

CALIFORNIA INSTITUTE OF TECHNOLOGY

Summer Undergraduate Research Fellowships
1996 Annual Report

SURF



SURF is one of the premier academic programs that keeps the Institute a leader in education and research. SURF offers our students unparalleled experiences and gives them a strong advantage as they begin their careers or attend graduate school. The integration of knowledge learned from textbooks and in the classroom with real research problems encourages critical, analytical thinking. SURF students learn how to do research; they ask new questions; they may discover solutions to unsolved problems; they often become co-authors of scientific papers; and importantly, they become colleagues within their research groups.

Many members of the Caltech community are required to provide a SURF experience for our students. The mentors and their research groups, the SURF Board, the SURF Administrative Committee, donors, volunteers, and administrative staff—all of these individuals and groups are important to the success of SURF. The commitment of almost 800 people to ensuring an outstanding educational experience for our students creates strong bridges among various constituencies including alumni, prospective students, donors, parents, staff, JPL, faculty, and students—both undergraduate and graduate. I thank all involved for your leadership, your support, your hard work, and your loyalty to SURF and to the Institute.

I want to personally thank Doug and Betty Nickerson for their outstanding leadership in creating the J. Weldon Green SURF Endowment to support a SURF student annually and to challenge Caltech to raise two additional endowments. I also want to express deep appreciation to Carl and Shirley Larson, to Warren and Katharine Schlinger, and to The Associates for establishing SURF endowments this year in response to the challenge. The enthusiastic and committed support of these friends has greatly strengthened the financial foundation of the SURF program. On behalf of future students who will be supported and their mentors: Thank you!

**Thomas E. Everhart
President
California Institute of Technology**

DEDICATION

The 1996 SURF program is dedicated to Edward B. Lewis, Thomas Hunt Morgan Professor of Biology, Emeritus, in celebration of his receiving the 1995 Nobel Prize for Physiology or Medicine, in recognition of his long commitment to research and teaching, and in honor of his mentoring five SURF students. Professor Lewis' passion for research, his insight and intuition, his dedication to basic research in genetics that continues to yield deeper understanding is an inspiration for today's students.

SURF was not the beginning of undergraduate research at the Institute. When I was an undergraduate, I worked in the Guggenheim Aeronautics Laboratory on structural research for Jay Fredericks. Many students worked for Ernest Swift in chemistry and became co-authors of papers. It took Fred Shair's vision in 1979 to pull together the best aspects of these earlier programs to create the excellent learning experience that SURF provides. Betty and I were introduced to SURF in 1982 by Elba Smith, Director of The Associates, and Ed Baum, Senior Development Officer. Samuel Krown, a member of The Associates, had become interested in SURF, became its founding donor, established the first SURF endowment, created the SURF Board, and served as its first chairman. We were pleased to become charter members—together with Joanna Muir, Hannah Bradley, Marcella Bonsall, and Vic

Veysey—of this committee to help support the vigorous and dynamic three-year-old program started by Fred Shair, then a professor of chemical engineering at Caltech. Betty succeeded Samuel Krown as SURF Board chair in 1985.

The SURF program has grown and prospered. Eighteen students participated in 1979, when SURF began; 248 in 1996. The small group of supporters has also grown.

The endowment has increased and has put SURF on a more robust financial base. Hugh Colvin boosted the SURF endowment by establishing nine funds. Last year's challenge added four more endowed SURF positions, bringing the total number of endowments to 29. These endowments have added to the financial support and stability of the program.

In 1992 the Institute agreed to underwrite up to 20 SURF positions against the subsequent year's fundraising efforts. This important commitment added stability and certainty to the SURF award process. SURF has become a mature program. We must continue to work hard to maintain the level of support and to ensure that SURF can continue to provide the outstanding experiences we desire for Caltech undergraduate students.

In addition to our fundraising efforts, the SURF Board held the annual Kickoff Dinner featuring Caltech's latest Nobel laureate, Ed Lewis, Thomas Hunt Morgan Professor of Biology, Emeritus, and this year's SURF dedicatee. The annual barbecue on the first day of SURF was attended by all students and by many sponsors and potential supporters. Joanna Muir put together a donor/student dinner which generated much enthusiasm among all who attended. In the coming year the Board will discuss proposals from the administration to increase the scope of SURF.

I want to thank the SURF staff, Carolyn Merkel, Susan Clark, and Carol Casey, for their help. And I want to thank all our friends for their past support; I hope and trust that we will warrant continued participation. We look forward to the next years with enthusiasm and optimism.



Douglas B. Nickerson

FROM THE SURF ADMINISTRATIVE COMMITTEE

Terry Cole

The SURF Administrative Committee (AdComm) sets the academic policies of the SURF program, oversees the intellectual standards, and advises the Caltech administration on long term plans for development of SURF and programs relating to SURF. The committee consists of faculty from each of the Institute's academic divisions, senior members of the JPL technical staff, student representatives, and members of the Caltech administrative staff, including the SURF Director. All of the faculty members of the committee are or have been SURF research advisors. In addition to overseeing and planning, the Committee participates in SURF directly. Its members review all of the students' research proposals – more than 300 this year. Members of the committee participate

in judging the competitors at the Doris S. Perpall Speaking Awards and often participate in SURF Seminar Day.



Terry Cole

During the past year the Committee worked closely with SURF Director Carolyn Merkel, Doug Nickerson and members of the SURF Board, and the Caltech Development Office to bring additional fellowship funds into the program. Specifically, we strongly support the Small Business Industrial Associates Program that will bring funds to support SURFers working with Caltech faculty on research of interest to these industrial firms. Members of the AdComm have supported the students in initiating the *Caltech Undergraduate Research Journal*. This journal will provide a vehicle for more extensive reporting of SURF and other undergraduate research endeavors.

The AdComm is pleased that the Southern California Conference on Undergraduate Research founded by the Caltech SURF program has become a tradition among southern California universities and colleges. This conference was held at the Claremont Colleges in November, 1995.

The SURF Administrative Committee looks forward to another outstanding year in 1997!

The SURF Student Advisory Council (SURFSAC) had its third year with ten members chosen by interviews conducted by previous SURFSAC members. This year's elected officers were Priya Rai, Chair; Lin Jia, Vice Chair; and Sudipta Bardhan, Secretary. Carlos Maldonado was nominated to chair this year's *Caltech Undergraduate Research Journal (CURJ)* committee. The purpose of SURFSAC is to advise the SURF office on student needs and interests for undergraduate research and to provide feedback from the students on program activities and research experiences. An important activity, started last year by Chou Hung, was the *Caltech Undergraduate Research Journal*. The first issue, containing the eleven best SURF reports from the 1995 program, will be published this fall.

SURFSAC had three goals for this year:

- Our first goal was to establish guidelines to standardize the submission format for *CURJ*. The guidelines include a detailed outline of what sections should be included in the *CURJ* submission, the length of the report, and the tone of the report, which should be technical enough for a member from the same field of research but which should also coherently present "the big picture" to someone in a different field.

- SURFSAC members serve as ombudspople for the SURF class, and each of us was assigned a group of about 20 peers. To facilitate communication, the SURFSAC members made personal contact with each of

their group members in addition to e-mailing them frequently. Ms. Kathy Harris, Training and Organization Development Specialist, JPL, led a training session in problem solving and conflict resolution to help us better assist our groups and to address productively any issues that might arise.

- Finally, SURFSAC coordinated recreational and social activities for SURF students and mentors. Sudipta Bardhan coordinated a very successful series of five Wednesday night dinners for students to interact informally with different faculty members. Other events included trips to Disneyland, the beach, and Old Town Pasadena; Friday night movies in the Y lounge, two sports events at Braun Gym, an ice cream social, and a dessert afternoon for women SURFers, mentors, and staff.

SURFSAC will hold information sessions for prospective SURFers during the academic year and will help with program planning for next summer. All in all, 1996-97 promises to be an innovative and productive year.



The SURF Student Advisory Council

T

he essence of the SURF program is the tutorial interaction between student and research sponsor, protégé and mentor. The program, modeled on the grant-seeking process, requires that students, in collaboration with their mentors, write a proposal for their projects. The proposals are reviewed by a faculty committee, and awards are made on the basis of reviewer recommendations and available funding. Students receiving a SURF award carry out the work during ten weeks in the summer, and at the conclusion, submit a technical report and give an oral presentation. Oral presentations are given at SURF Seminar Day, a symposium modeled on a professional scientific meeting. The Director's Report summarizes the activities and highlights of the 1996 SURF program.

It takes a community to make a SURF!

For each student, there are at least three or four other people working hard to ensure a quality experience. The extraordinary experience SURF provides its students requires a large cadre of faculty, graduate students, postdoctoral scholars, and JPL staff who serve as mentors. The SURF Board is a volunteer committee that helps raise funds for student stipends. The SURF Administrative Committee oversees the academic and intellectual components of the program and reviews students' proposals. The SURF Student Advisory Council provides an important student voice in planning and implementing the program and gives feedback on activities. Close to 200 donors to the 1996 program helped make it possible for 248 students to participate in SURF this year. Many staff members in accounting, development, human resources, the immigration office, payroll, academic departments, JPL, and, of course, the SURF office help with administrative or fundraising aspects of the program. The active support of the administration is crucial to the health of SURF.



Carolyn Merkel

PROFILE OF 1996 SURF PARTICIPANTS

<i>Division</i>	<i>Total Number of Students</i>	<i>Number of Caltech Students</i>	<i>Number of Non-Caltech Students</i>	<i>Number of Research Sponsors</i>
Biology	37	26	11	24
Chemistry and Chemical Engineering	50	41	9	25
Engineering and Applied Science	44	39	5	28
Geological and Planetary Sciences	10	9	1	6
Humanities and Social Sciences	5	3	2	4
Physics, Mathematics, and Astronomy	45	40	5	29
Jet Propulsion Laboratory	41	12	29	22
Small Business Industrial Associates	6	6	0	6
Off-Campus	5	5	0	5
Education SURFs	5	1	4	1
	248	182	66	150

PROFILE OF THE 1996 SURFERS

Sophomores	21%
Juniors	33%
Seniors	46%
Women SURFers	30%
Minority SURFers	10%
Median Grade Point Average	3.6/4.0*
Average Grade Point Average	3.5/4.0*

* Caltech students only, excluding freshmen

16% of living alumni who received their BS degrees from Caltech have participated in SURF.

SURF Statistics

Students participating in SURF are academically very strong. Academic excellence, however, is not necessarily a predictor of research talent or interest, and the eligibility requirement for applicants is a minimum GPA of 2.0. The following statistics demonstrate the excellence of SURF students.

At Caltech's 1996 Commencement:

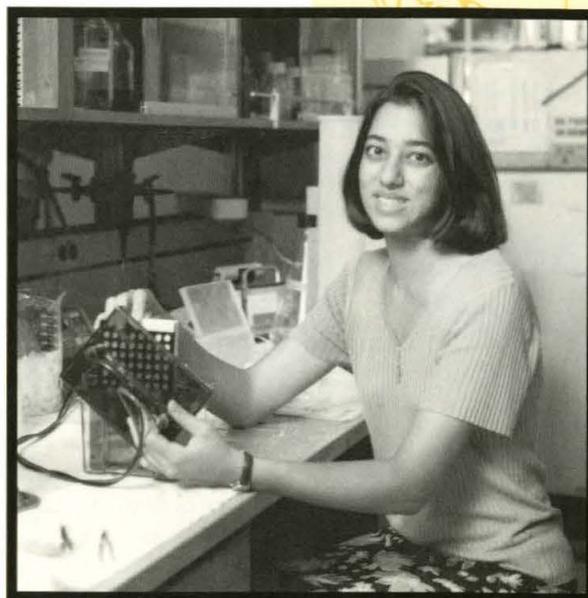
49% of the 1996 graduating class participated in SURF at least once

58% of the students graduating with honor were SURFers

77% of the Caltech Prize and Carnation Scholarships were won by former SURFers

Minority Undergraduate Research Fellowships (MURF)

Eleven students participated in the 1996 MURF program which runs concurrently and is closely associated with SURF. The MURF program provides support for talented non-Caltech undergraduates to spend a summer working in a research laboratory and is aimed at improving the representation of African Americans, Hispanics, Native Americans, Puerto Ricans, and Pacific Islanders in biological, chemical, and engineering sciences. MURF students participate in all aspects of the SURF program.



**SURF PROVIDES THE OPPORTUNITY
FOR A YOUNG SCIENTIST TO EXPLORE
AND SEEK ANSWERS TO THE
MYSTERIOUS QUESTIONS IN SCIENCE.
NOT ONLY DOES SURF PROVIDE AN
INVALUABLE LABORATORY
EXPERIENCE FOR THE
UNDERGRADUATES, BUT IT ALSO
PREPARES THEM FOR A FUTURE
IN SCIENCE.**

*Nasim Afsarmanesh
Mrs. Vernon L. Barrett SURF Fellow*

Small Business Industrial Associates

Six students worked on industrial research projects with company and faculty mentors. This program gives students a unique opportunity to expand their research experiences into the industrial environment with the value-added benefit of the advice and wisdom of faculty co-sponsors. Companies participating are listed on page 35.

