

SURF

CALIFORNIA INSTITUTE OF TECHNOLOGY

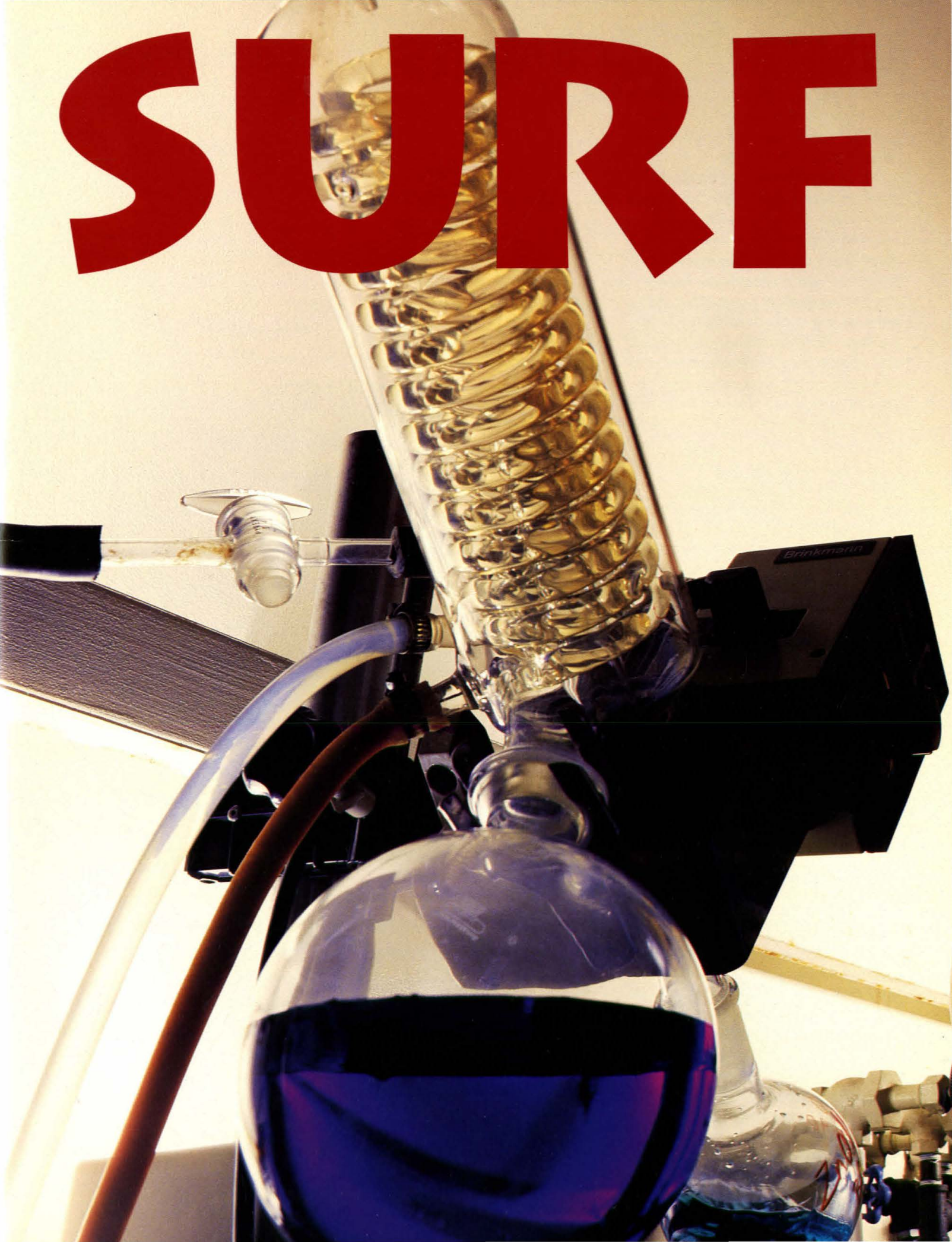
Summer Undergraduate Research Fellowships

Annual Report



1994

SURF



Congratulations to SURF on another outstanding year! This summer marked the SURF program's sixteenth year—sixteen years of remarkable achievement and growth. As I have listened to the SURF seminars over the seven years since I have been President, I have come to value the achievements of SURF students and their research sponsors more and more. The SURF experience provides a research-oriented counterpoint to the normal classroom experience. It also fosters collegiality between the research sponsor and the student—between mentor and protégé. This combination creates a team that produces new ideas and discoveries through superlative mutual stimulation.

The success of the SURF program depends on the active involvement of many people. More than 450 individuals including donors, friends, students, research sponsors, and administrative staff participate on the Caltech SURF team. I want to express my deep gratitude to all, and especially to those who have given time, money, wise counsel, and leadership to enrich the students and the program. SURF is one of the activities that helps Caltech achieve its place of quality and excellence in the academic world. The Institute is indebted to those who make it possible.

Thomas E. Everhart
President
California Institute of Technology

DEDICATION

This year's SURF program is dedicated to the late Dr. Edward C. Posner whose commitment to the education of students was legend at Caltech and JPL. Through the SURF program alone, he directly influenced 60 students. Ed's legacy to the education of young people stretches far and touches many as evidenced by his involvement with SURF, one program on his long list of interests. In dedicating SURF to Dr. Posner, we recognize his outstanding contributions to the SURF program and his passion for education and research.

FROM THE SURF BOARD

Carl V. Larson

On behalf of the SURF Board I extend our deep appreciation to Lew Allen who served as Chair of the Board from January 1992 to January 1994. Under Lew's strong leadership the SURF program became financially more robust through the important underwriting agreement with the Institute for SURF student stipends and through successful fund raising.

