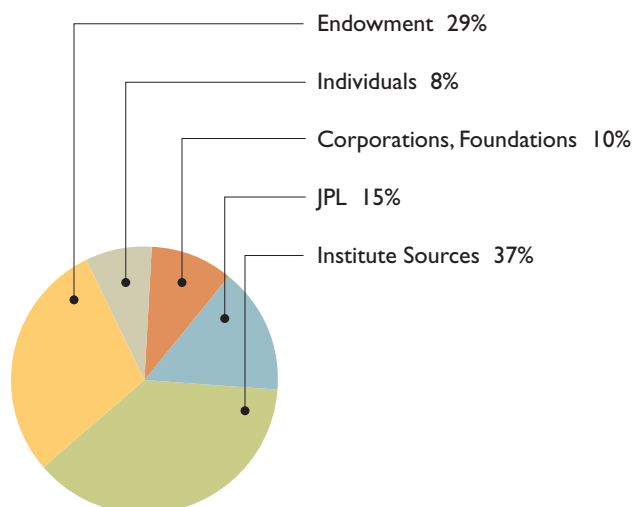
Special Offer!

A Caltech alumnus and his wife have contributed \$2 million to match up to \$50,000 toward a \$125,000 named SURF endowment! Endowments will be named as you designate. Only a few matches remain!

Benefits to Donors

- > Each year a student will be selected to bear the endowment name
- > Donor will receive a letter introducing the student supported
- > Donors may have opportunity to meet the student
- > May receive letters of appreciation from the student
- > Invitation to SURF Seminar Day to hear student's oral presentation
- > Knowledge that they have made an important investment in the futures of Caltech's talented students
- > Strengthen Caltech through support of SURF
- > Ensure future of the program

2006 SURF Funding Sources



Honor Roll of SURF Donors

GIFTS TO ENDOWMENT

BRENDA AND LOUIS J. ALPINIERI
SURF ENDOWMENT

Dr. and Mrs. Louis J. Alpinieri

THE ASSOCIATES
SURF ENDOWMENT

Mr. and Mrs. Donald M. Alstadt

Mr. and Mrs. Robert E. Anderson

Mr. and Mrs. George L. Cassat

Dr. and Mrs. Hubert E. Dubb

Mrs. William R. Fair

Mr. and Mrs. John H. Glanville

Mr. C. Richard Johnson

Mr. and Mrs. Gordon C. McClure

Mr. and Mrs. Martin H. Webster, Esq.

HANNAH BRADLEY
SURF ENDOWMENTS

Mrs. Hannah Bradley

DR. TERRY COLE
SURF ENDOWMENT

Mrs. Terry Cole

Mr. and Mrs. John H. Glanville

Mr. and Mrs. Thomas R. Hamilton

KAREN AND JAMES CUTTS
SURF ENDOWMENT

Dr. and Mrs. James A. Cutts

MARY P. AND DEAN C. DAILY
SURF ENDOWMENT

Mr. Dean C. Daily II

CHARLES AND VALERIE ELACHI
SURF ENDOWMENT

Dr. and Mrs. Charles Elachi

JOHN AND BARBARA GEE
SURF ENDOWMENT

Mr. and Mrs. John D. Gee

GENERAL SURF ENDOWMENT
Anonymous

Dr. William E. Farrell

Dr. Cathleen Godzik

HARRY B. GRAY
SURF ENDOWMENT

Dr. and Mrs. Daniel C. Harris

W.H. HALPENNY
SURF ENDOWMENT

Mr. William H. Halpenny

WILLIAM HASSENZAHN FAMILY
SURF ENDOWMENT

Dr. and Mrs. William V. Hassenzahl

ROBERT T. HERZOG
SURF ENDOWMENT

Mr. Robert T. Herzog

EDWARD W. HUGHES
SURF ENDOWMENT (2005)

Mrs. Edward W. Hughes

TOSHI KUBOTA AERONAUTICS
SURF ENDOWMENT

Dr. and Mrs. Eli Reshotko

LARSON SCHOLARS

Mr. and Mrs. Carl V. Larson

THOMAS LAURITSEN
SURF ENDOWMENT

Mrs. Robert Leighton

LESTER LEES AERONAUTICS
SURF ENDOWMENT

Mrs. Lester M. Lees

Dr. and Mrs. Eli Reshotko

NORTHERN CALIFORNIA
ASSOCIATES SURF ENDOWMENT

Mrs. W.B. Scarborough

TONI AND BOB PERPALL
SURF ENDOWMENT

Mr. and Mrs. Robert C. Perpall, Sr.