SURF FUNDING

SURF is unique among undergraduate research programs in the country in that over half of the stipend funds are raised from external, non-federal sources. We depend upon the gifts from individuals, foundations, and corporations to build a robust financial base. The moneys raised are used to match funds from faculty research grants and contracts. Donors contributing the amount of a full stipend or more are listed with the students supported on pages 12 through 32. All contributors are listed at the back of the annual report. Each student receives a stipend of \$3600 for the ten-week summer period, a total stipend budget of \$892,800 for the 248 participants this year. The Institute pays administrative costs for the program; mentors pay all research costs. All funds raised from outside sources are used for student stipends or special research-related opportunities.

New SURF Endowments

J. Weldon Green SURF Endowment

We are deeply grateful to Doug and Betty Nickerson for creating the J. Weldon Green SURF Endowment in memory of Betty's father and for challenging the Caltech community to raise an additional two endowments to support SURF students in perpetuity. We are delighted to announce that the campaign was more than successful, raising an additional three endowments! This leadership gift demonstrates a deep commitment to the values of research in the undergraduate experience.

Shirley and Carl Larson SURF Endowment

We thank Carl and Shirley Larson for establishing an endowment to support a student annually. The creation of this fund is an important investment in the futures of the students who will be supported. The loyalty of SURF's friends is a strong asset on which the program depends. Carl Larson has served on the SURF Board since 1993, chairing the Board in 1994 and 1995.

Warren and Katharine Schlinger SURF Endowment

We greatly appreciate the generous gift of a SURF endowment by Dr. and Mrs. Warren Schlinger. This gift strengthens the financial foundation of SURF and ensures that each year students will be able to count SURF among the excellent experiences of their Caltech careers.

The Associates SURF Endowment

The Associates responded generously to the SURF endowment challenge, contributing the amount of a full endowment to be known as The Associates SURF Endowment. The students supported by this endowment will benefit from the vision and generosity of this important group.

Annual Funds

SURF depends upon and greatly values the many friends who contribute annually to the program. These many donations cumulatively provide significant support for student stipends and build a robust financial base each year. All funds raised from private sources are used to support Caltech students working with faculty. Donors contributing the amount of a student stipend, or more, by annual gifts or through endowment, are listed with the students supported in all SURF materials. Financial sponsors receive a written introduction to the students and may have the opportunity to meet the students at special events.

Funding Profile

Faculty grants and Institute sources	45%
JPL and NASA	17%
Foundations	15%
Endowment	12%
Individuals	5%
Corporations	5%

(Percentages do not total 100% because of rounding.)

1996 SURF PROGRAM AND ACTIVITIES

SURF Student Advisory Council

The SURF Student Advisory Council (SURFSAC) was active and productive this summer. The purpose of the council is to provide a student voice to the planning and implementation of the SURF program and to give feedback from the students to the SURF administration. SURFSAC members continued their role as ombudspople for their peers to answer questions, give advice, and serve as a resource. Sudipta Bardhan coordinated five faculty-student dinners at local restaurants to give participants the chance to interact informally. Nasim Afsarmanesh and Amy Zheng planned several successful social activities. Lin Jia made all arrangements for 23 SURFers for a day at Disneyland. We thank these students for their hard work, good ideas, and effective leadership.

Caltech Undergraduate Research Journal

One of SURFSAC's most important activities was the initiation of the *Caltech Undergraduate Research Journal (CURJ)*. Chou Hung chaired the first *CURJ* committee which will publish the eleven best research papers authored by Caltech undergraduates or students who did their research at Caltech. Each paper submitted received three reviews, the first by the student review board and two by faculty reviewers. The *CURJ* review board members were Chou Hung (SURF '95, BS '96), Mintao Fan (SURF '95, BS '96), Diana King (SURF '95), and Priya Rai (SURF '95, '96); Pamela Bjorkman (Biology), Kim Border (Social Sciences), Charles Brokaw (Biology), Jerrold Marsden (Engineering and Applied Science), Robert McKeown (Physics), and John Roberts (Chemistry).



**SURF ALLOWS STUDENTS TO GET A FEEL
FOR WHAT THE WORLD OF RESEARCH IS
REALLY LIKE WHILE STILL IN SCHOOL.
THE VALUABLE THINGS I HAVE LEARNED
AND WILL CONTINUE TO LEARN THIS
SUMMER HAVE SPARKED MY INTEREST
IN RESEARCH AND HAVE HELPED
PREPARE ME FOR THE FUTURE.**

*Steven P. Bennett
Mr. and Mrs. Francis V. Pesenti SURF Fellow*

The second *CURJ* will be published in April, 1997. Carlos Maldonado will chair this year's *CURJ* committee.

Professional Development Seminars

Eight Monday evening sessions addressed issues students will face as they prepare for and commence their professional careers. This series, created and coordinated by alumnus William M. Whitney, encourages students to make short-term decisions in the context of long-term career and life goals. Bill has presented the substantive message of this series at the National Conference on Undergraduate Research and at the Southern California Conference on Undergraduate Research. This summer's sessions and their participants were:

On Planning Your Career: Logic versus Reality
Dr. William M. Whitney, Division Technologist, Observational Systems Division, JPL; Julia Kornfield, Associate Professor of Chemical Engineering; Kathleen Bartle-Schulweis, Director, Caltech Women's Center; John Davis, graduate student, electrical engineering, SURF '91.

The Role of Communication in Careers: Introduction to the Communication Program

Mary Ann Smith, President, Applied Leadership Systems; Steve Bennett, '95-96 SURF student; Carolyn Merkel, Director, SURF program.

Alternative Careers: What Can You Do with a Technical Background?

Sally Asmundson, Director, Career Development Center; with Bonnie Wallace, Science Writer, California Science Museum; Kevin Archie, USC graduate student in neuroscience; David Ritchie, attorney, D'Alessandro, Frazzini & Ritchie; Susan Murakami-Fisher, pathologist, Huntington Memorial Hospital; Betina Pavri, Member of the Technical Staff, JPL; Randy Pollack, in process of deciding between graduate school and work options.

Myers-Briggs Type Indicator

Lauren Stolper, Director, Fellowships Office; Rosana Madrid Gatti, Assistant Director, Career Development Center.

Balancing Family and Career

Charlene Liebau, Director, Admissions Office; Kathleen Bartle Schulweis; with Laura Hoopes, Provost, Pomona College; and Shenda Baker, Assistant Professor of Chemistry, Harvey Mudd College.

Scientists as Speakers

Thomas J. Meade, Senior Research Fellow, Biology; John Davis.

Dilemmas of the Workplace: Do the Right Thing! [But What Is the Right Thing?]

Bill Whitney; Helen Hasenfeld, Ombudsperson; Priya Rai, SURF student; Douglas Sanders, Ethics Officer, JPL.

Graduate School

Rosana Madrid Gatti, with panelists John Davis, Delwyn Elder, graduate student in chemistry; and Ivett Leyva, graduate student in aeronautics.

Communication Program

For many students, the SURF presentation at the conclusion of the summer is their first opportunity to give a technical talk. The assignment is particularly challenging because the presentation is given to a general audience comprised of people in the student's field and lay people. Mary Ann Smith created the SURF communication program to help students prepare for the required presentation. The program is aimed for students at all levels of experience and comfort with public speaking.

Peer Coach Workshops

Ms. Smith trained eleven Caltech SURFers to facilitate workshops to help students organize and prepare their oral presentations, to learn public speaking skills and techniques, and to develop analogies to explain technical material to a lay audience. Peer coaches meet with small groups of SURF students for three sessions.

Through group interaction and exercises, students gain confidence and experience in talking about their research. This process has led students to ask more probing questions of their mentors, improving the educational quality of their research experiences.

Audio Visual Workshop

Wayne Waller, Director, Media Integration Laboratory, trained peer coaches in the creation of electronic and computer-based visual aids. These resources will be increasingly prominent in the workplace, and SURF students have the chance to develop experience and skill in using them to enhance their oral presentations.

Scientists as Speakers

Thomas J. Meade gave two short technical presentations to the SURF students on his work in developmental biology. Following his presentation, he discussed how he created visual aids to help his audience understand his work; he pointed out the transitions from one part of his talk to another; he talked about how to communicate technical material; and he answered many questions.

John Davis, a former SURF student and now graduate student in electrical engineering, spoke briefly about his experiences with giving talks and seminars. His advice: when preparing a talk, step back from your work to regain the big picture of your project and report only the highlights, not all the details.

Doris S. Perpall SURF Speaking Awards

Jeremy Darling, Samson Timoner, and Jane Brock were the winners of the third annual Doris S. Perpall SURF speaking competition. The winners were chosen after a three-round competition judged by faculty members, JPL staff, alumni, and graduate students. Robert C. Perpall, BS '52, MS '56, endowed the prizes in memory of his late wife as an incentive for students to give outstanding presentations.



**SURF MAY TAKE YOU INTO NEW
TERRITORY. I STARTED MY SUMMER
EXPECTING TO DO PURELY
EXPERIMENTAL WORK; BY THE END,
I WAS HACKING OUT A MATHEMATICAL
MODEL OF MY WORK.**

*Andrew S. Huntington
Warren and Katharine Schlinger
SURF Endowment*

Conferences

SURF Seminar Day

Saturday, October 19, SURF students presented the results of their research in a symposium modeled on a professional scientific meeting. Students, faculty, mentors, JPL staff, donors, alumni, and parents of SURFers attended the oral and poster presentations. Seminar Day is the first round in the Perpall competition, and the best presenters advanced to the semi-final round.

National Conference on Undergraduate Research

The tenth National Conference on Undergraduate Research (NCUR) was held in April, 1996, at the University of North Carolina at Asheville, the institution that started the conferences in 1987. More than 2400 students, faculty, and administrators from colleges and universities nationwide participated in NCUR with approximately 1800 students giving oral or poster presentations of their research. These conferences are multi-disciplinary, including the sciences, math, engineering, humanities, fine and performing arts. Students have the opportunity to find out how research is conducted and reported in other disciplines. Ten students represented Caltech at NCUR. Caltech hosted the 1991 National Conference on Undergraduate Research.

Southern California Conference on Undergraduate Research

The third annual Southern California Conference on Undergraduate Research was held at Pomona College in November, 1995. SCCUR was attended by more than 400 undergraduate students, faculty, and administrators from colleges and universities in the region including a delegation of Caltech students. SCCUR was started by SURF and held at Caltech in 1993 and 1994; the fourth annual SCCUR will be held at Occidental College in 1996.

Seminar Series

Each Wednesday at noon, members of the Caltech faculty or JPL staff presented seminars giving an overview of their areas of research. Speakers and their topics were:

R. Michael Alvarez, Associate Professor of Political Science, *Why Do Political Candidates Sling Mud, Attack Each Other, and Avoid Substantive Discussion?*

Glen R. Cass, Professor of Environmental Engineering and Mechanical Engineering, *Air Pollution in the Los Angeles Basin*

Andrea Goldsmith, Assistant Professor of Electrical Engineering, *Wireless Communication in the 21st Century*

Adriana Ocampo, Research Scientist, JPL, *Dead Dinosaurs Tell No Tales, But Rocks Do*

David L. Goodstein, Professor of Physics and Applied Physics; Frank J. Gilloon Distinguished Teaching and Service Professor; Vice Provost, *Scientific Fraud*

Barbara Imperiali, Associate Professor of Chemistry, *Protein Architecture: Understanding and Utilizing Nature's Blueprints*

John P. Preskill, Professor of Theoretical Physics, *Quantum Communication and Quantum Computation*

Ellen Rothenberg, Professor of Biology, *How Does the Immune System Work?*

David J. Stevenson, Professor of Planetary Science, *The Early Earth: Conditions for the Origin of Life*

Each Friday at noon, members of the JPL staff presented seminars giving an overview of their areas of research to the JPL SURF students. Speakers and their topics were:

Patricia M. Beauchamp, Observational Systems Division, *Miniature, Low Power Instruments for a New Millennium*

Bonnie J. Buratti, Earth and Space Sciences Division, *Comets: Rosetta Stones of the Solar System*

David H. Collins, Systems Division, *Miniature, Low-Cost, Highly Autonomous Spacecraft*

Andrea Donnellan, Telecommunications Science and Engineering Division, *The Northridge Earthquake: GPS Results*

Kevin R. Heim, Avionic Systems and Technology Division, *Tiny Bubbles: Memories that Don't Ho Never Had*

Sammy A. Kayali, Office of Engineering and Mission Assurance, *GaAs Reliability and Related Research*

Eric M. Slimko, Mechanical Systems Engineering and Research Division, *Mars Pathfinder and New Millennium: Two Faster-Better-Cheaper Mars Missions*

Ben Smith, Information Systems Development and Operations Division, *Autonomous Spacecraft for the Next Millennium*

Stephanie D. Wilson, Avionic Systems and Technology Division, *One Way of Getting from Jupiter to Earth Orbit*

Roundtable

Professor of Physics Thomas Tombrello; Ms. Louise Wannier, President and CEO, DEX Information Systems; and Dr. Jean de Pruneda, Division Leader, Chemical Sciences Division, Lawrence Livermore National Laboratory, presented an informative session contrasting the research environments in academia, industry, national laboratories, and start-up companies.