As the new Chair of the SURF Board, I am committed to the premier education afforded to Caltech students. SURF enhances the academic program by encouraging them to apply knowledge gained in the classroom to ask new questions and to solve problems at the forefront of science and



Carl Larson

technology. By introducing students to research and through its innovative programming, SURF provides tactical support for Caltech's strategic educational plan.

The mission of the SURF Board, written twelve years ago, remains our guiding principle: The SURF Board is a voluntary support organization consisting of individuals 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.

The activities of the past year have supported our mission.

- The Administration, through President Thomas Everhart and Provost Paul Jennings, agreed again this year to underwrite up to 20 stipends for Caltech students recommended by the Administrative Committee to receive awards. The agreement alleviates the uncertainty caused by the late receipt of stipend moneys. So far, SURF has not had to use any of the underwritten funds.
- We thank Joanne Clarey, Director, and Phyllis Hosey, Corporate Activities Coordinator, Corporate Relations Department for their innovation and effort in creating the Small Business Industrial Associates program. This summer five companies joined this new association, each sponsoring a SURF student, and gaining certain Institute privileges.

- The first Doris S. Perpall SURF speaking competition saw the best SURF speakers competing for three cash prizes. This contribution by Board member Bob Perpall to the SURF Communication Program provided important incentives for students to plan and organize their final presentations.
- The SURF Board committees remained active this year. The Campus Liaison Committee under the chairmanship of Bill Whitney coordinated the SURF Monday Night Discussions and the Roundtable speakers for this summer's program. The Student Relations Committee, chaired by Joanna Muir, held the annual thank-you-note-writing party to encourage named SURF students to personally thank their financial sponsors.

We look ahead to 1995 with the goal of meeting the fund-raising challenges for SURF and anticipate increasing opportunities for these bright and talented students. SURF depends upon the support of its many friends, and with your commitment, SURF's future is very bright!

The SURF Administrative Committee 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 other 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.

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. All of the faculty members of the committee are or have been SURF research advisors.

During the past year the Committee worked closely with SURF Director Carolyn Merkel, Carl Larson 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. This will provide a vehicle for students to learn about research topics of interest to the commercial sector and to investigate industrial research and development career opportunities.

We were pleased with the success of the first Southern California Conference on Undergraduate Research held at Caltech during the past academic year. This conference was organized and led by the SURF staff. This event should become a California academic tradition.

We look ahead with enthusiasm to the continuing development of undergraduate research at Caltech.



Terry Cole

DIRECTOR'S REPORT

Carolyn Merkel



Two hundred sixteen students SURFed at Caltech this summer, the program's sixteenth year. Days filled with research, lunch time seminars, and dinner time discussions made for a rich and satisfying mix of activity, reported below.

SURF initiated many new activities this year.

- The SURF team took the lead in organizing and hosting the first Southern California Conference on Undergraduate Research.
- The Corporate Relations department developed unique industrial SURF opportunities for students jointly mentored by faculty and industrial researchers.
- We held the first Doris S. Perpall speaking competition.
- A team of six SURFers joined Caltech's Young Engineering and Science Scholars program to create California education units and to try them out with the high school YESS participants.
- SURF coordinated Monday Night Barbecues for students in all Caltech summer programs creating a social environment to strengthen the student community.
- SURF joined the information superhighway this year listing all information on the World Wide Web, accessible to anyone on the Internet anywhere in the world.



Carolyn Merkel

PROFILE OF SURF 94

<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	54	41	13	39
Chemistry and Chemical Engineering	41	34	7	21
Engineering and Applied Science	28	26	2	19
Geological and Planetary Sciences	12	12	0	7
Humanities and Social Sciences	6	5	1	5
Physics, Mathematics and Astronomy	25	23	2	20
Jet Propulsion Laboratory	45	19	26	29
Off-Campus	5	5	0	5
	216	165	51	145

PROFILE OF THE 1994 SURFERS

Freshmen	<1%
Sophomores	17%
Juniors	31%
Seniors	52%
Women SURFers	34%
Minority SURFers	13%

Young Engineering and Science Scholars SURF

A team of six SURF students, under the mentorship of Paul Robinson (Assistant to the Chief Technologist, JPL), researched, created, developed, and wrote California education units and tested their projects with the 40 high school participants in Caltech's Young Engineering and Science Scholars (YESS) program. Three of the units focused on various aspects of boomerangs; the other three were radio telescopes, physics (the physics of Frisbees), and catapults. The goal of each project was to teach basic physics or engineering concepts around an unusual topic using a hands-on approach.

Minority Undergraduate Research Fellowships (MURF)

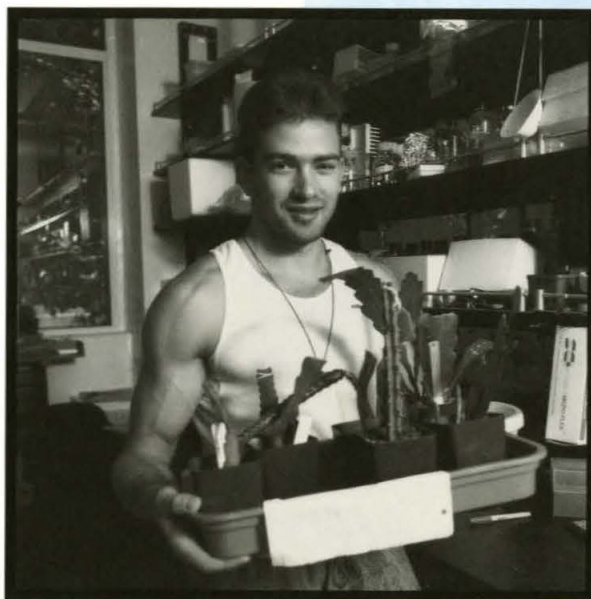
Fifteen students participated in the 1994 MURF program which runs concurrently and is closely integrated with SURF. The MURF program provides support for talented non-Caltech undergraduates to spend a summer working in a research laboratory and is aimed at improving the representation of African Americans, Hispanics, Native Americans, Puerto Ricans, and Pacific Islanders in biological, chemical, and engineering sciences. MURF students participate in all aspects of the summer program.