ERNEST R. ROBERTS
SURF ENDOWMENT

Ms. Karen V. Roberts

and Mr. James M. Sagawa

DR. CHANDLER C. ROSS
SURF ENDOWMENT

Mr. and Mrs. Carson E. Hawk

ØISTEIN AND RITA A. SKJELLUM
SURF ENDOWMENT and the

RITA A. AND ØISTEIN SKJELLUM
SURF ENDOWMENT

Dr. Anthony Skjellum, SURF '83

SAMUEL AND BERTA SPALTER
SURF ENDOWMENT

Mr. and Mrs. Lee Miller

Treesdale Partners LLC

LAURENCE STUPPY
SURF ENDOWMENT

Ms. Elizabeth J. Pike

SURF BOARD ENDOWMENT

Mr. and Mrs. John H. Glanville

Dr. and Mrs. William M. Whitney

NELLIE BERGEN AND ADRIAN
FOSTER TILLOTSON SURF
ENDOWMENT

Mrs. Albert L. Burford

ERIKA C. VOTE
SURF ENDOWMENT

Dr. Carol J. Vote

Estate of Mrs. Fred A. Zapletal

FRANK W. WOOD MEMORIAL
SURF ENDOWMENT

Mr. Richard H. Cox

ANNUAL GIFTS

Gifts to Annual Stipend Fund

Gifts of \$5,000 or More

Mr. Robert M. Abbey

Dr. and Mrs. Lew Allen, Jr.

Mrs. Hannah Bradley

Ms. Jane C. Chen

Dr. Paul S. and Dr. Carla Hummel

Mr. and Mrs. Richard Krown

Dr. Eugene K. Maun

Mr. and Mrs. Robert L. Noland

Mr. and Mrs. Benjamin M. Rosen

Mr. and Mrs. David P. Rossum

Mr. and Mrs. Henry Shapiro

Dr. and Mrs. Edward C. Stone

Mr. Fred M. Wells

Mr. John E. Young

Gifts of \$1,000 - 4,999

Mr. and Mrs. Paul L. Armstrong

Mr. James C. Beck

Dr. and Mrs. George N. Boone

Mr. Daniel H. Chou, SURF '97

Dr. and Mrs. Thomas E. Everhart

Mr. and Mrs. Jay Farr

Mr. and Mrs. Russell Faucett

Dr. Robert H. Harris

Mr. and Mrs. Robert Henigson

Mr. Stephen V. Hwan, SURF '89

Mrs. George G. Jewell

Mr. and Mrs. Joseph L. Koo

Dr. Susan Murakami

and Mr. Leroy Fisher

Dr. and Mrs. John D. Roberts

Dr. Gary W. Stupian

Mr. Craig A. Zupke, SURF '84

Gifts of \$500–999

Mr. and Mrs. Arlen W. Bell
 Dr. Peter L. Davis
 Dr. and Mrs. Hideo Ikawa
 Dr. and Mrs. Paul C. Jennings
 Mr. and Mrs. James M. Kendall, Jr.
 Mrs. Eric G. Laue
 Mr. Mani M. Limlamai, SURF '03
 Dr. Evangelos Simoudis
 Dr. Tsung-Chow J.
 and Dr. Hui-Fang Su

Gifts Under \$500

Mr. and Mrs. Nobuhiko Abe
 Ms. Lada A. Adamic, SURF '95, '96
 Mr. Viktor Y. Alekseyev, SURF '97, '98
 Dr. and Mrs. James J. Angel,
 SURF '79, '80
 Mr. and Mrs. Hugh A. Baird
 Dr. Joshua A. Bardin, M.D.
 Dr. Jeannie E. Barrett,
 SURF '89, '90, '91
 Mrs. Lynne S. Batchelder
 Mr. and Mrs. Harry S. Blackiston, Jr.
 Dr. and Mrs. Donald L. Blumenthal
 Mr. Peter A. Brier
 Mrs. Anna J. Brosnahan, SURF '90
 Dr. Patricia V. Burke
 Mr. Jonathan O. Burrows,
 SURF '96, '97
 Mr. Lee J. Burrows, SURF '90
 Mr. and Mrs. Willis A. Bussard
 Mr. Joseph Y. Chang, SURF '98, '99
 Ms. Shirley S. Chen, SURF '96
 Mr. Benjamin Y. Chu, SURF '02, '03
 Mr. Peter K. Clark
 Mr. Richard W. Clark, SURF '91
 Ms. Susan D. Clark
 Mr. David H. Close
 Mr. Evan G. Colgan, SURF '81
 Mr. and Mrs. LeRoy F. Coulter
 Dr. Edward T. Croke III
 Mrs. Fereshteh Daroeian
 Dr. and Mrs. John F. Davis, SURF '91
 Dr. Heather L. Dean, SURF '98, '99
 Mr. Peter J. Dennedy-Frank,
 SURF '00, '02
 Mr. Jeffrey T. Denniston
 Ms. Sayuri Desai, SURF '88
 Mr. James H. Dooley
 Dr. Duane R. Edgington
 Dr. David C. Elliot
 Ms. Iljia J. Fitzgerald, SURF '98, '99, '00
 Mr. Thomas S. Fletcher, SURF '03
 Mr. Tracy T. Furutani, SURF '82
 Mr. and Mrs. Walter Galitzki
 Dr. John A. George
 Dr. Morteza Gharib