MY EXPERIENCES AS A SURF RESEARCHER WERE VERY POSITIVE AND REWARDING. I GAINED A LOT OF THINGS I WILL NEED FOR A FUTURE CAREER IN SCIENCE: SOME BASIC KNOWLEDGE IN NEUROBIOLOGY, TECHNICAL LAB SKILLS, AND ABOVE ALL – PATIENCE, PATIENCE, PATIENCE!

Mary L. Mosier
Mr. and Mrs. Downie D. Muir III SURF Fellow

SURF INDEX OF STUDENTS AND MENTORS

STUDENT	TOPIC	MENTOR
Lada A. Adamic <i>Senior, Ph</i>	Reduction of Particulates in Film Growth with Liquid Targets	Harry A. Atwater, Jr. <i>Associate Professor of Applied Physics</i>
Nasim Afsarmanesh <i>Sophomore, Bi</i> <i>Mrs. Vernon L. Barrett</i> <i>SURF Fellow</i>	The Detection of the Cellular Receptor for the Yellow Fever Virus	Robbert van der Most <i>Research Fellow in Biology</i> James H. Strauss <i>Ethel Wilson Bowles and Robert Bowles Professor of Biology</i>
Reginald C. Ajakwe University of Redlands <i>Junior, Ch/Bi</i> <i>MURF</i>	Analysis of Essential Proteins Involved in the Cell Cycle Progression from G1 to S Phase	Raymond Deshaies <i>Assistant Professor of Biology</i>
Xenia Amashukeli Brown University <i>Senior, Ch</i>	Nonlinear Optical Properties in Organic Materials	William A. Goddard III <i>Charles and Mary Ferkel Professor of Chemistry and Applied Physics</i>
Timothy K. Anderson University of California, San Diego <i>Sophomore, Bi</i>	14-3-3 Antibody Test for Creutzfeldt-Jakobs Disease	Michael G. Harrington <i>Member of the Beckman Institute</i>
Noah Arribas-Layton <i>Sophomore, EAS</i>	An Engineering Project for High School Students: An Introduction to Aerodynamics	Paul A. Robinson, Jr. <i>Professor of Physics,</i> <i>Principia College</i>
Michael D. Astle <i>Sophomore, EAS</i>	Wavelets in Java	Peter Schröder <i>Assistant Professor of Computer Science</i>
C. Michael Atkin <i>Sophomore, EE</i> <i>Ford Motor Company SURF Fellow</i>	Designing Advanced Cruise Control	Joseph Weber <i>Postdoctoral Scholar in Electrical Engineering</i>
Daniel I. Azuma <i>Senior, CS</i> <i>Northern California Associates SURF Endowment Fund</i>	The Chemistry Animation Project: Molecular Orbitals	Nathan S. Lewis <i>Professor of Chemistry</i>
Matthew P. Bachmann <i>Sophomore, Ge/Env Eng</i> <i>Sidney R. and Nancy M. Petersen SURF Endowment</i>	Analysis of Damaging Earthquake Ground Motions	David J. Wald <i>Visiting Associate in Geophysics</i>
Dave M. Bacon <i>Senior, Ph/Lit</i> <i>Mr. John Glanville and Ms. Teri Oldknow SURF Fellow</i>	Quantum Computers and NP-Complete Problems	Nicolas Cerf <i>Research Fellow in Physics</i> Christoph Adami <i>Division Research Fellow in Physics</i>
Milena Banjevic University of Toronto <i>Senior, CS/Ma</i>	Algorithm Development for Simultaneous Temperature and Cloud Property Retrieval from Thermal Infrared Data	Glenn S. Orton <i>Senior Research Scientist, JPL</i>

STUDENT**Sudipta Bardhan**

Junior, Bi
Mr. and Mrs. Robert L. Noland
SURF Fellow

Jason W. Barnes

Junior, Ay

Matthew E. Barnett

Sophomore, ChE
Mr. and Mrs. John E. Young SURF
Fellow

Klejda Bega

Sophomore, Ph
Samuel P. and Frances Krown
SURF Endowment Fund

Cyrus H. Behroozi

Senior, Ph
Samuel P. and Frances Krown
SURF Endowment Fund

Steven P. Bennett

Senior, Bi/Ch
Mr. and Mrs. Francis V. Pesenti
SURF Fellow

Ronak J. Bhatt

Junior, Ph
Richter Scholar

Christopher Bisbee

Junior, Ch
Dreyfus Foundation SURF Fellow

Christopher A. Brichford

Sophomore, CS/EE
Samuel P. and Frances Krown
SURF Endowment Fund

Andrew S. Brown

Swarthmore College
Senior, CS

Jonathan O. Burrows

Sophomore, APH
Donald S. Clark SURF Endowment
Fund

Jun Cai

Senior, Ph
Richter Scholar

TOPIC

An Exploration of the Binuclear Copper Site
of the Cu_A Protein

History of the Impacts of the Comet
Shoemaker-Levy 9 Fragments as Seen from
the AAT

Engineered Protein-Membrane Interactions

Development of an Electromagnetic
Calorimeter for SLAC E155

Dynamics of Trapped Magnetic Particles
and Fluids

Optimization and Characterization of a
Semiconductor-Based Photoreactor in Terms
of Organic Substrate Mineralization in
Aqueous Systems

Analysis of Pulse Profiles of X-Ray Binaries

Conformational Changes of
3-Methoxypentanedioic Acid as a Function
of pH

LIGO FFT User-Interface

Scalable Concurrent Programming on the
Avalon A12 Multicomputer

Metallic Glass in Microfabrication Processes

Flux Conservative Formulation of Numerical
Relativity and Gravitational Collapse

MENTOR

John H. Richards
Professor of Organic Chemistry

Glenn S. Orton
Senior Research Scientist, JPL

Frances H. Arnold
Associate Professor of Chemical
Engineering

Robert D. McKeown
Professor of Physics
Todd Averett
Research Fellow in Physics

Kenneth G. Libbrecht
Professor of Physics

Michael R. Hoffmann
James Irvine Professor of
Environmental Chemistry

Thomas A. Prince
Professor of Physics

John D. Roberts
Institute Professor of Chemistry,
Emeritus; Lecturer

Rochus E. Vogt
R. Stanton Avery Distinguished
Service Professor and Professor
of Physics
Hiroaki Yamamoto
Senior Scientist in Physics

Stephen Taylor
Assistant Professor of Computer
Science

William L. Johnson
Ruben F. and Donna Mettler
Professor of Engineering and
Applied Science

Kip S. Thorne
Richard P. Feynman Professor
of Physics

STUDENT	TOPIC	MENTOR
Michaeleen B. Callahan <i>Junior, Bi</i> <i>The Caltech Alumni Association</i> <i>SURF Fellow</i>	Discrimination between Immediate and Indirect Autoregulation of <i>APETALA3</i> in <i>Arabidopsis</i>	Elliot M. Meyerowitz <i>Professor of Biology</i> Robert W.M. Sablowski <i>Research Fellow in Biology</i>
Myfanwy G. Callahan <i>Junior, Env</i> <i>The Lluella Morey Murphey</i> <i>Foundation SURF Fellow</i>	Gaseous Hydrogen Peroxide Levels in the Los Angeles Area	Michael R. Hoffmann <i>James Irvine Professor of</i> <i>Environmental Chemistry</i>
John Joseph M. Carrasco <i>Senior, Ph</i> <i>William H. and Helen Lang SURF</i> <i>Fellow</i>	T ⁺ T ⁻ Decays: An Exploration of Parity Symmetry Violation	Alan J. Weinstein <i>Associate Professor of Physics</i>
Miguel A. Castro <i>University of Redlands</i> <i>Senior, Bi/Ch</i> <i>MURF</i>	Improvement of DNA Sequencing by Site-Directed Mutagenesis of <i>T. aquaticus</i> DNA Polymerase	John H. Richards <i>Professor of Organic Chemistry</i>
Christopher J. Chang <i>Senior, Ch</i> <i>Arthur A. Noyes SURF Endowment</i> <i>Fund</i>	Spectroscopy and Catalytic Properties of Vanadyl Schiff-Base Complexes	Harry B. Gray <i>Arnold O. Beckman Professor</i> <i>of Chemistry</i>
Steven M. Chase <i>Senior, APh</i> <i>Allied Signal SURF Fellow</i>	On the Viability of Nitrogen Dioxide and Acetone as Fluorescent Markers for Studying Gas-Phase Turbulent Mixing	Paul E. Dimotakis <i>John K. Northrup Professor of</i> <i>Aeronautics and Professor of</i> <i>Applied Physics</i>
Ann W. Chen <i>Senior, Bi/H</i> <i>Hugh F. and Audy Lou Colvin</i> <i>International Fellowship Endowment</i>	Stature, Living Standards, and Economic Development	James Z. Lee <i>Associate Professor of History</i>
Shirley S. Chen <i>Senior, Ch</i> <i>Richter Scholar</i>	Observations of N ₂ H ⁺ in the Young Stellar Object L1551	Geoffrey A. Blake <i>Associate Professor of</i> <i>Cosmochemistry and Planetary</i> <i>Science</i>
Yebo Chen <i>Sophomore, CS/APh</i>	Automatic Compensation of Drift for Optical Alignment into a Fixed-mirror Fabry-Perot Cavity	Rochus E. Vogt <i>R. Stanton Avery Distinguished</i> <i>Service Professor and Professor</i> <i>of Physics</i> Robert Spero <i>Member of the Professional Staff</i> <i>in Physics</i>
Yeng-Long Chen <i>Junior, ChE</i>	An Investigation of the Flow Induced Alignment in Triblock Copolymers	Julia A. Kornfield <i>Associate Professor of Chemical</i> <i>Engineering</i>
Alwin Y. Chi <i>Sophomore, EE/Ec</i>	Hyper Forum	Bruce C. Murray <i>Professor of Planetary Science</i> <i>and Geology</i>

STUDENT

Keng-Hwee Chiam
University of Michigan
Senior, Ph/Computer Eng

Kai Wai E. Chiu
Senior, EE
Dr. York Liao SURF Fellow

Nicholas I. Cholý
Junior, APh
Applied Materials SURF Fellow

John F. Christensen
Junior, ChE
Mr. and Mrs. A.A. Burnand SURF
Fellow

Alexander J. Conley
Claremont McKenna College
Senior, Ph

Christopher W. Connor
University of Cambridge
Junior, Eng

Joseph V.L. Cook
Sophomore, EE

Marc A. Coram
Senior, CS/Ma
Arthur R. Adams SURF Fellowship

Brian R. D'Urso
Junior, Ph
Samuel P. and Frances Krown
SURF Endowment Fund

Daryush J. Dawid
University of Cambridge
Junior, Ph

Andreas K. Demetriades
University College London
Senior, Medicine

Eric M. Dennis
Junior, Ph
Arthur E. Lamel Memorial
SURF Fund

TOPIC

Data Acquisition for Measuring Heat Capacity
of Helium-3 Near Its Critical Temperature

The Development of a 500W 7MHz Power
Amplifier

Modeling Growth and Reflow of Interconnect
Lines

Volume Reduction of Hazardous Waste
Through Molten Metal Processing

Computer Modeling of Extreme Scattering
Events

Streamlining Astronomical Data Reduction

A Visual Catalog of Near-IR Ground-Based
Images of Jupiter – or – Eighty or so Days
Around a World

Geometric Properties of Siegel Disks

Electromagnetic Waves in Mixed Dielectric
Structures

Thermal Noise in the Suspension of the
LIGO Interferometers

An Introduction into Experimental
Embryogenesis for YESS Students

Bragg Reflection of Non-Plane Waves

MENTOR

Inseob Hahn
Member of the Technical Staff,
JPL

David B. Rutledge
Professor of Electrical Engineering

Harry A. Atwater, Jr.
Associate Professor of Applied
Physics

Adel F. Sarofim
Lamot du Pont Professor
of Chemical Engineering,
Massachusetts Institute
of Technology