Congratulations SURFers!

At Commencement 1994:

- 53% of students receiving their bachelor's degrees had completed a SURF.
- 65% of the students graduating with honors were former SURFers.
- 78% of the students receiving prizes were SURF students.

We are proud of these remarkable students!



SURF IS PROVIDING ME WITH MORE THAN A SUMMER JOB. I HAVE THE VALUABLE OPPORTUNITY TO TEST AND, I HOPE, PROVE MYSELF IN A LABORATORY SETTING BEFORE ATTEMPTING TO GO ON TO GRADUATE SCHOOL. I FEEL VERY FORTUNATE TO BE ABLE TO PARTICIPATE IN THE SURF PROGRAM.

*Matthew Metz, Senior
Richter Scholar*

SURF PROGRAM AND ACTIVITIES

SURF Seminar Day

Each SURF student is required to give an oral presentation of his or her research on SURF Seminar Day in October. The symposium is modeled on a professional technical meeting with parallel oral and poster sessions. Donors, students, faculty, JPL staff, alumni, and parents attend the SURF seminars to hear the students' reports.

Communication Program

For many students, the required presentation on SURF Seminar Day is their first experience in public speaking. To help them prepare for this talk, SURF offers a communication program of seminars and small group workshops led by trained peer coaches. Mary Ann Smith, SURF communication consultant, designed the program and trained the coaches.

We were delighted with the long article, including color photographs, featuring a SURF peer coach group, which appeared in the August 15 edition of the *Los Angeles Times*. Reprint copies are available in the SURF office.

The SURF Talk Book

Now in its second printing, *The SURF Talk Book* provides written materials, exercises, guidelines, and checklists for presenters to help with organization and preparation for oral or poster presentations. This book contains the course material used in Peer Coach Workshops.

Peer Coach Workshops

Mary Ann Smith trained 15 Caltech SURFers to skillfully facilitate workshops to help students organize and prepare their oral presentations, learn public speaking techniques and skills, and to develop analogies to explain technical material to a non-technical audience. Through group interaction, students gain confidence and experience in talking about their research. Peer coaches also assisted with final rehearsals prior to SURF Seminar Day.

Scientists as Speakers

Scott Fraser, Anna L. Rosen Professor of Biology, spoke to SURFers on *Biological Imaging: An Interdisciplinary Application to the Study of Embryonic Patterning*. Following his lively, enthusiastic, informative presentation, he discussed how he prepares a talk for various audiences, the importance of communicating technical information to lay audiences, and how he develops analogies to help the audience understand technical information.

Doris S. Perpall SURF Speaking Awards

The first Doris S. Perpall SURF speaking competition was held during the year. Robert C. Perpall, a member of the SURF Board, endowed the prize as an incentive for students to prepare excellent final oral presentations on SURF Seminar Day. Three prizes were awarded at the conclusion of a three-round competition. Winners were Jonathan Weinstein, Adele Shakal, and Jasmine Anderson.

Professional Development Seminars

Caltech alumnus William M. Whitney, Ph.D. (Division Technologist, Observational Systems Division, JPL) coordinated a series of six informal weekly discussions on issues students will face as they prepare for and commence their professional careers. The sessions and participants were:

Role of Communication in Careers

Mary Ann Smith, SURF Communication Consultant

Scientists as Speakers

Scott Fraser, Ph.D., Anna L. Rosen Professor of Biology, Caltech

Decision Making: Yes, You Can Change Your Mind!

Kathleen Bartle-Schulweis, Director, Women's Center, Caltech

Important Career Decisions: The Benefits of Thinking Ahead

William M. Whitney; Julia Kornfield, Ph.D., (SURF '81, B.S. '83), Assistant Professor of Chemical Engineering, Caltech; Jacklyn Green, Ph.D., Project Scientist, SR-71 Hypersonic Aircraft Research Platform, JPL; Michal Peri, Ph.D. (Ph.D. '94, Caltech).

*Career Options: What Can You Do
with a Technical Background?*

Carolyn Merkel; Pedro Pizzaro, Ph.D. (Ph.D. '93),
McKinsey and Company, Inc.; Eric Korevaar (B.S.
'81), President, Astro Terra Corporation; James
Dunn, M.D., Ph.D. (B.S. '85), Resident in General
Surgery, University of California, Los Angeles;
Virgil Shields, Ph.D. (B.S. '74), Member of the
Technical Staff, JPL.

Ethical Conduct and Misconduct in the Workplace

William M. Whitney; Ann Bussone, Director,
Employee Relations, Caltech; Kathleen Katovich,
Associate General Counsel, Caltech/JPL; Gerard
Tembrock, Manager, Business Ethics Office, JPL.

Seminars

Special Seminar by Professor Freeman Dyson

SURF welcomed Freeman Dyson, Professor of
Physics at the Institute for Advanced Study at
Princeton, a Distinguished Visiting Scientist at JPL
this summer. Professor Dyson inspired an enthusi-
astic and interactive audience of students and
faculty with his talk, *Modern Directions in Applied
Physics*.