Dr. Edray H. Goins, SURF '92, '93
 Dr. Cynthia-May S. Gong,
 SURF '96, '97, '98
 Dr. and Mrs. Robert H. Grubbs
 Dr. Philip M. Gschwend
 Mr. and Mrs. Franklin Hardesty
 Mr. and Mrs. Thomas C. Hays
 Mrs. Marion E. Heckman
 Mr. and Mrs. Wallis G. Hines
 Dr. Timothy A. Hochberg, SURF '87
 Ms. Sally D. Holbrook
 Ms. Elizabeth J. Hong,
 SURF '98, '99, '00
 Ms. Karen T. Hong, SURF '92
 Mr. Everett W. Howe, SURF '85
 Mr. Ron Hsieh
 Mr. Kathryn C. Hsu
 Mr. and Mrs. Kenneth Hui,
 SURF '82, '83
 Mr. Carter Hunt
 Mr. and Mrs. Stephen Jewell
 Dr. Alfred L. Johnson, Jr.
 Mr. Neil C. Jones, SURF '95, '96
 Mr. and Mrs. Raymond F. Jurgens
 Mr. and Mrs. Abner Kaplan
 Dr. Ann R. Karagozian
 Mrs. Laurie Kasparian
 Dr. Robert M. Kieckhefer
 Dr. Joseph L. Kirschvink
 Dr. and Mrs. James S. Kort
 Dr. and Mrs. James J. Kosmicki
 Mr. Milan P. Kovacevic, SURF '98
 Dr. and Mrs. Santosh Krishnan,
 SURF '83, '84, '85
 Mr. Wai P. Kwan, SURF '95
 Ms. Mimi Lau
 Mr. Benjamin G. Lee, SURF '99, '00, '01
 Dr. and Mrs. Jason T. Lee,
 SURF '92, '93
 Dr. and Mrs. Jack E. Leonard
 Mr. Zebao Li
 Mr. and Mrs. Wenzhong Ling
 Mr. Neville S. Long
 Mr. Le Val Lund
 Mr. and Mrs. William A. Mahoney
 Mrs. James H. Marlow
 Mr. Antonio Martinez
 Mr. Alvaro G. Masias, SURF '99, '00
 Mrs. Melody H. McLaren
 Mr. Aron J. Meltzner, SURF '97, '98, '99
 Dr. and Mrs. Lothrop Mittenthal
 Mr. Bassem N. Mora,
 SURF '86, '87, '88
 Dr. Christopher J. Myers,
 SURF '89, '90
 Mr. and Mrs. John L. Nairn, Jr.
 Mr. Charles K. Nartey
 Dr. Donald P. Nierlich

Dr. Megan E. Nuñez
 Ms. Mary C. Page
 Mrs. Pamela J. Peters
 Mr. and Mrs. Timothy T. Pham,
 SURF '85
 Mr. and Mrs. Harold R. Pollock
 Mr. Nicolas Pujet
 Dr. Nantian Qian
 Ms. Anandi Raman Creath,
 SURF '94, '95
 Dr. Irving Rappaport
 Mr. Paul B. Ré
 Dr. and Mrs. Sembiam Rengarajan
 Mr. David B. Ritchie, SURF '79
 Mr. Donald G. Roberts
 Mr. Bruce Rugar
 Dr. David B. Rutledge
 Mr. and Mrs. Peter Sanford
 Mr. Mark D. Savellano, SURF '92
 Dr. Stefan Schlamp
 Mr. and Mrs. Thomas W. Schmitt
 Mr. Fred A. Shahir
 Ms. May S. Shelton
 Dr. Douglas G. Shiels, SURF '91, '92
 Ms. Rebecca L. Smith
 Mr. and Mrs. Rodney B. Spears
 Mr. and Mrs. William G. Steele, Jr.
 Dr. and Mrs. Michael S. Stefanko
 Mr. and Mrs. Larry Stein
 Dr. Eric Strong
 Mr. and Mrs. Derek M. Surka,
 SURF '92, '93
 Mrs. Amy Sutherland
 Mr. Jeffrey D. Tekanic, SURF '87
 Mr. and Mrs. James H. Thessin
 Mr. Louis K. Thomas, SURF '97
 Mr. Thao N. Tran, SURF '96
 Dr. A. Jennifer Trotter, SURF '93, '94
 Dr. Juanito S. Villanueva, SURF '80, '81
 Mrs. Lynne E. Watters, SURF '85
 Mr. and Mrs. Joseph Wilpiseszki
 Dr. Richard C. Wilson
 Mrs. Allen E. Wolfe
 Mr. Scot A. Wolfe, SURF '88, '89
 Dr. James W. Workman
 Mr. Shuyun Wu
 Mr. Xiao Xu, SURF '02, '03, '04
 Dr. Vincent Yang
 Mrs. Victoriano L. Yao
 Mr. and Mrs. Paul Yen
 Dr. Yuk L. Yung
 Dr. Chung-en Zah
 Ms. Summer R. Zhang, SURF '00

Memorial Gifts

In Memory of Frederick W. Thiele
Mr. and Mrs. David F.Thiele

Corporate Donor

The Aerospace Institute

Matching Gifts

Agilent Technologies
Barclays Global
The Boeing Company
Chevron Corporation
Corning Incorporated
Fluor Corporation
GenCorp
Hewlett-Packard/World Reach
IBM Corporation
JP Morgan Chase
Microsoft Corporation
Procter & Gamble

Foundation Donors

Caltech Alumni Association
Howard Hughes Medical Institute
W.M. Keck Foundation
John and Maria Laffin Trust
Paul K. and Evalyn E. Cook Richter
Memorial Funds