John W. Armstrong
Member of the Technical Staff,
JPL

Glenn S. Orton
Senior Research Scientist, JPL

Glenn S. Orton
Senior Research Scientist, JPL

Jacek Graczyk
Olga Tausky-John Todd
Instructor in Mathematics

Axel Scherer
Professor of Electrical Engineering

Rochus E. Vogt
R. Stanton Avery Distinguished
Service Professor and Professor
of Physics
Seiji Kawamura
Member of the Professional Staff
in Physics

Paul A. Robinson, Jr.
Professor of Physics,
Principia College

Amnon Yariv
Thomas Myers Professor of
Electrical Engineering and
Professor of Applied Physics

STUDENT	TOPIC	MENTOR
Vandana R. Desai Senior, Ay Mr. and Mrs. Thomas H. Wiancko SURF Fellow	A Search for High Redshift Quasars	S. George Djorgovski Associate Professor of Astronomy
Ramya N. Dissanayake Senior, EE	Joystick Controlled Miniature Camera System	Eric R. Fossum Senior Research Scientist, JPL
David S. Djambazov Sophomore, Ph	Numerical Thermoelastic Analysis of Complicating Factors in Optics Used in Laser Interferometers for Detection of Gravitational Waves	Rochus E. Vogt R. Stanton Avery Distinguished Service Professor and Professor of Physics Dennis Coyne LIGO Deputy Systems Engineer
Patrick J. Drew Sophomore, Bi Thomas Hunt Morgan SURF Endowment Fund	Neural Activity in Area X of the Adult Zebra Finch	Masakazu Konishi Bing Professor of Behavioral Biology
Arun N. Durairaj Junior, Bi	The Effect of the FORSE-1 Antibody on the Development of the Central Nervous System	Paul H. Patterson Professor of Biology
Daniel A. Eckstein Senior, Bi Bristol-Myers Endowment Fellowship	<i>In Vivo</i> Comparison of GFP Variance Designed for Use in Mammalian Cells	Barbara J. Wold Associate Professor of Biology
Uri T. Eden Sophomore, Ma/EE Richter Scholar	Human Magnetoreception	Joseph L. Kirschvink Professor of Geobiology
Jarah M. Euslin Senior, Ph/Ma	Error Correction Algorithms for Quantum Computers	John P. Preskill Professor of Theoretical Physics
David W. Farnham Junior, Ph Mr. and Mrs. Ralph W. Jones SURF Fellow	Fitting Profiles of Accreting X-ray Pulsars	Thomas A. Prince Professor of Physics
James Farrell Reed College Senior, Interdisciplinary Ch/Ph Howard Hughes Medical Institute SURF Fellow	Loop Modifications to the Designed Peptide Bba1	Barbara Imperiali Associate Professor of Chemistry
Patricio H. Figueredo Universidad de Buenos Aires Senior, Ge	The Crustal Evolution of Ganymede: Preliminary Models and Galileo Observations	Robert Carlson NIMS Principal Investigator, JPL
Michael A. Fisher Sophomore, AMa/CS Richter Scholar	The Chemistry Animation Project: Molecular Orbitals	Nathan S. Lewis Professor of Chemistry

STUDENT

Samantha Foster
Senior, EAS
Dr. Marcella Bonsall SURF Fellow

Brian E. Frazier
Sophomore, EAS

Margaret A. Gabriel
Sophomore, Ch
Dreyfus Foundation SURF Fellow

Samantha S. Gizerian
Sophomore, Bi
Howard Hughes Medical Institute
SURF Fellow

Emma E. Goldberg
Sophomore, Ph/Ay
Richter Scholar

Nir Goldman
Yale University
Senior, Ch
Dreyfus Foundation SURF Fellow

Marize A. Gominho
Central State University
Senior, Water Resources Management

Cynthia-May S. Gong
Sophomore, Ge/Bi

Alex Goretsky
Junior, ChE
Hugh F. and Audy Lou Colvin SURF
Endowment Fellowship

Dustin L. Green
Junior, CS

Charmaine R. Gregory
Rensselaer Polytechnic Institute
Senior, Bioch/Bioph
MURF

Timothy O. Gunter
Senior, Ph
Applied Materials SURF Fellow

TOPIC

History of Parks in Los Angeles

The Chemistry Animation Project:
Periodic Trends

The Conformations of Succinic Acid as
Determined by NMR Spectroscopy

Isolation and Characterization of the
Reductase Component of the Particulate
Methane Monooxygenase

Development of an Electromagnetic
Calorimeter for SLAC E155

Investigation of C-C Bond Rotation Rates
in Hexabutylguanidinium Cation

Application of Synthetic Aperture Radar
in Hydrology

Human Magnetoreception?

Metal Complexing Polymers as Glucose Sensor

Telescopes in Education

The Integration of Cell Cycle and
Differentiation: An Analysis of the Roles of
p27 and rux

Aluminum and Copper Reflow for High-Aspect
Ratio Integrated Circuit Fabrication

MENTOR

William F. Deverell
Visiting Associate in History

Nathan S. Lewis
Professor of Chemistry

John D. Roberts
Institute Professor of Chemistry,
Emeritus; Lecturer

Sunney I. Chan
George Grant Hoag Professor
of Biophysical Chemistry

Robert D. McKeown
Professor of Physics
Todd Averett
Research Fellow in Physics

John D. Roberts
Institute Professor of Chemistry,
Emeritus; Lecturer

Anthony Freeman
Group Supervisor, JPL

Joseph L. Kirschvink
Professor of Geobiology

Frances H. Arnold
Associate Professor of Chemical
Engineering

Gilbert A. Clark
Program Manager, Telescopes
in Education, JPL

Barbara J. Wold
Associate Professor of Biology

Harry A. Atwater, Jr.
Associate Professor of Applied
Physics

STUDENT

Francisco Guzmán
Senior, Ph

David E. Hackenson
Sophomore, ChE
Richter Scholar

Zoran Hadzibabic
University of Cambridge
Senior, Ph

David K. Hammond
Sophomore, Ch
Howard Hughes Medical Institute
SURF Fellow

Dragos A. Harabor
Senior, CS

Douglas A. Hartley
University of California, Los Angeles
Senior, Ma

Cailin C. Henderson
Senior, Bi
Northern California Associates SURF
Endowment Fund

Benjamin R. Hendricks
Sophomore, Bi
Richter Scholar

Michael J. Herrera
Senior, Ma
Richter Scholar

Johannes Hess
University of Siegen
Senior, Ph

Laura J. Hidas
Stanford University
Sophomore, Bi/Ch

TOPIC

Characterization of the Radiation Emitted
by the NIST Synchrotron

Explosives Detection by Particle Deflagration
and Optical Signature Characterization

Modeling the Spectrum of the Hydrogen
Pressurized Ammonia in the Far Infrared

Development of Co-acacen Derivatives with
Electron-donating Substitutes

Human Magnetoreception

Spectral Properties of Ganymede

The Role of BDNF in LTP

The Chemical Nose

The Application of New Statistical Methods
on Original Data Collected from Various Fields
in Science

Lock Acquisition of an Optical-Lever Based
Alignment System in the LIGO 40 m
Interferometer

Crystallization of the DNA-Intercalating
Metal Complex $\text{Ir}(\text{phen})_2\text{phi}^{3+}$ Bound to
an Oligonucleotide

MENTOR

Gerald T. Fraser
Research Scientist, National
Institute of Standards and
Technology
Angela Hight Walker
National Institute of Standards
and Technology
Thomas A. Tombrello
Professor of Physics

Jesse L. Beauchamp
Professor of Chemistry

Glenn S. Orton
Senior Research Scientist, JPL

Thomas J. Meade
Senior Research Fellow in Biology

Joseph L. Kirschvink
Professor of Geobiology

G. Edward Danielson
Member of the Professional Staff
in Planetary Science

Erin M. Schuman
Assistant Professor of Biology

Nathan S. Lewis
Professor of Chemistry

Gary A. Lorden
Professor of Mathematics

Rochus E. Vogt
R. Stanton Avery Distinguished
Service Professor and Professor
of Physics
Robert Spero
Member of the Professional Staff
in Physics

Jacqueline K. Barton
Professor of Chemistry

STUDENT	TOPIC	MENTOR
Aaron K. Higgins <i>Sophomore, EE</i>	The Chemistry Animation Project: Hybridization and Resonance	Nathan S. Lewis <i>Professor of Chemistry</i>
Sasha Hinkley Reed College <i>Junior, Ph</i>	Ground Based Support for the First Ganymede Encounter in the Thermal Infrared	Glenn S. Orton <i>Senior Research Scientist, JPL</i>
Holly A. Hofer Delaware Valley College <i>Sophomore, Small Animal Science</i>	Odor Preferences in Rodents	James M. Bower <i>Associate Professor of Biology</i> Christine Chee-Ruiter <i>Graduate Student in Biology</i>
Amanda K. Hoffman Furman University <i>Junior, CS/Ma</i>	Formal Methods in Software Safety Techniques	John C. Kelly <i>Group Leader, JPL</i>
Mingjing Huang <i>Junior, EAS</i> <i>Logicon RDA SURF Fellow</i>	Computer Assisted Analysis of CMV Retinopathy	Douglas Yoon <i>Research Scientist, Logicon RDA</i>
Sung H. Huh <i>Sophomore, Ch/CS</i>	The Chemistry Animation Project	Nathan S. Lewis <i>Professor of Chemistry</i>
Andrew S. Huntington <i>Senior, Ch</i> <i>Warren and Katharine Schlinger</i> <i>SURF Endowment</i>	Charge Carrier Dynamics Within a Ni-Si Schottky Barrier Photonic Displacement Sensor	John D. Baldeschwieler <i>Professor of Chemistry</i>
Jae H. Hur <i>Junior, Bi</i> <i>Howard Hughes Medical Institute</i> <i>SURF Fellow</i>	The Genetic Identification of Factors that Interact with LEAFY in <i>Arabidopsis thaliana</i>	Elliot M. Meyerowitz <i>Professor of Biology</i> Doris Wagner <i>Research Fellow in Biology</i>
Jennifer K. Hutchings University College London <i>Senior, Ph</i>	Spectral Modelling of Shoemaker-Levy 9, Fragment K, Main Event	Glenn S. Orton <i>Senior Research Scientist, JPL</i>
Minneola P. Ingersoll Stanford University <i>Junior, CS</i>	Efficient Auction Design and Packaging	David P. Porter <i>Visiting Associate in Economics</i>
Mark G. Jackson Duke University <i>Sophomore, EE/Ph</i>	Measurement of the Complex Dielectric Constant at Microwave Frequencies	Martin Barmatz <i>Technical Group Leader, JPL</i>
Nicole M. Jackson Occidental College <i>Junior, Ch</i>	Electrochemistry of Methylene Blue Bound to a DNA-Modified Electrode	Jacqueline K. Barton <i>Professor of Chemistry</i>
Joanne W. Jang <i>Sophomore, Bi</i>	CRABS CLAW Gene Family	John L. Bowman <i>Assistant Professor of Plant</i> <i>Biology, University of California</i> <i>at Davis</i> Barbara J. Wold <i>Associate Professor of Biology</i>

STUDENT

Brian S. Jenkins
Senior, Ch
Howard Hughes Medical Institute
SURF Fellow

Lin Z. Jia
Senior, Bi
Glenn Foundation SURF Fellow

Conrad A. Jones
Southern University
Junior, Ch/ChE
MURF

Neil C. Jones
Senior, Ch
Mr. Robert M. Abbey SURF Fellow

Brandy N. Justice
Furman University
Senior, CS

Sham M. Kakade
Senior, Ph
Richter Scholar

Dae W. Kang
Junior, CS

Anuraag R. Kansal
Senior, ChE
Semiconductor Systems, Inc. SURF
Fellow

Pinar Karaca
Swarthmore College
Junior, Ec/Ma

Hee S. Kim
Senior, Ec
Richter Scholar

Sung H. Kim
Occidental College
Junior, Ph

TOPIC

A Study of the Effects of Salt Concentration on the Stability of Rubredoxin from *Pyrococcus Furiosus*

Localization by Immunocytochemistry of Neurotrophins BDNF and NT-3 and their Respective Trk Receptors in Hippocampal Tissues

The Role of *Xenopus* Orc2 Gene in Cell Cycle Control

A Versatile New Sensing Diode

Technology Transfer

Efficiency of Error Correction in Quantum Computing

Exploration of Java and Its Wavelet

Rheology of Spin-Coating

Combinatorial Auction Design

The Economics of Television Network-Affiliate Relationship

Three-Dimensional Behavior of Granular Materials Under Vertical Vibration

MENTOR

Sunney I. Chan
George Grant Hoag Professor
of Biophysical Chemistry

Erin M. Schuman
Assistant Professor of Biology

William G. Dunphy
Associate Professor of Biology;
Associate Investigator, Howard
Hughes Medical Institute