Weekly Noon Seminars

Each Wednesday, members of the Caltech faculty
or JPL technical staff presented overviews of their
areas of research. Speakers and topics were:

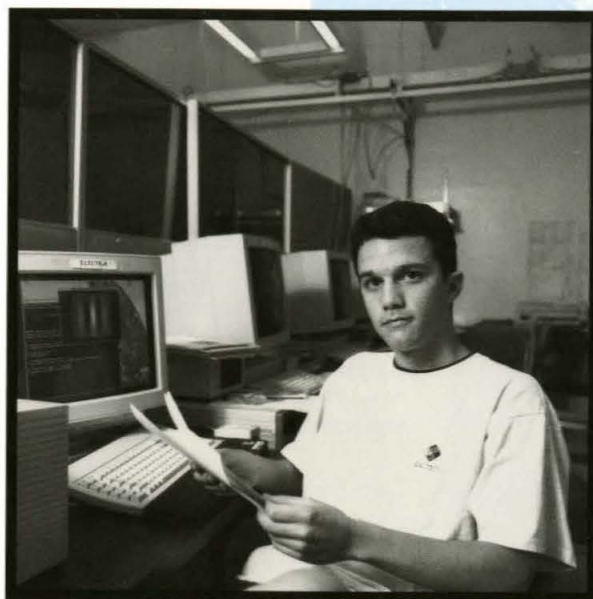
Jesse L. Beauchamp, Professor of Chemistry,
*Probing the Secrets of Biological Molecules Trapped in
an Electromagnetic Bottle*

Geoffrey A. Blake, Associate Professor of Cosmo-
chemistry, *New Tools for Exploring Stratospheric
Chemistry*

S. George Djorgovski, Associate Professor of
Astronomy, *Exploring the High-Redshift Universe from
Palomar and the Keck*

Diane Evans, Jet Propulsion Laboratory, SIR-C
Project Scientist

Douglas Flamming, Assistant Professor of History,
*African Americans and the Transformation of the
Democratic Party, 1865 - 1965*



**THIS SURF PROJECT HAS HELPED ME TO
CONFIRM MY FEELINGS ABOUT A
CAREER IN RESEARCH WHILE WORKING
ON TOPICS AT THE LEVEL OF GRADUATE
STUDENTS HERE AT CALTECH.**

*Serge Belongie, Senior
Carl and Shirley Larson SURF Fellow*

Melany L. Hunt, Assistant Professor of Mechanical Engineering, *Particle Flows*

Stephen L. Mayo, Assistant Professor of Biology and Assistant Investigator, Howard Hughes Medical Institute, *Protein Design Automation (Steps Toward an Ultimate Biotechnology)*

Axel Scherer, Associate Professor of Electrical Engineering, *Nanofabrication of Semiconductor Structures: Have Our Dreams Come True?*

Nai-Chang Yeh, Assistant Professor of Physics, *Novel Vortex Properties of High-Temperature Superconductors*

Each Friday members of the JPL technical staff presented summaries of their work to the JPL SURF students. Speakers and their topics were:

Martin G. Buehler, Electronics and Control Division, *Reliability and Radiation Assurance Experiment (RRELAX) for the Clementine Mission*

Bonnie J. Buratti, Earth and Space Science Division, *The Bursty Nature of 2060 Chiron*

William H. Duquette, Information Systems Division, *Exploration of Huge Data Sets Through Parallel Image Rendering—or—How to Monopolize Expensive Super-Computers*

Jacklyn R. Green, Observational Systems Division, *The SR-71 Blackbird: NASA's Newest High Speed, High Altitude Research Aircraft*

Deborah J. Jackson, Telecommunications Science and Engineering Division, *Photonic Processors: A Systems Approach*

Steven E. Johnson, Systems Division, *SURFSAT-1*

Norman E. Lay, Systems Division, *Mobile Satellite Communications Research at JPL*

Allen P. Nikora, Office of Engineering and Review, *Software Reliability*

Sarita Thakoor, Electronics and Control Division, *Can Ferroelectric Memories Replace Disk Drives?*

Roundtable Discussions

Roundtable discussions provided students the opportunity to meet in small groups with leaders in academia, industry, or government to discuss current topical or career development issues. Discussion leaders this summer were:

Lew Allen, Retired Director, JPL, *National Security Research and Development in the Post-Cold War Era*

Jay Aller, Science Writer for Caltech, and Lisa Wilson, Science Writer for *Pasadena Star-News*, *Communicating Science to the Lay Public*

James M. Bower, Associate Professor of Biology, *Teaching Science to Pre-College Students and Teachers*

Bill Gross, Chair and Founder, Knowledge Adventure, Inc., *The Entrepreneurial Experience*

Melany L. Hunt, Assistant Professor of Mechanical Engineering, *Career and Family Intersection*

Carl A. Kukkonen, Director for the Center for Space Microelectronics Technology, JPL, *Raising Money for Research and Development or for Business*

Arthur J. Murphy, Jr., Technology Development Manager, JPL, *Recent Changes in Research and Development Opportunities in Industrial and Government Laboratories*

Henry McBay, Distinguished Visiting Scientist at JPL

Jerry Nunnally, Director of Development, *From Student to Alum*

Mimi Sengupta (B.S. '93, SURF '90, '91), First-Year Medical Student at University of California, Los Angeles, *From Caltech to Medical School*

Monday Night Barbecues

SURF coordinated weekly barbecues for students in all summer programs on the campus. The dinners, held in front of Winnett Center, offered students a chance to get together for fellowship, food, and fun. The barbecues immediately preceded the SURF Professional Development Seminars.