ENDOWMENTS

1982

Samuel P. and Frances Krown

SURF Fellows
TATYANA A. SHATOVA

Mentors: Professor Mark E. Davis and
Mr. Brendan C. Mack

ALEXANDER R. SIEGEL

Mentors: Professor James McKerrow,
Professor Douglas C. Rees, and
Dr. Ben Kelly

SARAH E. WADSWORTH

Mentors: Professor Paul H. Patterson
and Dr. Benjamin Deverman

ELEANOR M. WAXMAN

Mentors: Professor Jesse L. Beauchamp
and Mr. Evan Neidholdt

MICHAEL R. WHITE

Mentor: Dr. Eric Wambach

JAIME B. GARNICA

Mentor: Associate Professor Kevin M.
Gilmartin

ZIQING ZHAO

Mentors: Professor Harry B. Gray and
Dr. Ekaterina Pletneva

1984

William H. and Helen Lang

SURF Fellow
STANLEY P. BURGOS

Mentors: Professor Harry A. Atwater
and Ms. Carrie E. Ross

1986

Flintridge Foundation

SURF Fellows

JESSICA A. ARNOLD

Mentor: Associate Professor Lynne
Hillenbrand

HENNA KERMANI

Mentor: Professor Judith G. Cohen

Lester Lees Aeronautics

SURF Fellow

KEVIN K. CHEN

Mentor: Professor Morteza Gharib

1988

Arthur R. Adams SURF Fellows

NING BAO

Mentor: Professor Peter C. Ordeshook

DAVID W. CHEN

Mentors: Professor Frances H. Arnold
and Mr. Jesse Bloom

CALYANI GANESAN

Mentors: Professor James H. Strauss
and Dr. Marlene Biller

DANIEL TOFAN

Mentors: Professor John E. Bercaw and
Mr. Theodor Agapie

**Peter A. Lindstrom, Jr.,
SURF Fellow**

ANDREEA D. STUPARU

Mentors: Professor James R. Heath and
Ms. Rosemary D. Rohde

**Northern California Associates
SURF Fellow**

GREGORY S. SCHMIDT

Mentors: Dr. Vilupanur Ravi and
Professor Guruswaminaidu
Ravichandran

1989

Bristol-Myers SURF Fellow

JOHN P. SADOWSKI

Mentors: Professor Peter B. Dervan
and Mr. Justin D. Cohen

Donald S. Clark SURF Fellow

YUKI KIMURA

Mentors: Professor Sossina M. Haile
and Dr. Peter Babilo

Class of '36 SURF Fellow

ARTURO A. PIZANO

Mentors: Professor Harry B. Gray and
Ms. Melanie Pribisko

**Hugh F. and Audy Lou Colvin
SURF Fellow**

LAURA E. LINDZEY

Mentor: Professor Richard M. Murray

**Hugh F. and Audy Lou Colvin
International SURF Fellow**

NATHAN W. CHAN

Mentors: Assistant Professor Andreas
Kappler, Professor Janet G. Hering,
and Ms. Katja Amstätter

William N. Lacey SURF Fellow

SHAWN X. YU

Mentors: Professor David A. Tirrell and
Mr. Kechun Zhang

**Thomas Hunt Morgan
SURF Fellow**

JOSEPH C. DONOVAN

Mentors: Professor Seymour Benzer
and Dr. Bader Al-Anzi

Arthur A. Noyes SURF Fellow

YEKATERINA Y. ZAK

Mentors: Professor Harry B. Gray and
Mr. Don Walker

**Professor Fredrick H. Shair
SURF Fellow**

DEEPAK MISHRA

Mentors: Professor Harry B. Gray, Dr. John Magyar, and Ms. Crystal Shih**Ernest H. Swift SURF Fellow**

NOAH A. RAHMAN

Mentor: Professor Jonas C. Peters

1990

**Toshi Kubota Aeronautics
SURF Fellow**

TIMOTHY G. CURRAN

Mentors: Professor Joseph E. Shepherd and Dr. Zhe Liang

1991

**Sidney R. and Nancy M. Petersen
SURF Fellow**

DANIEL W. ROWLANDS

Mentors: Professor Jacqueline K. Barton and Ms. Fangwei Shao**Dr. Chandler C. Ross
SURF Fellow**

JEFFREY J. GRAHAM

Mentors: Professor Joseph E. Shepherd and Mr. James A. Karnesky

1992

**Edward W. Hughes
SURF Fellow (1992)**

ELIZABETH C. SHAY

Mentors: Professor Eric H. Davidson and Dr. Feng Gao**Arthur E. Lamel Memorial
SURF Fellow**

ADITYA RAJAGOPAL

Mentors: Professor Axel Scherer and Mr. Saurabh Vyawahare

1993

**Howell N. Tyson, Sr.,
SURF Fellow**

KEVIN W. WATTS

Mentors: Professor Joseph E. Shepherd and Ms. Sally P. Moffett

1994

Arthur Rock SURF Fellow

ROBERT D. BARISH

Mentors: Associate Professor Erik Winfree and Dr. Paul W. Rothemund**Erika C. Vote SURF Fellow**

