SURF

Summer Undergraduate Research Fellowships

Annual Report 2000

CALIFORNIA INSTITUTE OF TECHNOLOGY




SURF 2000 is dedicated to Dr. Terry Cole, senior faculty associate in chemistry and chemical engineering and chief technologist at JPL. Terry was chair of the SURF Administrative Committee from 1989 until his death in August 1999. He brought great enthusiasm, energy, and an endless stream of ideas to the job. He was committed to and personally interested in the students. Terry opened the door for SURF's expansion to JPL in 1983, and since that time over 1,500 students have worked at the Lab. Through this dedication, we are proud to recognize Terry Cole's many contributions to the SURF program.

SURF HAS BEEN DEDICATED TO THE FOLLOWING PEOPLE:

1985	Dr. Ernest Swift
1986	Dr. Lee A. DuBridge
1987	Dr. Robert P. Sharp
1988	Dr. Ray D. Owen
1989	Dr. Hans W. Liepmann
1990	Dr. Fredrick H. Shair
1991	Dr. Lew Allen Jr.
1992	Dr. John D. Roberts
1993	Dr. Robert E. Bacher
1994	Dr. Edward C. Posner
1995	Mr. Samuel P. Krown
1996	Dr. Edward B. Lewis
1997	Dr. Harold Brown
1998	Dr. Thomas E. Everhart
1999	Dr. Ward Whaling
2000	Dr. Terry Cole

COVER

The photograph of the ocean on the cover was taken by Terry Cole.

The Summer Undergraduate Research Fellowships program is one of the jewels in Caltech's crown. The Institute is deeply proud of this program, which offers unparalleled opportunities for our students to engage in research with faculty and JPL technical staff on projects at the forefront of science, engineering, technology, and the humanities. SURF is widely recognized as the premier undergraduate research program in the country, and it is one of the enterprises that keeps Caltech at the forefront of higher education.

SURF students become colleagues with the other members of their research groups and thus are welcomed into the community of scholars. Under the guidance of their mentors, they explore the secrets of nature or develop new devices or processes. They sink their roots into the culture of inquiry, analysis, and ethics. SURF allows students to apply knowledge gained in the classroom to real-world problems as they ask new questions and attempt to solve new problems. And they are introduced to the importance of clearly communicating their work.

A large and loyal community provides the personal involvement and financial support that SURF requires. I want to thank the many individuals and groups who help to make the program possible. The essence of SURF is the tutorial relationship between mentor and protégé, and the program depends upon the enthusiastic participation of the Caltech faculty and JPL technical staff as well as the graduate students and postdoctoral fellows who provide day-to-day guidance. I greatly value the partnership with Caltech of the many donors who contribute financial support for SURF student stipends. Your gifts and grants are important investments in the futures of our talented students. And to the students I extend my hearty congratulations on your participation in SURF 2000. Avanti!

David Baltimore

President

From the SURF Board

Robert Perpall (BS '52, MS '56)
Chairman, SURF Board

Caltech's SURF program is riding a wave of success into the new millennium! In the words of President Baltimore, SURF has become an integral part of the Caltech undergraduate experience. The Western Association of Schools and Colleges (WASC) has recognized this fact. In order to ensure the future of SURF, WASC has strongly recommended that the program be fully endowed.

The SURF Board recognizes this need and has formulated a long-range plan that includes continuing the increase of endowment. While considering this challenge, we came to recognize that many people—including mentors, staff, and members of the SURF Administrative Committee (AdComm), the SURF Student Advisory Council (SURFSAC), and the SURF Board—provide support and guidance that money alone cannot buy. We also recognized that the number of Caltech alumni who were SURFers has grown to a large fraction of Caltech alumni—56 percent of living alumni who received their BS degrees since 1980 have participated in SURF. We have, therefore, included in our plan the development of a SURF alumni network.

During the past year, the SURF Board has seen financial support increase from all sides. Most notably, three full SURF endowments resulted from efforts of the Caltech Associates, including one endowment given by Bob and Alice Roney. George and MaryLou Boone pledged a substantial gift to SURF in their estate plans. Two former SURF students have established endowments, and two anonymous donors have given endowments in honor of faculty members at the Institute.

We welcome five new board members this year: Mr. John Glanville, Dr. Robert Parker, Dr. Neal Pings, Mr. Dave Rossum, and Dr. Ward Whaling. Each of them has been associated with SURF in the past and brings a special personal quality to add to the already rich pool of talent available to support and guide the program. I'm sure they will carry on the tradition of past SURF boards.

The passing of Mrs. Amytis Barrett, a long-time supporter and enthusiast, saddened us. She was a cheerleader for SURF, and we will miss her.

The communications program that has been vigorously supported by the SURF Board is flourishing. *The Caltech Undergraduate Research Journal (CURJ)*, produced by SURFSAC, the Bonsall prize for excellence in written reports, and the Perpall prize for excellence in oral presentations continue to prove that Caltech students are among the best at communications as well as academics.

Long-time SURF Board member Joanna Muir is chairwoman of the donor-student relations committee. With the help of the able staff of the Caltech Student-Faculty Programs Office, she organized the most successful Donor Appreciation Dinner ever. Fifty-seven guests were in attendance in the Athenaeum Hall of Associates for a great evening of camaraderie among students, donors, board members, and mentors.

SURF owes a special debt of gratitude to Dr. Bill Whitney for all his many efforts on behalf of the program.

The SURF Board was formed in the early days of SURF to provide advice, encouragement, and financial support and to contribute to the vitality, continuity, and effectiveness of the SURF program. We are dedicated to the educational values of undergraduate research at Caltech. I want to take this opportunity to express my personal thanks to all who have made this year a success. It is an honor and a privilege to serve as chairman of the SURF Board.