John D. Baldeschwieler
Professor of Chemistry

John C. Kelly
Group Leader, JPL

John P. Preskill
Professor of Theoretical Physics

Peter Schröder
Assistant Professor of Computer
Science

Peter Haaland
Research Physicist, Semiconductor
Systems, Inc.
Julia A. Kornfield
Associate Professor of Chemical
Engineering

David P. Porter
Visiting Associate in Economics

Simon J. Wilkie
Assistant Professor of Economics

Theodore Y. Wu
Professor of Engineering Sciences
Mingming Wu
Assistant Professor of Physics,
Occidental College

STUDENT	TOPIC	MENTOR
Clay H. Kishiyama Senior, ME AeroVironment, Inc. SURF Fellow	Chain Efficiency and Idler Drag	Paul MacCready Chairman, AeroVironment, Inc. Erik K. Antonsson Associate Professor of Mechanical Engineering
Daniel M. Kleiman Junior, Ma/Ec First Quadrant SURF Fellow	Time-Series and Non-Linear Market Analysis	David Krider Associate, First Quadrant Corporation Scott Page Assistant Professor of Economics
Kurt A. Klein Sophomore, Ch	Alternate Synthesis of 4'-(4''-Ferrocenylphenyl)-2,2':6',2''-terpyridine	Fred C. Anson Professor of Chemistry
Minoree Kohwi Sophomore, Bi Glenn Foundation SURF Fellow	LIF and Neuropeptide Expression Regulation	Paul H. Patterson Professor of Biology
Tai A. Lam Junior, Ph	LIGO: The Mirror Contamination Test	Rochus E. Vogt R. Stanton Avery Distinguished Service Professor and Professor of Physics Andreas C. Kuhnert Member of the Professional Staff in Physics
Benjamin F. Lane Senior, Ay Richter Scholar	The Binary Millisecond Pulsar Companions of B1957+20 and J2051-0821	Shrinivas R. Kulkarni Professor of Astronomy
John C. Langford Senior, Ph/CS Richter Scholar	Finding Heavy Neutrino Signatures at LEP2	Harvey B. Newman Professor of Physics
Gretchen M. Larson Senior, Ch Edward W. Hughes SURF Endowment	Metal Regulation of DNA Binding Polyamides	Peter B. Dervan Bren Professor of Chemistry
Andrew S. Laucius Junior, EAS	Optimizing a Program that Simulates a LIGO Interferometer	Rochus E. Vogt R. Stanton Avery Distinguished Service Professor and Professor of Physics Kent Blackburn Senior Engineer
Alana M. Laurence Sophomore, ME Erika C. Vote SURF Endowment	LIGA Metrology	Michael Hecht Member of the Technical Staff, JPL Stephen J. Manion Member of the Technical Staff, JPL
Ted A. Laurence Senior, Ph Richter Scholar	EXPOSE (EX POst facto Synthesis Experiment)	Christopher Martin Professor of Physics

STUDENT	TOPIC	MENTOR
Luis A. Lesmes University of Southern California <i>Senior, Psychobi/Ch</i> MURF	Size Constancy and Object Recognition	John M. Allman <i>Hixon Professor of Psychobiology</i> <i>and Professor of Biology</i>
Yu-chun Liao Imperial College <i>Sophomore, Ch</i> Dreyfus Foundation SURF Fellow	The Effect of Hydrogen Bonding and Change in pH on Conformational Equilibria	John D. Roberts <i>Institute Professor of Chemistry,</i> <i>Emeritus; Lecturer</i>
Brian N. Limkethai <i>Junior, EE</i>	Tiny Transponder	Dimitrios Antsos <i>Member of the Technical Staff,</i> <i>JPL; Lecturer in Electrical</i> <i>Engineering</i>
James Lin <i>Senior, CS</i> Arthur Rock SURF Endowment	A Problem Solving Environment to Aid in the Evaluation and Simplification of Vector Equations	James R. Arvo <i>Associate Professor of Computer</i> <i>Science</i>
Frank H. Ling <i>Senior, ChE</i>	Degradation of PNP, 4CP, and NB by Sonication and Ozonolysis	Michael R. Hoffmann <i>James Irvine Professor of</i> <i>Environmental Chemistry</i>
Christianto Liu <i>Sophomore, EE</i>	Optimization of the JPL Mid-Infrared Camera Software	Michael E. Ressler <i>Research Scientist, JPL</i>
Erin M. Lynch <i>Junior, Ph</i>	Rotational Period of Nereid	Bonnie J. Buratti <i>Research Scientist, JPL</i>
Robert S. Lyons <i>Senior, Ay</i> Flintridge Foundation SURF Fellow	An Analysis of the Absorption Spectrum of Q1442+2931	Wallace L.W. Sargent <i>Ira S. Bowen Professor</i> <i>of Astronomy</i>
Carlos Maldonado <i>Senior, ChE</i> William N. Lacey SURF Endowment Fund	Vapor Sensing Based on Stress Compensated Quartz Oscillators	Mark E. Davis <i>Warren and Katharine Schlinger</i> <i>Professor of Chemical Engineering</i>
Noah Malmstadt <i>Senior, ChE</i>	Directed Evolution of a Thermostable Subtilisin	Frances H. Arnold <i>Associate Professor of Chemical</i> <i>Engineering</i>
Vuk Mandic <i>Junior, Ph</i>	Analysis of Signal and Background for Higgs Production	Harvey B. Newman <i>Professor of Physics</i>
Obadiah J. Manley <i>Senior, APh</i> Logicon RDA SURF Fellow	Neural Network Prediction of Manufacturing Processes	Gregg Wilensky <i>Senior Scientist, Logicon RDA</i>
James C. Manners University College London <i>Senior, Ph</i>	Molecular Absorption and Modelling the Jovian Atmosphere	Glenn S. Orton <i>Senior Research Scientist, JPL</i>

STUDENT	TOPIC	MENTOR
Jeremiah M. Mans <i>Junior, APh</i> <i>Richter Scholar</i>	Microdevices for Electrophoretic Analysis	Michael L. Roukes <i>Associate Professor of Physics</i>
Milena Marinova <i>Junior, CS</i>	Refinement and Implementation of Image Reconstruction Techniques on Jupiter Images	Glenn S. Orton <i>Senior Research Scientist, JPL</i>
Benjamin P. Marriage Leicester University <i>Junior, Ph</i>	Reduction of Ground Based Observations of Jupiter in Support of the Jupiter/Galileo s/c Mission	Glenn S. Orton <i>Senior Research Scientist, JPL</i>
Ellen L. Martin <i>Sophomore, Bi</i>	Territorial Expression and Cis-regulatory Organization of CylIIa in the Sea Urchin Embryo	Maria Ina Arnone <i>Research Fellow in Biology</i>
Sebastian M. Maurer <i>Senior, Ph</i> <i>Dr. and Mrs. Samuel P. Morgan</i> <i>SURF Fellow</i>	Vortex Pinning by Cylindrical Defects in Type-II Superconductors - Numerical Solutions to the Ginzburg-Landau Equations	Thomas A. Tombrello <i>Professor of Physics</i> Nai-Chang Yeh <i>Associate Professor of Physics</i>
Dennis D. Maxwell, Jr. College of Charleston <i>Senior, Ph/Eng</i>	Radial Velocities of Five CSPN Binary Candidates	James K. McCarthy <i>Assistant Professor of Astronomy</i>
Devon J. McClain <i>Junior, Ay</i> <i>Richter Scholar</i>	Characteristics of a High Dispersion 1200GR/MM Grism Optimized Using Electromagnetic Theory	James K. McCarthy <i>Assistant Professor of Astronomy</i>
Ryan L. McCorvie <i>Sophomore, AMa</i>	Decision Analysis and Optimization for F-B-C Missions	Ralph F. Miles, Jr. <i>Senior Member of the Technical Staff, JPL</i>
Jeffrey M. Mendez <i>Sophomore, Ch</i> <i>Richter Scholar</i>	Two Photon Induced Fluorescence for Tumor Imaging	Seth R. Marder <i>Member of the Beckman Institute</i>
Steven S. Michael <i>Junior, APh</i> <i>Howell N. Tyson, Sr. SURF Fund</i>	LIF Imaging of Transverse Jet Flow	Paul E. Dimotakis <i>John K. Northrup Professor of Aeronautics and Professor of Applied Physics</i>
Jeffrey C. Miller <i>Senior, Bi</i> <i>Class of '36 Endowment Fund</i>	Insertion of a More Efficient Caged Compound into Membrane Proteins	Henry A. Lester <i>Professor of Biology</i>
Sonia L. Minassian Harvey Mudd College <i>Senior, Ma</i>	Analysis of Reflectance Spectra	William D. Smythe <i>Member of the Technical Staff, JPL</i>
Benjamin H. Mok <i>Sophomore, Ph/Bi</i> <i>Samuel P. and Frances Krown</i> <i>SURF Endowment Fund</i>	Analysis of the Sea Urchin <i>TEF-1</i> Transcription Enhancer Factor Gene	Eric H. Davidson <i>Chandler Professor of Cell Biology</i>

STUDENT	TOPIC	MENTOR
Christina Molodowitch <i>Junior, Ch</i> <i>Howard Hughes Medical Institute</i> <i>SURF Fellow</i>	Analysis of Promoter Function in Living <i>Drosophila</i> Embryos	Carl S. Parker <i>Professor of Chemical Biology</i>
Brian M. Monroe <i>Junior, Ay</i>	Near-Infrared Study of Interacting Galaxies	B. Thomas Soifer <i>Professor of Physics</i>
Deimetra L. Moore Tennessee State University <i>Senior, EE</i> <i>MURF</i>	Design of an Intelligent Flight Control System for Helicopter Roll-Axis Control	Rodney M.F. Goodman <i>Professor of Electrical Engineering</i>
Mary L. Mosier <i>Junior, Bi</i> <i>Mr. and Mrs. Downie D. Muir III</i> <i>SURF Fellow</i>	Visualization of CaMK II in Mammalian Brain Slices	Mary B. Kennedy <i>Professor of Biology</i>
Carter M. Moursund <i>Senior, EE</i> <i>AstroTerra Corporation SURF Fellow</i>	Video Compression for Transfer Over a Noisy Channel	Eric Korevaar <i>President, AstroTerra</i> <i>Corporation</i> Glen A. George <i>Lecturer in Computer Science and</i> <i>Electrical Engineering</i>
Hai Ah Nam Scripps College <i>Senior, Ph</i>	Numerical Simulations of Charge Transport in a CZT Detector	William A. Mahoney <i>Senior Scientist, JPL</i>
Maksim V. Narovlyansky <i>Sophomore, Ch</i> <i>Richter Scholar</i>	Quantum Calculation of Streamlines of Probability Current Density and Application to Chemical Reactions	Aron Kuppermann <i>Professor of Chemical Physics</i>
Mark L. Neidengard <i>Senior, EAS</i> <i>Dr. and Mrs. Gordon E. Moore</i> <i>SURF Fellow</i>	An Asynchronous, Quasi-Delay Insensitive Floating Point Multiplier	Alain J. Martin <i>Professor of Computer Science</i>
Bradley D. Nelson <i>Junior, CS</i>	Portable Graphical Tools for Concurrent Plasma Simulation	Stephen Taylor <i>Assistant Professor of Computer</i> <i>Science</i>
Thomas A. Niday <i>Senior, Ph</i> <i>Richter Scholar</i>	Analysis of Spiral Chaos	Michael C. Cross <i>Professor of Theoretical Physics</i>
Matthew M. Noble <i>Senior, ME</i> <i>Dr. Chandler C. Ross SURF Fellowship</i>	Particle-Wall Collisions in a Two Phase Particle Fluid Flow	Melany L. Hunt <i>Associate Professor of Mechanical</i> <i>Engineering</i>

STUDENT

Scott C. Noble
Senior, Ph
Mr. and Mrs. Fred M. Wells SURF
Fellow

Eldar Z. Noe Dobrea
Florida Institute of Technology
Senior, Space Science

Steven P. Notari
University of California, Santa
Barbara
Senior, Bioch
MURF

Barbara A. Novak
Junior, Bi
Richter Scholar

Kpemike Ogouma
Central State University
Senior, Water Resources Management

Siddhartha Padmanabha
Junior, Bi
Howard Hughes Medical Institute
SURF Fellow

Oon-Gil Paik
Senior, EAS

Payam Pakzad
Junior, EE

Jeremy M. Pallotta
University of New Hampshire
Senior, CS

Kartik C. Parija
Drake University
Senior, CS/Ma

Linda J. Park
Junior, ChE
Richter Scholar

TOPIC

Solving the NP-Complete 3-SAT Problem
Through Simulation of a Quantum Computer

Planetary Meteorology on Jupiter

A New Drive Technology for Chronic Tetrode
Recording in Mammals

Construction of a Full-length cDNA Clone of
the Dengue Type 2 Viral Genome

Application of Synthetic Aperture Radar in
Hydrology

Search for Pistillata Expression Factors

A Smart Internet Search Engine

Tiny Transmitter

Analysis of Freeze/Thaw Conditions Over
Alaskan Transects Through ERS-1 Satellite