RILEY L. FRANKS

Mentor: Mr. Mark Garcia

1995

The Associates SURF Fellows

ANDREW P. KOSITSKY

Mentors: Professor Jean-Philippe Avouac and Dr. Mohamed Chlieh

JACK J. LEE

Mentors: Assistant Professor Christina D. Smolke and Mr. Travis Bayer

PO-LING LOH

Mentor: Professor Dinakar Ramakrishnan

CALEB E. NG

Mentors: Professor Douglas C. Rees and Dr. Eric Johnson

EMMA R. SCHMIDGALL

Mentor: Assistant Professor Marc W. Bockrath**Shirley and Carl Larson
SURF Fellow**

TODD R. GINGRICH

Mentor: Professor Nathan S. Lewis**Warren and Katharine Schlinger
SURF Fellow**

ZHONGYI LU

Mentor: Professor Frances H. Arnold

1996

J. Weldon Green SURF Fellow

PO-RU LOH

Mentor: Professor Matthias Flach

1998

Carolyn Ash SURF Fellow

NATALIE A. BECERRA

Mentors: Professor Melany L. Hunt and Ms. Nathalie Vriend**Robert L. Blinkenberg
SURF Fellows**

MICHAEL J. INADOMI

Mentors: Professor Robert D. McKeown and Dr. Christopher Jillings

YAN ZHANG

Mentors: Professor Michael C. Cross and Dr. Mason A. Porter

1999

**Bob and Carole Chapman
Minority SURF Fellow**

JESSICA N. GONZALEZ

Mentor: Professor Richard M. Murray**J. Kent Clark SURF Fellow**

THOMAS E. MORPHET

Mentor: Professor Philip T. Hoffman**Dr. Paraskeva N. Danailov
SURF Fellow**

NOAH M. JAKIMO

Mentors: Professor Paul W. Sternberg and Dr. Weiwei Zhong**Robert K. and Alice L. Roney
SURF Fellow**

ALEXANDRIA Y. GRUBBS

Mentors: Professor Guruswaminaidu Ravichandran and Ms. Charlotte Bolyard**Øistein and Rita A. Skjellum
SURF Fellow**

PAKPOOM SUBSOONTORN

Mentors: Assistant Professor Erik Winfree and Mr. Jongmin Kim**Rita A. and Øistein Skjellum
SURF Fellow**

MATTHEW D. LEW

Mentors: Assistant Professor Changhui Yang and Mr. Xiquan Cui

2000

Dr. Terry Cole SURF Fellow

CHRISTINA V. THEODORIS

Mentors: Professor Eric H. Davidson and Dr. Joel Smith**Thomas C. Hays SURF Fellow**

BENJAMIN GOLUB

Mentor: Professor Matthew O. Jackson**Victor Neher SURF Fellow**

NICHOLAS R. HUTZLER

Mentors: Professor Bradley W. Filippone and Dr. Brad Plaster**Alain Porter Memorial
SURF Fellow**

LORI C. SPALSBURY

Mentors: Professor Nicholas Z. Scoville and Dr. Kartik Sheth

2001

Marcella Bonsall SURF Fellows

TANIA BANDYOPADHYAY

Mentors: Professor Peter Gillespie and Professor Henry A. Lester

DAVID J. ROSENMAN

Mentors: Assistant Professor Grant J. Jensen and Ms. Hongyu J. Ding

MARY E. WAHL

Mentors: Professor Eric H. Davidson and Dr. Paola Oliveri

Rossum Family SURF Fellow

HELEN M. BERMUDEZ

Mentors: Professor John M. Allman and Dr. Jason A. Kaufman

2002

Ray Owen SURF Fellow

PREETHA K. SINHA

Mentors: Professor Paul H. Patterson and Ms. Natalia Malkova**SURF Board SURF Fellow**

CHRISTOPHER E. MOODY

Mentors: Dr. Richard A. Lee, Professor David L. Goodstein, and Dr. Robert V. Duncan

2003

David C. Elliot SURF Fellow

JONATHAN W. GARDNER

Mentor: Professor Philip T. Hoffman**Doris Everhart SURF Fellow**

DIANA H. LIN

Mentors: Assistant Professor Anand R. Asthagiri and Mr. Stephen Chapman

2004

Heather and Paul Haaga SURF Fellow

ABDUL T. AHAD

Mentors: Professor James R. Heath and Ms. Heather Agnew**Thomas Lauritsen SURF Fellow**

CHANDNI K. DHANJAL

Mentor: Dr. Matthew P. Golombek

2005

Stephen Adelman Memorial SURF Fellow

JOSHUA J. FEINGOLD

Mentor: Professor Richard M. Murray**Karen and James Cutts SURF Fellow**

SIERRA V. PETERSEN

Mentor: Professor John M. Eiler**Mary P. and Dean C. Daily SURF Fellow**

STEVEN R. GRAY

Mentors: Professor Melany L. Hunt and Mr. Angel Ruiz Angulo**Frederick W. Drury, Jr., SURF Fellow**

EKTA N. BHOJWANI

Mentors: Professor Harry B. Gray and Ms. Gitrada Arjara**Charles and Valerie Elachi SURF Fellow**

PARVATHY R. MENON

Mentors: Professor Yu-Chong Tai and Mr. Damien Rodger**Fred and Jean Felberg SURF Fellow**