CONFERENCES

Southern California Conference on Undergraduate Research (SCCUR)

SURF organized and hosted the first annual SCCUR conference in November, 1993. Over 400 students, faculty, and administrators attended the symposium with more than 125 students presenting their research in oral and poster sessions. The second conference will be held at Caltech on November 19, 1994. Keynote speakers will be Fredrick H. Shair (Manager, Educational Affairs, JPL, and founder of the SURF program) who will speak on *Grand Challenges for Science in Society* and Joann M. Stock (Associate Professor of Geophysics) who will speak on *The Stress Fields that Cause Earthquakes in Southern California*. The third conference will be held at the Claremont Colleges.

National Conference on Undergraduate Research (NCUR)

Twenty Caltech students attended the eighth annual NCUR at Western Michigan University in April, 1994. This conference is multidisciplinary including the sciences, mathematics, engineering, humanities, and fine and performing arts. Students report the experience was stimulating, interesting, and rich. Caltech hosted the fifth NCUR in 1991 as part of the Institute's centennial celebration.



**I HAVE LEARNED A GREAT DEAL
ABOUT THIS PROJECT AND HAVE
GAINED INVALUABLE LABORATORY
EXPERIENCE. CONVERSATIONS WITH
STUDENTS FROM OTHER SCHOOLS
AND FROM OTHER COUNTRIES HAVE
HELPED ME REALIZE I AM EXTREMELY
FORTUNATE TO HAVE THE
OPPORTUNITY TO DO THIS EXCITING
AND CHALLENGING WORK.**

*Amanda Eckermann, Sophomore
Ernest Haywood Swift SURF Endowment Fund*

SURF FUNDING

As with any fellowship, SURF students receive a stipend; in 1994 the amount was \$3600 for the ten week period, a total salary budget of \$777,600. Most of these funds are raised from external, non-federal sources as shown in the table below. Since the Institute pays administrative costs for the program, and research sponsors pay research expenses, all moneys raised from other sources are used for student stipends or special research-related opportunities.

Individuals	8%
Endowment	12%
Corporations/Foundations	16%
JPL and NASA	21%
Caltech Faculty and other Institute Sources	43%

Current Operating Funds

We thank the Administration for agreeing again this year to underwrite up to 20 SURF stipends against funds expected, but not yet received, from fund-raising efforts. This agreement has been important in allowing us to make SURF awards on schedule and eliminating the lengthy waiting list necessary in previous years. We thank President Thomas Everhart and Provost Paul Jennings for continuing this agreement. We are pleased to report that we will not draw on Institute underwriting this year.

Donors who contribute the amount of a SURF stipend (\$3600) or more, by annual contributions or through endowment, are listed with the students in the index of students and sponsors in the annual report. The sponsors frequently meet the students whom they have supported. All funds raised from private sources are used to support Caltech students doing SURF projects with Caltech faculty.

Small Business Industrial Associates

Joanne Clarey, Director, and Phyllis Hosey, Corporate Activities Coordinator, Corporate Relations Department, established the Small Business Industrial Associates program to encourage small companies to affiliate with Caltech. An annual fee supports a SURF stipend and gives companies access to such Caltech resources as the library and the Research Directors Conference. The SURF students carry out their projects in joint collaboration with a Caltech faculty member and a researcher at the company on problems often initiated by the company. This program gives SURF students the opportunity to expand their research experiences into the industrial environment. Initial response from the students and their research sponsors has been enthusiastic and positive.

Cryopharm; First Quadrant Corporation; Kinemetrics, Inc.; Kinetics Technology International Corporation; and Vestar, Inc. are the five charter companies in this program.

Endowment Funds

The SURF endowment was created to ensure the continuation of the program. Individuals may establish an endowment, named as the donor designates, for \$100,000; the proceeds from the fund will support one student annually in perpetuity. A SURF endowment is an excellent investment in the future of bright and talented students. Currently, 22 endowment-supported students SURF each summer.

This year we were delighted to add the Arthur Rock SURF Endowment to this list. Given by Teledyne, Inc., this fund was established in honor of Mr. Rock upon his retirement last spring as a director of the corporation.

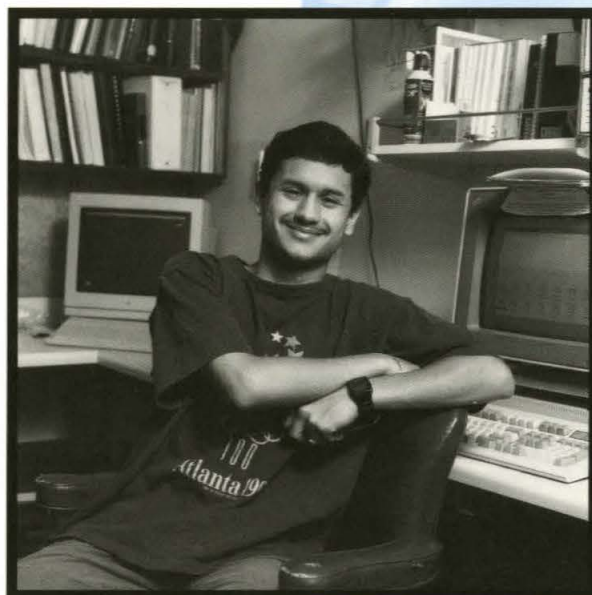
Memorial Funds

We thank the family, friends, and colleagues of Erika Vote for their generous contributions to the Erika C. Vote SURF Memorial Fund. This fund will support a woman student working in the Microdevices Laboratory at the Jet Propulsion Laboratory, a fitting memorial to a young woman who was enthusiastic about learning and captivated by her own undergraduate research experiences.

We also thank the contributors to the Edward C. Posner and the Chandler C. Ross memorial funds for their continued generosity in providing stipends in honor of their colleagues.