Effects of Atmospheric Changes in the Jovian
System due to the Impact of Comet Shoemaker
Levy 9 with Jupiter
Focus: Temperature Perturbations

Analysis of Melting and Crystallization
Characteristics of PHB

MENTOR

Nicolas Cerf
Research Fellow in Physics
Christoph Adami
Division Research Fellow
in Physics
Steven E. Koonin
Vice President and Provost;
Professor of Theoretical Physics

Glenn S. Orton
Senior Research Scientist, JPL

Gilles Laurent
Assistant Professor of Biology and
Computation & Neural Systems

Ellen G. Strauss
Senior Research Associate
in Biology

Anthony Freeman
Group Supervisor, JPL

Elliot M. Meyerowitz
Professor of Biology
Xuemei Chen
Postdoctoral Research Fellow

Glen A. George
Lecturer in Computer Science
and Electrical Engineering

Dimitrios Antsos
Member of the Technical Staff,
JPL; Lecturer in Electrical
Engineering

Kyle C. McDonald
Research Scientist, JPL

Glenn S. Orton
Senior Research Scientist, JPL

Julia A. Kornfield
Associate Professor of Chemical
Engineering

STUDENT	TOPIC	MENTOR
Hiranya V. Peiris University of Cambridge Junior, Ph	The Galileo PPR Experiment	Terry Z. Martin Member of the Technical Staff, JPL
Adam G. Petrie Junior, Ay	The Search for High Redshift Galaxies: Designing Effective Selection Criteria	Charles C. Steidel Assistant Professor of Astronomy
Lena Petrovic Senior, CS Samuel P. and Frances Krown SURF Endowment Fund	Subdivision Surface Editor	Peter Schröder Assistant Professor of Computer Science
Zachary S. Pithow Princeton University Senior, Ph	Fluorescence Measurement of Neurotransmitter Transporter Conformational Change and Proton Leak Current	Henry A. Lester Professor of Biology
Alexei Polichtchouk Senior, Ph Richter Scholar	Electron Propagation in Semiconductor Nanostructures	Michael C. Cross Professor of Theoretical Physics Michael L. Roukes Associate Professor of Physics
Lea Popovic University of Toronto Senior, Ma	Data Reduction of Near Infra-red Images of Saturn	Glenn S. Orton Senior Research Scientist, JPL
Mason A. Porter Junior, AMa Richter Scholar	Cross Cultural Efforts Between Mathematics and Engineering	Jerrold E. Marsden Professor of Control and Dynamical Systems
Wei Qin Senior, EE	A 200W 13.56MHz Class-E Power Amplifier for Communications	David B. Rutledge Professor of Electrical Engineering
James J. Quallen Senior, Ch Howard Hughes Medical Institute SURF Fellow	Creation of Magnetic Beads for GST-Fusion Protein Purification	John N. Abelson George Beadle Professor of Biology
Vincent R. Quitoriano Junior, PI Sci	Modeling the Landers Earthquake: Basin Response in Simulated and Recorded Ground Motions	David J. Wald Visiting Associate in Geophysics
Priyamvada Rai Senior, Bi Mr. and Mrs. Victor V. Veysey SURF Fellow	<i>In vivo</i> Comparison of Charged and Uncharged Levels of Human Mitochondrial tRNAs	Giuseppe Attardi Grace C. Steele Professor of Molecular Biology
Kumar S. Raman Senior, Ph Lester Lees Aeronautics SURF Fellowship	Flame Speed Measurements During Unsteady Combustion	Joseph E. Shepherd Associate Professor of Aeronautics

STUDENT

David R. Relyea
Senior, Ph
Dr. and Mrs. Lew Allen, Jr. SURF
Fellow

Michelle Rojas-Soto
University of Puerto Rico,
Rio Piedras
Senior, Bi
MURF

Jason A. Roth
Sophomore, CS

Keri L. Ryan
Junior, CE

Saurabh Saha
Junior, Bi

Anna M. Salazar
Senior, Bi
Richter Scholar

Richard H. Salvador
Stanford University
Junior, CS
MURF

Wes T. Salzillo
Junior, APh
Allied Signal SURF Fellow

Glenn M. Sammis
Stanford University
Sophomore, Ch

Maria F. Satterwhite
Junior, Ch
Mrs. Edwin L. Cline SURF Fellow

Gina L. Serraiocco
Senior, Bi
Shirley and Carl Larson SURF Fellow

TOPIC

Finding Correlations within the LIGO 40-m
Interferometer Slow Monitoring System

The Preparation of a Neurogenin Fusion
Protein

The Chemistry Animation Project:
Molecular Orbitals

Demonstrations for AM35

Gene Expression and Protein Localization
in *Leishmania* with the Green Fluorescence
Protein

Selection of RNA Ligand to DbpA

Image Processing for Computer Navigation
and Obstacle Avoidance: The Floor
Recognition Approach

Imaging of a Transverse Jet in Cross-Flow

Towards the Synthesis of an Oxytocin Analog
Using Ring-Closing Metathesis

Excited States in Stratospheric Chemistry

CLARK KENT: Epi-genetic Phenomenon
Explains Paradox?

MENTOR

Rochus E. Vogt
*R. Stanton Avery Distinguished
Service Professor and Professor
of Physics*
Andreas C. Kuhnert
*Member of the Professional Staff
in Physics*

David J. Anderson
*Associate Professor of Biology;
Associate Investigator, Howard
Hughes Medical Institute*

Nathan S. Lewis
Professor of Chemistry

John F. Hall
*Associate Professor of Civil
Engineering*

Stephen M. Beverley
*Hsien Wu and Daisy Wen Yu
Professor, Department of
Biological Chemistry and
Molecular Pharmacology,
Harvard Medical School*

John N. Abelson
George Beadle Professor of Biology

Demetri Psaltis
Professor of Electrical Engineering

Paul E. Dimotakis
*John K. Northrup Professor of
Aeronautics and Professor of
Applied Physics*

Robert H. Grubbs
*Victor and Elizabeth Atkins
Professor of Chemistry*

Mitchio Okumura
*Associate Professor of Chemical
Physics*

Elliot M. Meyerowitz
Professor of Biology

STUDENT	TOPIC	MENTOR
Barry Shapira <i>Junior, Ch</i> <i>Mr. and Mrs. Clayton H. Englar</i> <i>SURF Fellow</i>	Synthesis and Study of Annulene	Andrew G. Myers <i>Professor of Chemistry</i>
Kanna Shimizu <i>Senior, EE</i> <i>Richter Scholar</i>	Non-Realtime Voice Compression	Glen A. George <i>Lecturer in Computer Science</i> <i>and Electrical Engineering</i>
Andrew C. Silberfarb <i>Junior, Ph</i>	Resistive Plate Counter Detectors	Douglas Michael <i>Senior Research Fellow in High</i> <i>Energy Physics</i>
Manish Sinha <i>Imperial College</i> <i>Senior, Ae</i>	How and Why Aircraft Fly	Paul A. Robinson, Jr. <i>Professor of Physics,</i> <i>Principia College</i>
Ben A. Siron <i>Senior, APh</i>	High Resolution Electron Projection Lithography Using Cyclotron Orbits	Axel Scherer <i>Professor of Electrical Engineering</i>
Frances M. Siu <i>Junior, EE</i> <i>Ford Motor Company SURF Fellow</i>	Improved Boundary Conditions of Surface Micromachined Diaphragms	Yu-Chong Tai <i>Associate Professor of Electrical</i> <i>Engineering</i>
Douglas A. Smith <i>Rensselaer Polytechnic Institute</i> <i>Senior, EE</i>	Automating a TIE Telescope on Palomar Mountain	Gilbert A. Clark <i>Program Manager, Telescopes in</i> <i>Education, JPL</i>
Edwin Soedarmadji <i>Senior, EE/APh</i>	Ghost-Canceling Antenna System for DirecTV	William B. Bridges <i>Carl F Braun Professor</i> <i>of Engineering</i>
Michael D. Stage <i>Senior, Ph</i> <i>Dr. and Mrs. Michael J. Callaghan</i> <i>SURF Fellow</i>	12.5 μm Imaging of the Galactic Center: A Mid-IR Search for a Central Black Hole	Michael W. Werner <i>Senior Research Scientist, JPL</i>
Ann M. Stimmler <i>Sophomore, EAS</i> <i>Ernest H. Swift SURF Endowment</i> <i>Fund</i>	The Design and Construction of an Odor Discrimination Device for Rats	Nathan S. Lewis <i>Professor of Chemistry</i> James M. Bower <i>Associate Professor of Biology</i>
Kathryn A. Stofer <i>Junior, Bi</i> <i>Mr. and Mrs. William B. Hicks</i> <i>SURF Fellow</i>	Optimization of a Technique for Visualizing an Activated Protein Kinase in Neural Tissue	Mary B. Kennedy <i>Professor of Biology</i>
Paul O. Storaasli <i>Junior, EE</i>	Design of Recycling Mirror Servo Electronics for 40m LIGO	Rochus E. Vogt <i>R. Stanton Avery Distinguished</i> <i>Service Professor and Professor</i> <i>of Physics</i> Jay Heefner <i>Project Engineer in Physics</i>

STUDENT	TOPIC	MENTOR
Ronald H. Stowell <i>Senior, Ph/AMa</i>	Linear Response of a Pure-Electron Plasma in a Magnetic Field Due to a Current-carrying Wire	Noel R. Corngold <i>Professor of Applied Physics</i>
Andrew K. Strauss <i>Sophomore, EAS</i> <i>Mrs. Hannah Bradley SURF Fellow</i>	Shift Multiplexing – A Method of Mass Holographic Storage	Demetri Psaltis <i>Professor of Electrical Engineering</i>
Erik W. Streed <i>Sophomore, Ph</i> <i>Dreyfus Foundation SURF Fellow</i>	Electrostatic Attraction's Effect on the Conformational Distribution of β -alanine ($+NH_3CH_2CH_2CO^{2-}$)	John D. Roberts <i>Institute Professor of Chemistry, Emeritus; Lecturer</i>
Advoquita P. Stude <i>Junior, Env</i>	Chemical Characterization of Ambient Aerosols over the Atlantic Ocean	Michael R. Hoffmann <i>James Irvine Professor of Environmental Chemistry</i>
Julius T. Su <i>Junior, Ph</i>	Femtosecond Elementary Processes in Chemical and Biological Systems	Ahmed H. Zewail <i>Linus Pauling Professor of Chemistry and Professor of Physics</i>
Winston Y. Su <i>Stanford University</i> <i>Sophomore</i>	The Study of Particulate Air Pollution Control as a Supplement to High School Science Curricula	Paul A. Robinson, Jr. <i>Professor of Physics, Principia College</i>
Ki-Young Suh <i>Senior, Bi</i> <i>Glenn Foundation SURF Fellow</i>	Occlusion Experiment for BDNF and NT-3	Erin M. Schuman <i>Assistant Professor of Biology</i>
Toufic M. Suidan <i>Senior, AMa/Ma</i>	Nonlinear Molecular Dynamics	Stephen Wiggins <i>Professor of Applied Mechanics</i>
Philip M. Sutton <i>Senior, CS</i> <i>Samuel P. and Frances Krown SURF Endowment Fund</i>	Rendering Microsurface-Based Textures Using Texels	Alan H. Barr <i>Associate Professor of Computer Science</i>
Kai-hsu Tai <i>Junior, Ch</i>	Simulation of DNA Intercalation by Rhodium(III) Polyamine Complexes	William A. Goddard III <i>Charles and Mary Ferkel Professor of Chemistry and Applied Physics</i>
Miguel A. Talavera <i>University of Puerto Rico, Mayaguez</i> <i>Senior, Ch</i> <i>MURF</i>	RNA Aptamer Selection for HLA-B27	Pamela J. Bjorkman <i>Associate Professor of Biology; Associate Investigator, Howard Hughes Medical Institute</i>
Wesley N. Tanaka <i>Sophomore, CS</i>	Caltech Infospheres Project: Bringing Theory to the Marketplace	K. Mani Chandy <i>Professor of Computer Science</i>
Victoria M. Tanusheva <i>Junior, Ma</i> <i>Richter Scholar</i>	Topological Puzzles	Tomasz S. Mrowka <i>Professor of Mathematics</i>