SHAI BARAK

Mentors: Professor Demetri Psaltis and Mr. James R. Adleman**Robert I. and Winifred E. Gardner SURF Fellow**

DAVID M. ROSEN

Mentor: Professor Richard M. Murray**Harry B. Gray SURF Fellow**

PAUL M. MAGYAR

Mentors: Professor George R. Rossman and Dr. Timothy D. Glotch**William Hassenzahl Family SURF Fellow**

CHRISTINE F. PARRY

Mentors: Professor Oscar P. Bruno and Dr. Young Ae Han**Robert T. Herzog SURF Fellow**

MICHAEL J. COMSTOCK

Mentor: Associate Professor Warren C. Brown**Edward W. Hughes SURF Fellow (2005)**

ANDREA R. DUBIN

Mentors: Professor Jacqueline K. Barton and Ms. Amie Boal**Joanna Wall Muir SURF Fellow**

ANGELA ZAH

Mentors: Professor Marianne Bronner-Fraser and Mr. Meyer Barenbaum**Ernest R. Roberts SURF Fellow**

MICHAEL B. EASLER

Mentors: Professor Janet G. Hering and Mr. Richard Wildman**Soli Deo Gloria SURF Fellow**

BENJAMIN H. YANG

Mentors: Professor Harry A. Atwater and Mr. Matthew Dicken**Nellie Bergen and Adrian Foster Tillotson SURF Fellow**

JONATHAN C. LIONG

Mentors: Professor Seymour Benzer and Dr. William Ja**Mary Vodopia SURF Fellow**

EMILY R. RUSSELL

Mentor: Associate Professor Sergei G. Gukov**Frank W. Wood SURF Fellow**

GLENN S. WAGNER

Mentors: Professor Paul E. Dimotakis and Dr. Aristides Bonanos

2006

Brenda and Louis J. Alpinieri SURF Fellow

CHAITANYA RASTOGI

Mentor: Professor Axel Scherer**Robert F. Connelly SURF Fellow**

AMANDA L. SILBERSTEIN

Mentors: Associate Professor Brian M. Stoltz and Ms. Jennifer Roizen**John and Barbara Gee SURF Fellows**

ALEX A. KRIKORIAN

Mentors: Professor Joseph L. Kirschvink and Mr. Robert Kopp

JING SHEN

Mentor: Professor Richard M. Murray**W.H. Halpenny SURF Fellow**

ELETTE C. BOYLE

Mentor: Associate Professor Federico M. Echenique**Toni and Bob Perpall SURF Fellow**

NATHAN L. DONNELLAN

Mentors: Professor Joseph L. Kirschvink and Mr. Robert Kopp**Samuel and Berta Spalter SURF Fellow**