THE SURF TEAM

The SURF team numbers more than 450 individuals. SURF's long-term success can be attributed to the strong commitment of the research sponsors and outstanding students. We depend upon and value the generous financial contributions of our many friends, the vigorous support of the SURF Board, the dedication of the SURF Administrative Committee, and the efforts of our volunteers and consultants. With great skill, competence, and good humor Susan Clark and Carol Casey attend to the day-to-day, year round details of making SURF happen. A special acknowledgement to Fred Shair, without whom there would be no program. Thank you, SURF team!



**SURF IS TRULY A GREAT OPPORTUNITY
FOR UNDERGRADUATES TO GAIN
EXPERIENCE IN SCIENTIFIC RESEARCH
AND TO LEARN SKILLS THAT WILL HELP
IN GRADUATE SCHOOL, INDUSTRY, AND
OTHER FUTURE PURSUITS. ABOVE ALL,
SURF FUELS THE LOVE FOR SCIENCE
THAT BROUGHT ME TO CALTECH IN THE
FIRST PLACE.**

*José Miguel Hurtado, Jr., Junior
Richter Scholar*

SURF INDEX OF STUDENTS AND SPONSORS

STUDENT	TOPIC	RESEARCH SPONSOR
SAKENA ABEDIN Harvard University <i>Senior, Ch</i>	Modification of Microperoxidase-8	Harry B. Gray <i>Arnold O. Beckman Professor of Chemistry</i>
MINA AGANAGIC <i>Senior, Ph</i>	Applications of Time-Dependent Hartree-Fock to Studies of Atomic Collisions	Karlheinz Langanke <i>Senior Research Associate in Physics</i>
PRABHAT AGARWAL Trinity College, Cambridge University <i>Senior, Ph</i>	Wavelet-Analysis of Structure and Scaling Processes in Interstellar Clouds	Thomas N. Gautier <i>Member of the Technical Staff, JPL</i>
DONNA A. AKUTAGAWA <i>Junior, Bi</i> <i>Howard Hughes Medical Institute SURF Fellow</i>	BDNF-Expressing Cells in the Visual System of <i>Xenopus laevis</i>	Susana Cohen-Cory <i>Research Fellow in Biology</i>
ERICA L. ALLISTON <i>Senior, Bi</i> <i>Edward C. Posner Memorial SURF Fellowship</i>	A Simple Neural Network Used to Investigate Mechanisms of Figure Ground Segmentation	Christof Koch <i>Associate Professor of Computation and Neural Systems</i> Jochen Braun <i>Senior Research Fellow in Biology</i>
JASMINE R. ANDERSON <i>Senior, Ch</i> <i>Edward W. Hughes SURF Endowment</i>	Detection of Cleavage of DNA by Rhodium Complexes in Bacteria	Jacqueline K. Barton <i>Professor of Chemistry</i>
EVE A. ANDERSSON <i>Junior, ME</i>	Vibration-Induced Mixing and Segregation Phenomena in Granular Materials	Melany L. Hunt <i>Assistant Professor of Mechanical Engineering</i>
MEGAN Y. ANDREWS <i>Sophomore, Bi</i> <i>Howard Hughes Medical Institute SURF Fellow</i>	Cloning and Sequencing of CYIIIa P71 Transcription Factor cDNA	James A. Coffman <i>Senior Research Fellow in Biology</i>
CAITLIN ARDEN Cambridge University <i>Sophomore, Ph/Ge</i>	Infrared Observations of the Influence of the Impact of Comet P/Shoemaker-Levy 9 on the Atmosphere of Jupiter	Glenn S. Orton <i>Member of the Technical Staff, JPL</i>
ANNA E. ARREOLA Stanford University <i>Junior</i> <i>MURF</i>	A Study of Copper Uptake by the Type I Methanotroph <i>Methylobacter albus</i> BG8	Mary E. Lidstrom <i>Professor of Applied Microbiology</i>
SHRUTI BAJAJ <i>Junior, Bi</i> <i>Richter Scholar</i>	PI and AP3 Protein Distribution in Wild Type and Transgenic <i>Arabidopsis thaliana</i>	Elliot M. Meyerowitz <i>Professor of Biology</i>
ALEXEI Y. BARSKI <i>Senior, Ph</i>	Raman Thermometer	Kenneth G. Libbrecht <i>Associate Professor of Astrophysics</i>
ANNALIESE K. BEERY <i>Sophomore, Bi</i> <i>Northern California Associates SURF Endowment</i>	Creation of a Myogenin Transplacement Vector for Use in Transgenic Mice	Barbara J. Wold <i>Associate Professor of Biology</i>

STUDENT

SERGE J. BELONGIE
Senior, EE
Carl and Shirley Larson SURF Fellow

ZACKARY D. BERGER
Senior, Bi
Samuel P. and Frances Krown SURF Endowment

VANCE C. BJORN
Senior, EE/CNS
Arthur Rock SURF Endowment

SETH BLUMBERG
Junior, APh

CHARLES K. BOYCE
Senior, Bi/Lit
Samuel P. and Frances Krown SURF Endowment

LAURA E. BRADY
Junior, Ge

JEFFREY R. BRAMEL
Junior, Ph/Ec
Arthur R. Adams SURF Fellowship

JANE R. BROCK
Junior, Ch
Gladys K. Tucker Memorial SURF Fellowship

JOHN JOSEPH M. CARRASCO
Sophomore, Ph/Ma
Richter Scholar

MARYGRACE A. CASTRO
University of New Mexico
Junior, Psy/Pre Med
MURF

ANDREW J. CHAIKIN
University of St. Andrews
Senior, Ma/Ph

RAYMOND S. CHAN
Junior, Ph/Ma
NASA SURF Fellow

TOPIC

The Use of Two-Dimensional Gabor Functions for the Analysis of Local Orientation

Magnetite-associated Proteins of *Cryptochiton stelleri*

Financial Data Forecasting Using Wavelet Radial Basis Neural Networks

Determining the Heat Capacity for Binary Fluids with Fixed Impurities

Investigation of Magnetotactic Bacteria

Teachers Touch the Sky: A Week Long Astronomical Workshop for Elementary School Teachers

Development of Interactive Database Software for Japanese Department

A New Resolution for 2-amino-2'-hydroxy-1,1'-binaphthyl

On the Modal Analysis of Microwave Resonators Towards Optimization of the Quality Factor: A Finite Element Approximation

A Study on Cytochrome c Oxidase: An Insight into the Mystery of Aging?