STUDENT	TOPIC	MENTOR
Michael P. Thelen Loyola Marymount University <i>Junior, ME</i>	Ion Engine Gas Flow Calibration	John R. Brophy <i>Technical Group Supervisor, JPL</i>
Devi M. Thota <i>Sophomore, ME</i>	The Morphological Changes in Hippocampal Neurons Due to Extracellular Stimulation	Jerome Pine <i>Professor of Physics</i>
Matthew S. Tiscareno <i>Junior, Ph</i>	Analysis of Data of Jupiter's Moon Ganymede Received from the Near Infrared Mapping Spectrometer on the Galileo Spacecraft	G. Edward Danielson <i>Member of the Professional Staff in Planetary Science</i>
Sara M. Tolaney Princeton University <i>Junior, Molecular Bi</i> <i>Howard Hughes Medical Institute SURF Fellow</i>	Determining Protein-Protein Interaction Partners of Leafy, a Plant Developmental Switch	Elliot M. Meyerowitz <i>Professor of Biology</i>
Tony V. Tran <i>Junior, ChE</i>	Backbone and Spacer Length Effects on Side-Chain Liquid Crystal Polymers	Julia A. Kornfield <i>Associate Professor of Chemical Engineering</i>
Stephen P. Trowell University of Leicester <i>Senior, Ph</i>	Advanced Spacecraft Design: A Mission to Europa	Joan C. Horvath <i>Industry Liaison Officer, JPL</i>
James M. Turner <i>Junior, Ch</i> <i>Richter Scholar</i>	Recognition of 7 Base Pairs of DNA by a 5- γ -5 Pyrrole-Imidazole Polyamide Hairpin Motif	Peter B. Dervan <i>Bren Professor of Chemistry</i>
David E. Tytell <i>Sophomore, Ay/Ge</i> <i>Arthur R. Adams SURF Fellowship</i>	Interpretation of the Effects of Helium in the Jovian Interior	David J. Stevenson <i>Professor of Planetary Science</i>
Elwyn T. Uy <i>Senior, APh</i> <i>Mr. and Mrs. Robert L. Noland SURF Fellow</i>	The Holographic Sneaker Tracker	Demetri Psaltis <i>Professor of Electrical Engineering</i>
Diederik M. van Rappard Stanford University <i>Senior, Ch</i>	Protostars in the Rho Ophiuchus Cloud	Thomas G. Phillips <i>Professor of Physics</i>
Chris K. Varma <i>Sophomore, Bi</i>	Rapid Detection of Antigen Specific T-Cell Hybridomas	Leroy Hood <i>Professor and Chairman, Department of Molecular Biotechnology, University of Washington</i>
Anna N. Varshavsky <i>Junior, Bi</i> <i>Howard Hughes Medical Institute SURF Fellow</i>	Intracellular Signaling of Protein Tyrosine Phosphatase DPTP69D	Kai Zinn <i>Associate Professor of Biology</i>

STUDENT	TOPIC	MENTOR
Daniel Velez <i>Junior, ChE</i> <i>Professor Fredrick H. Shair SURF Endowment</i>	Novel Enzyme Substrate Specificities Through Directed Molecular Evolution on Sequences of Structurally Related Substrates	Frances H. Arnold <i>Associate Professor of Chemical Engineering</i>
Kwanchanok Viravaidya <i>Junior, ChE</i>	The Relative Importance of the Two Specific Binding Domains of Laminin in Extracellular Adhesion	Jeffrey A. Hubbell <i>Professor of Chemical Engineering</i>
Keely L. Walker <i>Senior, Bi</i> <i>Richter Scholar</i>	A Genetic Analysis of the Roles of Tyrosine Kinases and Tyrosine Phosphatases in Controlling Motor Axon Guidance in <i>Drosophila</i>	Kai Zinn <i>Associate Professor of Biology</i>
D. William Ward <i>Principia College</i> <i>Senior, Ch/English</i>	Modeling Pollution	Paul A. Robinson, Jr. <i>Professor of Physics, Principia College</i>
Rachel C. Weathers <i>Senior, ME/SES</i> <i>J. Weldon Green SURF Endowment</i>	Behavior of Granular Material in a Horizontally Vibrating Hopper	Melany L. Hunt <i>Associate Professor of Mechanical Engineering</i>
Lorenz G. Wegener <i>University of Cambridge</i> <i>Senior, Ph</i>	Reduction of Auticorrelation Between Temperature and Predictions for the Mixing Ratios of C ₂ H ₂ and C ₂ H ₆ on Jupiter	Glenn S. Orton <i>Senior Research Scientist, JPL</i>
Sindy H. Wei <i>Junior, Bi</i> <i>Dreyfus Foundation SURF Fellow</i>	Rotational Conformations of β -Alanine from NMR Spectroscopy	John D. Roberts <i>Institute Professor of Chemistry, Emeritus; Lecturer</i>
Barbara A. Weir <i>Senior, Bi</i> <i>Richter Scholar</i>	Purification and Characterization of 2 Kinases, <i>Thermotoga maritima</i> CheA and <i>Neurospora crassa</i> nik-2	Melvin I. Simon <i>Anne P. and Benjamin F. Biaggini Professor of Biological Sciences; Chair, Division of Biology</i>
Michael J. Westover <i>Sophomore, Ay</i> <i>Richter Scholar</i>	Reduction of Spectroscopic Data from Radio-Selected Quasars	Limin Lu <i>Research Fellow in Astronomy</i>
Eileen R. Wexler <i>Senior, EAS</i> <i>Richter Scholar</i>	The Chemistry Animation Project	Nathan S. Lewis <i>Professor of Chemistry</i>
Aloysius A. Wild <i>Senior, Ph</i>	Low Energy Nuclear Reactions Studied in the Presence of Target and Projectile Electrons	Karlheinz Langanke <i>Senior Research Associate in Theoretical Physics</i>
James A. Wild <i>University of Leicester</i> <i>Senior, Ph</i>	Advanced Spacecraft Design: Mission to Europa	Joan C. Horvath <i>Industry Liaison Officer, JPL</i>
Tamara S. Williams <i>Tennessee State University</i> <i>Junior, Ph</i> <i>MURF</i>	Towards Compositional Rules in Image Analysis	Pietro Perona <i>Assistant Professor of Electrical Engineering</i>

STUDENT

Travis J. Williams
Sophomore, Ch
Dreyfus Foundation SURF Fellow

Toby A.J. Wiseman
 University of Cambridge
Junior, Ph

Winston C. Yang
Senior, Ma
SURF Alumni Fellowship

Johanna A. Yao
Junior, Ch
Peter A. Lindstrom SURF Endowment

Wen X. Yin
 University of Cambridge
Senior, Ph

Simon Y. Yu
Senior, EAS
Toshi Kubota Aeronautics SURF Fellowship

Alan H. Yue
Junior, Ph
Richter Scholar

Veronica A. Zamudio
 University of Texas at El Paso
Junior, ME
NASA Minority SURF

Yuan Zhang
 Claremont McKenna College
Junior, Bioch
Howard Hughes Medical Institute SURF Fellow

Amy M. Zheng
Junior, Bi

TOPIC

Macroscale Synthesis of (+)-1-Trimethylsilyl-1,2-pentadiene-5-ol

Low Temperature Magnetostrictive Actuator

Derivatives of Self-Compositions of Functions

Novel Complexes of Osmium as Molecular Probes for DNA

Multiple Cavity Locking Sequence in a LIGO Interferometer

High-Strain-Rate Behavior of Metals at High Temperatures

Design and Construction of a Single-Frequency High-Power Diode Laser Amplifier

The Telescopes in Education (TIE) Project

The Synthesis of pdCpA and Tetrafluorotyrosine-Compounds Useful for the Study of Nicotinic Acetylcholine Receptors and Other Ion Channels

I. Prepare Monoclonal Antibody against UL18 Heavy Chain; II. Deglycosylation of UL18 by Site Specific Mutagenesis

MENTOR

Erick M. Carreira
Assistant Professor of Chemistry

Robert G. Chave
Applied Physicist, JPL

Richard M. Wilson
Professor of Mathematics

Jacqueline K. Barton
Professor of Chemistry

Rochus E. Vogt
R. Stanton Avery Distinguished Service Professor and Professor of Physics
 Lisa Sievers
Member of the Professional Staff in Physics

Guruswaminaidu Ravichandran
Associate Professor of Aeronautics

H. Jeff Kimble
Professor of Physics

Gilbert A. Clark
Program Manager, Telescopes in Education, JPL

Dennis A. Dougherty
Professor of Chemistry

Pamela J. Bjorkman
Associate Professor of Biology; Associate Investigator, Howard Hughes Medical Institute

Ae Aeronautics
 AMa Applied Mathematics
 APH Applied Physics
 Ay Astronomy
 Bi Biology
 BioPh Biophysics
 CE Civil Engineering
 Ch Chemistry
 ChE Chemical Engineering

CNS Computation & Neural Systems
 CS Computer Science
 EAS Engineering & Applied Science
 Ec Economics
 EE Electrical Engineering
 Eng Engineering
 Env Environmental Engineering
 Ge Geology
 GePh Geophysics

GeoCh Geochemistry
 Lit Literature
 Ma Mathematics
 ME Mechanical Engineering
 Ph Physics
 Psy Psychology
 PISc Planetary Science
 SS Social Science

The success of the Summer Undergraduate Research Fellowships program is evidenced by the generous support it receives each year. Donations of all sizes are important to keep SURF the model program it has grown to be. Our students benefit directly from the gifts of individual donors, corporations, and foundations who provide funds which help pay for student stipends.

This summer friends of the program issued a challenge for SURF to raise two endowments to be matched by a third. Endowment gifts of \$100,000 or more will ensure at least one student per year can share in the SURF experience. An endowment fund can be named as the donor designates and may be made by bequest. Individuals or groups establishing an endowment will have the chance to meet the student supported by the fund and their names will be listed with the students in the SURF annual report each year.

An annual contribution of \$3,600 provides a student fellowship for a single year. Donors who contribute the amount of a stipend will have the opportunity to meet the student supported and will have their names listed with the students in the annual report the following summer.

We thank the following donors for helping us make SURF '96 another exceptional year:

SURF Endowments

- Arthur R. Adams SURF Fellowships
- The Associates SURF Endowment Bristol-Myers Endowment Fellowship
- Donald S. Clark SURF Endowment Fund
- Class of '36 Endowment Fund
- Hugh F. and Audy Lou Colvin International Fellowship Endowment
- Hugh F. and Audy Lou Colvin SURF Endowment Fellowship
- Flintridge Foundation SURF
- J. Weldon Green SURF Endowment
- Edward W. Hughes SURF Endowment
- Samuel P. and Frances Krown SURF Endowment Fund
- Toshi Kubota Aeronautics SURF Fellowship
- William N. Lacey SURF Endowment Fund
- Arthur E. Lamel Memorial SURF Fund
- William H. and Helen Lang SURF Endowment Fund
- Shirley and Carl Larson SURF Endowment
- Lester Lees Aeronautics SURF Fellowship
- Peter A. Lindstrom SURF Endowment
- Thomas Hunt Morgan SURF Endowment Fund
- Northern California Associates SURF Endowment Fund
- Arthur A. Noyes SURF Endowment Fund
- Doris S. Perpall SURF Speaking Awards Endowment
- Sidney R. and Nancy M. Petersen SURF Endowment
- Arthur Rock SURF Endowment
- Warren and Katharine Schlinger SURF Endowment
- Professor Fredrick H. Shair SURF Endowment
- Ernest H. Swift SURF Endowment Fund
- Howell N. Tyson, Sr. SURF Fund
- Erika C. Vote SURF Endowment

Gifts to Endowments and Memorial Funds

- The Associates Endowment Challenge*
- Mr. & Mrs. John C. Abram
- Dr. & Mrs. Lew Allen *
- Archives of the California Institute of Technology
- Mr. Albert W. Atwood, Jr.
- Mr. & Mrs. R. Stanton Avery
- Mr. & Mrs. Hugh A. Baird
- Mr. & Mrs. Olin Barrett
- Mrs. Vernon L. Barrett
- Ms. Jeanne Bollay
- Dr. Marcella Bonsall *
- Mrs. Hannah Bradley *
- Ms. Carol L. Bressler
- Mr. James D. Burke
- Mr. & Mrs. A. A. Burnand *
- Mr. Kenneth O. Cartwright
- Mr. Norman P. Clement, Jr.
- Mrs. Edwin L. Cline*
- Mr. & Mrs. Theodore C. Combs
- Mr. & Mrs. David L. Douglas
- Mr. & Mrs. Paul A. Erskine
- Mrs. Russell Faucett
- Mr. Gordon Fish
- Mr. John Glanville & Ms. Teri Oldknow *
- Dr. & Mrs. Jesse L. Greenstein
- Mr. & Mrs. Alfred B. Hastings, Jr. *
- Mr. & Mrs. Raymond G. Hemann
- Mr. & Mrs. Robert Henigson
- Mr. & Mrs. William B. Hicks *
- Mr. & Mrs. George S. Holditch
- Mr. & Mrs. William L. Holladay
- Mr. & Mrs. R. G. Jenkins
- Mrs. J. Stanley Johnson
- Mrs. Robert Jordan
- Mr. James H. Knecht
- Mr. Robert W. Lester
- Mrs. Roland W. Lindhurst
- Mr. & Mrs. Harrison C. Lingle
- Mr. Richard A. McKay
- Mr. & Mrs. Allan Moore
- Dr. & Mrs. Gordon E. Moore *
- Dr. & Mrs. Samuel P. Morgan *
- Mr. & Mrs. Robert L. Noland *
- Dr. & Mrs. Ray D. Owen
- Mr. & Mrs. Robert J. Parks
- Mrs. J. Donald Pauley
- Mr. & Mrs. Francis V. Pesenti *
- Mrs. B. J. Ridder
- Mr. & Mrs. Robert K. Roney