VIVEK NARSIMHAN

Mentor: Professor Julia A. Kornfield**Laurence J. Stuppy SURF Fellow**

ANGELA W. CHANG

Mentors: Professor David J. Anderson and Dr. Wulf Haubensak

CORPORATE DONORS**The Aerospace Corporation
SURF Fellows****DANIEL S. CHAO***Mentors:* Professor Mark E. Davis and
Mr. John McKeen**AIMEE L. GILLESPIE***Mentors:* Professor Yuk L. Yung and
Mr. Charles E. Miller**MICHAEL S. GRINOLDS***Mentors:* Professor Ahmed H. Zewail
and Dr. Vladimir Lobastov**PETER S. HUNG***Mentor:* Assistant Professor Marc W.
Bockrath**JANET Y. SHEUNG***Mentors:* Professor Nai-Chang Yeh and
Dr. Slobodan Mitrovic**DANIEL E. THAI***Mentor:* Associate Professor Babak
Hassibi**FOUNDATION DONORS****Caltech Alumni Association****Thomas E. Everhart****SURF Fellow****RAHUL DEB***Mentors:* Professor Robert J. McEliece
and Dr. Douglass Chinn**John and Maria Laffin Trust****SURF Fellows****CHANDRA M. BARNETT***Mentors:* Professor Daniel Osherson,
Professor Yaser Abu-Mostafa, and
Dr. Christiane Fellbaum**MIRANDA E. STEWART***Mentor:* Associate Professor Steven R.
Quartz**Paul K. and Evalyn E. Cook
Richter Memorial Funds****Richter Scholars****JAMES W. BERGLUND***Mentors:* Assistant Professor
Christopher M. Umans and
Dr. Peter Keevash**WILLIAM R. CLARK***Mentor:* Associate Professor Matheiu
Desbrun**BUD B. COULSON***Mentor:* Professor David B. Wales**ZHEN E. FONG***Mentors:* Professor Elliot M.
Meyerowitz and Dr. Adrienne
Roeder**ELLEN HSU***Mentors:* Professor Eric H. Davidson
and Dr. Yi-Hsien Su**JAMES T. HUANG***Mentors:* Professor Carl S. Parker and
Ms. Jennifer C. Barnet**MICHELLE JIANG***Mentors:* Professor James F. Woodward
and Ms. Jessica Edwards**KRISTOPHER M. KAZLOWSKI***Mentors:* Professor Michael C. Cross
and Dr. Mason A. Porter**SUNGSHIK KIM***Mentors:* Assistant Professor Oded
Aharonson and Mr. Troy Hudson**JACOB L. KING***Mentors:* Professor Charles R. Plott and
Dr. Theodore T. Turocy**ASHOK L. KUMAR***Mentors:* Professor Harvey B.
Newman, Dr. Marat Gataullin, and
Dr. Julian J. Bunn**SIMON F. KUNG***Mentors:* Assistant Professor Shu-ou
Shan and Dr. Rumana Rashid**VIBHA LALJANI***Mentor:* Associate Professor Mathieu
Desbrun**CHEN YEE LIAW***Mentors:* Professor Ellen Rothenberg
and Dr. Mary A. Yui**KELLY C. LITTLEPAGE***Mentors:* Associate Professor James
West and Professor R. Preston
McAfee**THOMAS J. MAINIERO***Mentors:* Professor Michael C. Cross
and Dr. Mason A. Porter**RODOLFO NUÑEZ***Mentors:* Professor Oscar P. Bruno and
Mr. Zhiyi Li**CHUN CHE PENG***Mentors:* Professor Paul W. Sternberg
and Dr. Cheryl Van Buskirk**DAVID W. RENSRAW***Mentor:* Dr. Cheng Yeaw Ku**PRASHANT SARASWAT***Mentors:* Professor Harvey B. Newman
and Mr. Jason Trevor**RUOSHAN SUN***Mentors:* Assistant Professor Angelike
Stathopoulos and
Ms. Desirea Mecenas**NATALIE J. SZWEDA***Mentors:* Professor Nathan S. Lewis
and Mr. James Maiolo**ANDREW C. TAN***Mentors:* Professor Ralph Adolphs and
Dr. Michael L. Spezio**SIMONA TESCU***Mentors:* Professor Paul H. Patterson
and Dr. Ali Khoshnan**DALINA L. THRIFT-VIVEROS***Mentors:* Professor Jonas C. Peters,
Professor Harry B. Gray, Dr. Arjun
Mendiratta, and Ms. Jillian
Dempsey**TATJANA S. WIESE***Mentors:* Professor Michael C. Cross
and Dr. Mason A. Porter**JED C. YANG***Mentor:* Professor Richard M. Wilson**SAMI ZERRADE***Mentors:* Professor Christof Koch and
Mr. Moran Cerf**ANNUAL GIFTS****Mr. Robert M. Abbey SURF Fellow****SARAH A. FERGUSON***Mentor:* Associate Professor Steven R.
Quartz**Dr. and Mrs. Lew Allen, Jr.,
SURF Fellow****WILLIAM A. WEBB***Mentors:* Professor Michael C. Cross
and Dr. Mason A. Porter**Mr. and Mrs. Donald M. Alstadt
SURF Fellow****KLEMENTYNA SZWAYKOWSKA***Mentors:* Professor Harvey B. Newman
and Mr. Jason Trevor**Mr. and Mrs. Robert E. Anderson
SURF Fellow****JOHN J. HASIER***Mentor:* Assistant Professor Alex L.
Sessions**Hannah Bradley SURF Fellow****VERONICA J. ANDERSON***Mentors:* Professor Robert D.
McKeown and Ms. Theresa Lynn**Ms. Jane Chen SURF Fellows****MARIA I. CHIRIAC***Mentors:* Associate Professor Linda C.
Hsieh-Wilson and Ms. Katie Saliba**YUAN GONG***Mentors:* Assistant Professor Anand R.
Asthagiri and Mr. Claudiu
Giurumescu

**Dr. and Mrs. Hubert E. Dubb
SURF Fellows**

DANIEL T. KNOEPFLE

Mentor: Professor R. Michael Alvarez

IVA P. RASHKOVA

Mentor: Professor Jaksa Cvitanic**Harry B. Gray SURF Fellow**

DUSTIN D. HAWKER

Mentors: Dr. Jay R. Winkler and Dr.
Jennifer C. Lee**Richard and Dena Krown
SURF Fellow**

STEPHEN T. HEUMANN

Mentors: Assistant Professor Oded
Aharonson and Ms. Margarita
Marinova**Dr. Eugene K. Maun SURF Fellow**

BRIGITTA E. MIYAMOTO

Mentors: Professor Daniel P.
Weitekamp and Dr. Pratip
Bhattacharya**Mr. and Mrs. Robert L. Noland
SURF Fellow**

BRANDT A. BELSON

Mentors: Professor Oscar P. Bruno and
Dr. Randy Paffenroth**Mr. and Mrs. Richard M.
Rosenberg SURF Fellow**

VICTORIA H. PON

Mentors: Professor Seymour Benzer
and Dr. Bader Al-Anzi**Rossum Family SURF Fellow**

CORINNE L. PENDER

Mentors: Professor Ralph Adolphs and
Dr. Hackjin Kim**Mr. and Mrs. Henry Shapiro
SURF Fellow**

PAULINE J. KU

Mentors: Assistant Professor Victoria J.
Orphan and Dr. Tsegereda Embaye**Edward C. Stone SURF Fellows**