To Photometrically Reduce NSFCAM Images of Shoemaker-Levy 9 Collision with Jupiter

Initial Spin of Degenerate Dwarfs

RESEARCH SPONSOR

Rodney M.F. Goodman
Professor of Electrical Engineering

Joseph L. Kirschvink
Professor of Geobiology

Yaser S. Abu-Mostafa
Associate Professor of Electrical Engineering and Computer Science

David S. Cannell
Professor of Physics, University of California, Santa Barbara

Joseph L. Kirschvink
Professor of Geobiology

Bonnie J. Buratti
Member of the Technical Staff, JPL

Kayoko Hirata
Lecturer in Japanese

Erick M. Carreira
Assistant Professor of Chemistry

Nai-Chang Yeh
Assistant Professor of Physics

John M. Allman
Hixon Professor of Psychobiology and Professor of Biology

Glenn S. Orton
Member of the Technical Staff, JPL

Peter M. Goldreich
Lee A. DuBridge Professor of Astrophysics and Planetary Physics

STUDENT

CLARK C. CHANG
Senior, Ch/EAS
William H. and Helen Lang
SURF Endowment

LILY CHANG
Junior, EAS
Howard Hughes Medical Institute
SURF Fellow

AMALAVOYAL N. CHARI
Junior, Ph/Ma

PRISTA CHARUWORN
Sophomore, Bi
Richter Scholar

STEVEN M. CHASE
Sophomore, CS
Mr. Robert M. Abbey SURF Fellow

FINNY G. CHAVANIKAMANNIL
Senior, Ch
Dr. and Mrs. Robert L. Noland
SURF Fellow

ALIX J. CHEN
Senior, Ph

ANN W. CHEN
Sophomore, Bi
Thomas Hunt Morgan SURF
Endowment Fund

CINDY H. CHEN
Sophomore, ChE
Camille and Henry Dreyfus Foundation
SURF Fellow

LUCY CHEN
Senior, Bi
Samuel P. and Frances Krown
SURF Endowment

KAI WAI E. CHIU
Sophomore

WILLIAM C. CHUONG
Senior, Bi

MATTHEW A. CLAPP
Senior, EE

TOPIC

Investigation of a Solid Superacid: ZrO_2
Promoted by Iron, Manganese and Sulfate

Characterization of *Strongylocentrotus purpuratus*
Coelomocyte cDNA Library

Femtosecond Studies Employing Molecular
Dynamics

The Energetic Cost of Different Brain Structures

Parallelization and Visualization Of
Electromagnetic Scattering Code

Probing the Spliceosome Using Affinity
Cleavage

The Infrared Studies of the Center of the Galaxy

How Does the Nervous System Control Mating
Behavior in *C. elegans*?

The Development of Electron-Transfer
Activated Cobalt Drugs

Clarifying the Role of Brain Area Uva in the
Motor Control of Zebra Finch Song

NMR Conformational Analysis of Butanedioic
Acid in DMSO

Applications of Digital Analysis in the
Resolution of Timing of Purkinje Cell
Afferents in the Rat Cerebellar Cortex

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TOPIC

The Use of Caged Forms of Nitric Oxide (No) and Arachidonic Acid (Aa) to Study Their Role in the Expression of Long-Term Potentiation in the Hippocampus

BATSE Earth Occultation Observations of the 0.02 to 1.8 MeV Emission of the Crab Nebula

Synthesis, Characterization, and Reactivity of Iron 2,3,7,8,12,13,17,18-octaethyl-5,10,15,20-tetrakis[pentafluorophenyl]porphyrin

Diaminobenzidine Staining for Cytochrome c Oxidase Activity

Molecular Analysis of the Spatial Expression of Novel, Non-Protein Coding Transcripts from the BXD-Region of the Bithorax Complex of *Drosophila*

Undergraduate Surface Chemistry Experiments

Fine Mapping of *tsol* Gene By SSLP

A Search for Multiply Reflective Surfaces: Bouncing Off the Walls

Damage Detection on Structures

Cloning of the Genes Involved in the UBR1 - Mediated Dipeptide Uptake

Fiber Optic Micro-Sensor Network

The Role of Tryptophan Residues 68 and 222 in GABA Transporter Function

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BOB M. GINGRICH University of California, Santa Cruz <i>Junior, Ph</i>	Exploring the Opposition Effect in Highly Reflective Particulate Materials	Robert M. Nelson <i>Member of the Technical Staff, JPL</i>
ELEFTHERIOS GKIOULEKAS <i>Junior, Ph</i> <i>Richter Scholar</i>	Linear Transform Methods for Sequence Property Profile Analysis	Jerry E. Solomon <i>Member of the Beckman Institute</i>
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OLGA T. HARDY Duke University <i>Junior, Biomed. Eng.</i> <i>MURF</i>	Embryonic Phenotypes of Hsp83 Mutants in <i>Drosophila</i>	Howard D. Lipshitz <i>Associate Professor of Biology</i>
MICHAEL D. HARTL Harvard University <i>Junior, Ph</i> <i>NASA SURF Fellow</i>	The Magnetic Character Of Coronal X-Ray Bright Points	Harold Zirin <i>Professor of Astrophysics</i>
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Isolation and Characterization of Yeast Nuclear pre-mRNA Splicing Genes and Factors in *Saccharomyces cerevisiae*