Mr. Joseph Rosener, Jr.
Mr. Sidney Schafer
Dr. & Mrs. Alfred Schaff
Mr. & Mrs. W. J. Shirley
Drs. Tim K. & Annie Siu
Mr. & Mrs. Frank C. Smith
Mr. & Mrs. George F. Smith
Mr. & Mrs. William G. Steele, Jr.
Dr. Gary W. Stupian
Mr. & Mrs. Mabry Van Reed
Mr. & Mrs. Fred M. Wells *
Mr. & Mrs. T. H. Wiancko *
Mr. & Mrs. Allen E. Wolfe
Ms. Nancy S. York
Mr. & Mrs. John E. Young *

J. Weldon Green SURF Endowment
Mr. & Mrs. Douglas Nickerson

Toshi Kubota Aeronautics SURF Fellowship
Dr. & Mrs. Eli Reshotko

Shirley and Carl Larson SURF Endowment
Mr. & Mrs. Carl V. Larson

Lester Lees Aeronautics SURF Fellowship
Mr. Robert T. Herzog
Mrs. Lester M. Lees
Dr. & Mrs. Eli Reshotko

Peter A. Lindstrom SURF Endowment
Mr. Howard W. Lindstrom

Northern California SURF Endowment Fund
Dr. Holt Ashley
Mr. & Mrs. Ben G. Burke
Mr. & Mrs. Frederick W. Drury, Jr.
Mr. & Mrs. Hubert E. Dubb
Mr. Everett Eiselen
Mr. & Mrs. Clayton H. Englar *
Mr. & Mrs. Arnold L. Grossberg
Lewis A. Kingsley Foundation
Mr. Neville S. Long
Mr. & Mrs. John S. Page
Mr. & Mrs. Richard M. Rosenberg
Mr. & Mrs. W. B. Scarborough
Dr. & Mrs. Costa G. Sevastopoulos
Mrs. Dan T. Smith
Mr. & Mrs. Thomas A. Tisch

Sidney R. and Nancy M. Petersen SURF Endowment
Mr. & Mrs. Sidney R. Petersen

Dr. Chandler C. Ross Fellowship
Mr. Edward O. Ansell
Mr. & Mrs. Langdon F. Ayres
Mr. & Mrs. R. F. Brodsky
Mr. & Mrs. William A. Casler
Mr. & Mrs. Frank J. Dolinski
Mr. & Mrs. B. L. Dorman
Mr. & Mrs. Richard D. Geckler
Mr. & Mrs. George H. Gilbrech
Mr. & Mrs. Calvin A. Gongwer
Dr. & Mrs. Robert Gordon
Mr. & Mrs. Carson E. Hawk
Dr. Werner R. Kirchner
Mr. William P. Knight
Mr. & Mrs. Myron Lipow
Mr. & Mrs. George M. McRoberts
Dr. & Mrs. Eli Mishuck
Mr. & Mrs. Kenneth E. Price
Dr. Ernest R. Roberts
Mr. & Mrs. William L. Rogers
Mr. Donald D. Smith
Mr. & Mrs. Gerald L. Starrh
Mr. L. L. Thompson
Mr. & Mrs. Warren H. Yetter

Erika C. Vote SURF Endowment
Ms. Linda L. Lewis
Mr. & Mrs. Frederick C. Vote
Dr. Carol J. Vote

Warren and Katharine Schlinger SURF Endowment
Dr. & Mrs. Warren K. Schlinger

Memorial Gifts

In Memory of Tyler Woodward III
Mr. Keith A. Childs
Cub Scout Pack 134
Grover Cleveland P.T.A.

In Memory of Mrs. William S. Clark
Mrs. Vernon L. Barrett

Unrestricted Gifts

Mr. Robert Abbey *
Mrs. Vernon L. Barrett *
Mr. & Mrs. Harry S. Blackiston, Jr.
Dr. & Mrs. Donald Blumenthal
Mr. Michael Bronikowski

Dr. & Mrs. Michael J. Callaghan *
Mr. Raymond A. Cromley
Dr. & Mrs. Jan W. Dash
Dr. Peter L. Davis
Mr. & Mrs. James W. Dunham
Dr. Fred H. Eisen
Mr. Glen A. George *
Mr. & Mrs. Robert Henigson
Mr. & Mrs. Carter Hunt
Mr. & Mrs. Ralph W. Jones *
Mr. Raymond F. Jurgens
Mr. & Mrs. Abner Kaplan
Mr. & Mrs. James M. Kendall
Dr. & Mrs. Jack L. Kerrebrock
Dr. York Liao *
Mr. Le Val Lund
Mrs. Downie D. Muir *
Dr. Susan Murakami &
Mr. Leroy J. Fisher
Mr. & Mrs. Daniel G. Reichel
Mr. Daniel Rimkus
Mr. A. S. Thomas, Jr.
Mr. & Mrs. Victor V. Veysey *
Dr. & Mrs. William M. Whitney
Mr. & Mrs. Paul H. Winter
Mr. Jerry D. Woods
Dr. Clyde Zaidins
Mr. & Mrs. Fred A. Zapletal

Gifts from SURF Alumni

Mr. Loren I. Alving & Dzung Trinh
Mr. & Mrs. Ariel D. Anbar
Dr. James J. Angel
Mr. Stephen Bard
Mr. & Mrs. Kenneth M. Barker
Mr. John A. Behr
Ms. Leila A. Belkora
Mr. Ned B. Bowden
Ms. Tara L. Chapman
Mr. Richard W. Clark
Mr. James Dunn
Dr. Edward W. Felten
Mr. Marc Herant
Mr. Stephen V. Hwan
Ms. Anna M. Jaeckel
Mr. Ari D. Kaplan
Dr. Julia A. Kornfield
Mr. Jason T. Lee
Ms. Marcia J. Li
Mr. & Mrs. Niels Michelsen
Mr. & Mrs. Timothy T. Pham
Dr. Charles C. Reel
Ms. Zhanqing Ren
Mr. & Mrs. David B. Ritchie

Dr. Gregory D. Sayles &
Ms. Elizabeth A. Whelan
Mr. Douglas G. Shiels
Mr. Yun-chen Sung
Mr. Jeffrey D. Tekanic
Dr. Christine L. Tiller
Mr. Ned S. Wingreen
Mr. Chen Yuan

Corporate Donors

AeroVironment, Inc.
Allied Signal
AstroTerra Corporation
First Quadrant Corporation
Ford Motor Company
Logicon, Incorporated
Motorola
Semiconductor Systems, Inc.

Matching gifts were received from the following companies:

Allied Signal Foundation
AT & T
Chevron
GenCorp
IBM
NEC Research Institute, Inc.
Northern Illinois Gas Company
Procter & Gamble
Rockwell Corporation
SKF Industries, Inc.
Texaco Inc.
Transamerica Corporation
Varian Associates, Inc.

Foundation Donors

The Caltech Alumni Association
The Camille and Henry Dreyfus
Foundation Inc.
The Glenn Foundation for Medical
Research
Howard Hughes Medical Institute
Paul K. & Evalyn Elizabeth Cook
Richter Memorial Funds

**National Laboratories and
Federal Agencies**

Jet Propulsion Laboratory
National Aeronautics and
Space Administration

* These individuals contributed the amount of one or more SURF stipends.

If you would like further information about how you can contribute to SURF, please contact:

Carolyn Merkel

Director, SURF Program
California Institute of Technology
Mail Code 139-74
Pasadena, California 91125
Telephone: (818) 395-2885
FAX: (818) 449-9649
e-mail: surf@starbase1.caltech.edu
URL:
<http://www.cco.caltech.edu/~surf/>

SURF ADVISORY COMMITTEES AND SURF DEDICATEES

SURF BOARD

The SURF Board is a voluntary support organization consisting of individuals who are dedicated to the educational values of undergraduate research at Caltech, and who, through their advice, encouragement, and financial support, contribute to the vitality, continuity, and effectiveness of the SURF program.

Mr. Douglas B. Nickerson, Chair
Dr. Marcella R. Bonsall
Mrs. Hannah G. Bradley
Dr. Fred H. Eisen
Mr. Ralph W. Jones
Dr. Werner R. Kirchner
Dr. Paul MacCreedy
Mrs. Joanna W. Muir
Mr. Robert C. Perpall
Mrs. Edith Roberts
Dr. Alfred Schaff
Dr. Thomas J. Tyson
Mr. Victor V. Veysey
Mr. Frederick C. Vote
Dr. William M. Whitney

Life Members

Dr. Lew Allen, Jr.
Chair, 1992-94
1991 SURF Dedicatee
Mr. Samuel P. Krown
Chair, 1982-85
1995 SURF Dedicatee
Mr. Carl V. Larson
Chair, 1994-95
Mrs. Elizabeth G. Nickerson
Chair, 1985-88
Dr. Ray D. Owen
Chair, 1991-92
1988 SURF Dedicatee
Dr. John D. Roberts
1992 SURF Dedicatee
Dr. Fredrick H. Shair
1990 SURF Dedicatee

Ex-Officio Members

Ms. Sudipta Bardhan
Ms. Diane M. Binney
Dr. Terry Cole
Ms. Lin Jia
Ms. Carolyn Merkel
Mr. Jerry Nunnally
Ms. Priya Rai

Serving on SURF Board Committees, but not Members of the Board

Dr. Julia A. Kornfield
Dr. Kenneth Libbrecht

SURF ADMINISTRATIVE COMMITTEE

The role of the SURF Administrative Committee is to establish academic policy and maintain the pedagogical excellence of SURF. The committee reviews all student proposals and makes recommendations for awards.

Dr. Terry Cole, Chair
Dr. Frances H. Arnold
Dr. Paul M. Bellan
Dr. Charles J. Brokaw
Dr. Ronald L. Bush
Dr. Glen R. Cass
Dr. S. George Djorgovski
Dr. Robert H. Grubbs
Dr. Eleanor Helin
Dr. Herbert B. Keller
Dr. Joseph L. Kirschvink
Dr. Nathan S. Lewis
Dr. Kenneth G. Libbrecht
Dr. Thomas A. Tombrello
Dr. Richard M. Wilson
Dr. William M. Whitney

Ex-Officio Members

Ms. Sally J. Asmundson
Ms. Diane M. Binney
Dr. D. Roderick Kiewiet
Mr. Carl V. Larson
Mr. David S. Levy
Ms. Carolyn Merkel
Ms. Georgia A. Morton
Ms. Priya Rai
Dr. David Wales

SURF STUDENT ADVISORY COUNCIL (SURFSAC)

The role of SURFSAC is to provide student input to the planning and implementation of the SURF program and to provide feedback on program activities. SURFSAC members also serve as advisors to their peers.

Ms. Priya Rai, Chair
Ms. Nasim Afsarmanesh
Ms. Sudipta Bardhan
Mr. Jonathan Burrows
Ms. Lin Jia
Mr. Carlos Maldonado
Mr. Jeffrey Miller
Ms. Kanna Shimizu
Mr. Elwyn Uy
Ms. Amy Zheng

SURF DEDICATEES

Each year the SURF program is dedicated to an individual who has demonstrated commitment to outstanding undergraduate education and has promoted undergraduate research.

Dr. Lew Allen, Jr., 1991
Dr. Robert E. Bacher, 1993
Dr. Lee A. DuBridge, 1986
Mr. Samuel P. Krown, 1995
Dr. Edward B. Lewis, 1996
Dr. Hans W. Liepmann, 1989
Dr. Ray D. Owen, 1988
Dr. Edward C. Posner, 1994
Dr. John D. Roberts, 1992
Dr. Fredrick H. Shair, 1990
Dr. Robert P. Sharp, 1987
Dr. Ernest Swift, 1985

California Institute of Technology

SURF Office

Mail Code 139-74

Pasadena, California 91125

818/395-2885

Fax 818/449-9649

E-Mail surf@starbase1.caltech.edu