YULIYA Y. KUZNETSOVA

Mentors: Professor Marc P.
Kamionkowski and Dr. Daisuke
Nagai

LAUREN A. PORTER

Mentor: Professor Alan J. Weinstein**Frederick W. Thiele SURF Fellow**

PHILIP A. MUÑOZ

Mentors: Professor Demetri Psaltis and
Mr. Jae-Woo Choi**Mr. Fred M. Wells SURF Fellow**

CHRISTOPHER T. BECK

Mentor: Assistant Professor
Christopher M. Umans**Mr. and Mrs. John E. Young
SURF Fellow**

LI NI

Mentors: Professor Frances H. Arnold
and Mr. Mike M. Chen**2006 SURF DEDICATEE****Lew and Edie Wasserman
SURF Fellow**

XIN T. YE

Mentor: Assistant Professor Christina
D. Smolke**SURF PRIZE ENDOWMENTS**Marcella and Joel Bonsall SURF Prize
for Technical Writing

Doris S. Perpall SURF Speaking Award

**ENDOWMENTS THROUGH
PLANNED GIFTS**Kirk and Marjory Dawson Family
SURF Endowment

Dr. and Mrs. George Boone

Dr. Paraskeva N. Danailov Endowed
SURF Fellowship in Biology

SURF Administrative Committee

Dr. Fredrick H. Shair, *Chair*

Dr. Paul M. Bellan
 Dr. Geoffrey A. Blake
 Dr. John F. Davis, SURF '91
 Dr. S. George Djorgovski
 Dr. Steven C. Frautschi
 Dr. Joseph L. Kirschvink
 Dr. Nathan S. Lewis
 Dr. Carl S. Parker
 Dr. David B. Rutledge
 Dr. Thomas A. Tombrello, Jr.
 Dr. William M. Whitney
 Dr. Richard M. Wilson

Ex-Officio Members

Ms. Carolyn A. Ash
 Dr. Gerald Houser
 Mr. David S. Levy

Student Representatives

Mr. Abdul T. Ahad
 Mr. Jack J. Lee
 Ms. Angela W. Chang

SURF Board 2006

Mr. John D. Gee, *Chair*

Ms. Gabrielle A. Adelman,
 SURF '85, '86
 Ms. Karen Carlson
 Dr. James A. Cutts
 Mr. Kirk M. Dawson
 Dr. Phoebe Dea
 Mr. H. Kent Frewing
 Mr. John H. Glanville
 Mrs. Heather S. Haaga
 Dr. Catherine Jurca
 Ms. Leslie M. Maxfield,
 SURF '92, '93, '94
 Mr. Duane T. McRuer
 Dr. Robert A.R. Parker
 Mr. Don M. Pinkerton
 Dr. Robert C. Ritchie
 Dr. Robert K. Roney
 Mr. David P. Rossum
 Dr. Gary W. Stupian
 Mr. Sean A. Upchurch, SURF '92, '93
 Mr. Samuel N. Vodopia
 Dr. Ward Whaling

Life Members

Dr. Lew Allen, Jr.
 Mrs. Hannah Bradley
 Mr. Carl V. Larson
 Mrs. Downie D. Muir III
 Mrs. Douglas B. Nickerson
 Dr. Ray D. Owen
 Mr. Robert C. Perpall, Sr.
 Dr. John D. Roberts
 Dr. Fredrick H. Shair
 Dr. William M. Whitney

Ex-Officio Members

Ms. Carolyn Ash
 Ms. Debra Dison Hall
 Mr. Robert E. McQuinn
 Mr. Mark Reinecke

SURFSAC SURF Student Advisory Council

Mr. Abdul T. Ahad, *Chair*

Mr. Ning Bao
 Mr. Robert D. Barish, *Movie Coordinator*
 Ms. Ekta N. Bhojwani
 Ms. Angela W. Chang, *Secretary*
 Ms. Andrea R. Dubin
 Mr. Peter S. Hung
 Mr. Michael J. Inadomi
 Mr. Jack J. Lee, *Vice Chair*
 Ms. Dana J. Levine
 Ms. Parvathy R. Menon,
SURFSAC Supper Coordinator
 Mr. Deepak Mishra
 Mr. Caleb E. Ng,
SURFSAC Supper Coordinator
 Mr. Noah A. Rahman, *Movie Coordinator*
 Mr. Aditya Rajagopal
 Ms. Elizabeth C. Shay
 Ms. Jing Shen
 Mr. Pakpoom Subsoontorn
 Mr. Shawn X. Yu

SURF Co-Mentor Advisory Council

Ms. Gitrada Arjara
 Mr. Jesse Bloom
 Dr. Peter Capak
 Mr. Moran Cerf
 Dr. Vandana R. Desai,
 SURF '94, '95, '96
 Dr. Timothy D. Glotch
 Dr. Varoujan Gorjian,
 SURF '89, '90, '91
 Dr. Christopher Jillings
 Dr. Ali Khoshnan
 Dr. John Magyar
 Dr. Ashish Mahabal
 Mr. James Van Deventer
 Ms. Nathalie Vriend
 Mr. Richard Wildman

SURF

CALTECH

California Institute of Technology
Student-Faculty Programs Office

Mail Code 139-74
Pasadena, California 91125

Telephone 626.395.2885
Fax 626.449.9649
email sfp@its.caltech.edu
<http://www.sfp.caltech.edu>