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MARKO MILEK <i>Senior, Ph</i> <i>Hugh F. and Audy Lou Colvin</i> <i>International Fellowship Endowment</i>	Calculating Lyapunov Exponents for One Dimensional Aharmonic Motion with Various Forms of Dissipation	Vladimir Paar <i>Professor of Physics, University of Zagreb</i> Michael C. Cross <i>Professor of Theoretical Physics</i>
JENNIFER A. MILLER <i>Senior, Ch</i> <i>Richter Scholar</i>	Far Infrared Light Generation By Optical Photomixing	Geoffrey A. Blake <i>Associate Professor of Cosmochemistry</i>
ANTHONY F. MOLINARO <i>Junior, CS</i>	The Chemistry Animation Project	Nathan S. Lewis <i>Professor of Chemistry</i>
PENNY L. MUIR <i>Junior, Env</i>	Interactive Science for High School Students	Paul A. Robinson, Jr. <i>Assistant to the Chief Technologist, JPL</i>
VIKAS NANDA <i>Senior, Bi</i> <i>Richter Scholar</i>	Extraction of Fossil Protein and DNA from <i>Baculites inornatus</i>	Michael G. Harrington <i>Member of the Beckman Institute</i>

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Chemical Synthesis Research Leading to Total
Synthesis of Natural Product Palau' Amine

Immobilized Ferric Ion Affinity Electrophoresis
for Separation of Phosphorylated Proteins

Finding Contact Resistance of Transition
Metals/Diamond Interfaces and Sheet
Resistance of Diamond Films Using
Transmission Line Model

Antisense Inhibition of *No Tail* Gene Expression
In Zebrafish Embryos

Four Carbon Homologation of NLO
Chromophore Precursors with Aldehyde
Termini

Simulating the Resolution Performance of
Crystal Calorimeters for the CMS Experiment at
LHC and the BaBar Experiment at SLAC

The Color Centers of Amethyst

Field Discrimination Threshold of Honeybees
for 10 Hz Oscillating Fields

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Localization of PSDup-180 in the Rat Brain

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GEORGE W. PECK California State University, Dominguez Hills <i>Senior, Ph</i>	Spacial Configuration of the Magnetic Field of Selected Coronal Mass Ejections	Joan Feynman <i>Member of the Technical Staff,</i> <i>JPL</i>
AMY L. PEMBERTON <i>Senior, PlSc</i> <i>Richter Scholar</i>	The Photochemistry of Manganese and Iron and the Production of Desert Varnish	George R. Rossman <i>Professor of Mineralogy</i>
JOHN M. PETREN University of Scranton <i>Senior, CS</i>	Controlling the Infrared Filters on MIRLIN	Michael E. Ressler <i>Research Associate, JPL</i>
KAREN E.S. PHILLIPS Barry University <i>Senior, Ch</i> <i>MURF</i>	Optimization of First Nonlinear Hyperpolarizability (β) by the Synthesis and Characterization of Selected Donor-Acceptor Polyene Systems	Seth Marder <i>Member of the Beckman Institute</i>
ANANDI RAMAN <i>Senior, Bi/Ch</i> <i>Mr. and Mrs. Downie D. Muir III</i> <i>SURF Fellow</i>	Structural Analysis for Metal-Mediated Stabilization of an Antibody	Frances H. Arnold <i>Associate Professor of Chemical Engineering</i>
RADHIKA REDDY <i>Sophomore, ME</i>	KidSAT	JoBea Way <i>Member of the Technical Staff,</i> <i>JPL</i>
CHARLES P. REESE University of California, Los Angeles <i>Senior, EE</i>	Validation of Optical Instrument Modeling Software	David Redding <i>Member of the Technical Staff,</i> <i>JPL</i>
JASON L. REGIER Harvey Mudd College <i>Senior, Ph</i>	Software Integration Techniques and Their Application in Observations of Comet Shoemaker-Levy 9 Impact Sites	Stephen Gillam <i>Member of the Technical Staff,</i> <i>JPL</i>
DARREL K. ROBERTSON Leicester University <i>Junior, Ph</i>	Infra-Red Spectra and Data Reduction of Images from the Shoemaker-Levy 9 Comet Crash with Jupiter	Glenn S. Orton <i>Member of the Technical Staff,</i> <i>JPL</i>
ANIL ROOPNARINE <i>Junior, EAS</i>	The Chemistry Animation Project: Modeling the Diels Alder Reaction	Nathan S. Lewis <i>Professor of Chemistry</i>
KEVIN A. ROUST <i>Sophomore, Ay</i> <i>Flintridge Foundation SURF Fellowship</i>	Cepheids with Companions	Barry Madore <i>Research Astronomer, IPAC</i>

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The Expression Pattern of Genes Leading to the
Development of the Peripheral Nervous System

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Associate Investigator, Howard
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Chromatographic Materials for the Separation
of Unmodified Amino Acid Enantiomers via
Template Polymerization

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Analysis of the Coma Cluster at Optical
Wavelengths

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Study of the Effects of the Electron Screening
on the Dynamics of Nuclear Reactions

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Fabrication and Characterization of the Lattice-
Matched Group IV Ternary Alloys

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Synthase in LTP

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