From the SURF Administrative Committee

Frances Arnold

Dick and Barbara Dickinson Professor of Chemical Engineering and Biochemistry; Chair, SURF Administrative Committee

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 the 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 mentors.

In addition to overseeing and planning, the committee participates in SURF directly. Its members review all of the students' research proposals—more than 450 this year. Members of the committee participate in judging the competitors at the Doris S. Perpall Speaking Awards and assist in reviewing the students' final reports for the Marcella and Joel Bonsall Prize for Technical Writing.

The AdComm this year welcomed several members who are new to the committee, but not to the SURF program. New members are Geoffrey Blake, professor of cosmochemistry and planetary sciences and professor of chemistry; Carl Parker, professor of biochemistry; David Rutledge, professor of electrical engineering; and Michael Werner, senior research scientist, JPL.

In recognition of the growth of the SURF program and our continuing desire to provide the highest quality research experience, this summer we organized a "Mentor Orientation" session on the opening day of SURF. Some of Caltech's most thoughtful mentors—Ray Owen, Fred Shair, and Jack Roberts—shared their thoughts and experiences with a large group of SURF mentors. I believe that the graduate students and faculty who participated in this session, many of whom have never before worked with undergraduates, came away with the message that mentoring young scientists requires some thought and effort and can be very rewarding.

I would like to thank the AdComm, the faculty, and graduate students who served as SURF mentors or who reviewed proposals and presentations, the SURF staff, and particularly the director, Carolyn Merkel, for yet another very successful SURF summer.

SURF Student Advisory Council

Jason Chua
Chair

The ongoing mission of the SURF Student Advisory Council is to strengthen the research community, primarily through serving as a liaison between SURF students, mentors, and the SFP office. Also important to us is the planning of weekly events during the summer to allow the SURF community the chance to interact in an informal, non-academic environment. In order to facilitate the interaction between SURF students from Caltech and beyond, we planned trips this past summer to places such as the Pasadena Ice Skating Rink, the Norton Simon Museum, and Six Flags Magic Mountain.

Among our most popular events this last summer were the weekly SURFSAC Suppers, which provided a chance for two or three faculty members to meet with about ten students at an off-campus restaurant over dinner. The goal of these suppers was to allow faculty and students to meet in an informal environment; professors were able to learn about student life and aspirations, while students could learn about life after college, as well as the experiences of research scientists. The SURFSAC extends our thanks to all of the professors who attended, and especially to Professor Steve Frautschi, whose generous donation made these spectacular suppers possible.

The SURFSAC also edits and publishes the *Caltech Undergraduate Research Journal*, a collection of the best technical papers including papers that have won the Marcella and Joel Bonsall Prize for technical writing. Ushering in the new millennium, this year's "eCURJ" will be a fully web-based journal.

This year's SURFSAC consisted of twelve students hailing from four continents. Among us, for the first time, were representatives from both MURF (Minority Undergraduate Research Fellowship) and Axline SURF (SURF for incoming freshmen). I can wholeheartedly say that I deeply enjoyed the experience afforded me this year by the other members of the council, and I would like to thank Abel Bourbois, Craig Countryman, Caroline Gibbs, Basit Khan, Suhas Nayak, Tim Raub, Meghan Smith, Martha-Helene Stapleton, Rui Wang, Al Valdivia, and Nitzan Roth for all their hard work this summer. The SURFSAC would like to express gratitude to Ryan Tischler, Carol Casey, Cheryl Gause, and lest we forget, Carolyn Merkel for helping to make the first SURF of the millennium a big hit!

Director's Report

Carolyn Merkel

SURF, now in its 22nd year, marched into the new millennium with the largest class ever. Students collaborated with mentors at Caltech, JPL, and at many other sites around the world. We welcomed to the campus students from other colleges and universities both in the US and abroad. At this turn-of-the-century year, SURF has become a member of the global community, and students worldwide have gained the advantages of doing forefront research at Caltech. SURF 2000 was a banner year!

SURF 2000 Highlights

- SURF 2000 continued the trend: it was the largest class ever, with 349 students engaging in research with 184 faculty and JPL technical staff members. Eighteen students and 17 faculty participated in the first SURF program in 1979.
- The Minority Undergraduate Research Fellowships (MURF) program expanded this year with 28 participants.
- We were delighted this summer to help strengthen Caltech's connection with the Huntington Library, Art Collections, and Botanical Gardens. Four SURF students worked jointly with Caltech faculty and curators at the Huntington Library.
- This year the SURF Administrative Committee, under the leadership of Frances Arnold, Dickinson Professor of Chemical Engineering and Biochemistry, held the first annual mentor orientation, primarily for the graduate students and postdoctoral scholars who generally have the day-to-day supervision of SURF students. The purpose was to provide program information, formulate expectations about undergraduate research, and answer questions.

SURF Funding

SURF is unique in the country in many respects. One notable aspect of the program is its funding structure. The Institute pays the administrative costs of the program while the Student-Faculty Programs Office raises funds for student stipends from private external sources. The stipend in 2000 was $4,000; the total stipend budget this year was close to $1.4 million. With the vigorous assistance of the SURF Board, the SURF AdComm, the Development Office, and SURF's many friends, as well as the enthusiastic participation of the mentors, we have been successful in our fund raising endeavor.

We seek annual donations to provide stipend funds. This money is used to match faculty grants for Caltech students doing SURFs on the campus. An endowment was established in SURF's early days, and the SURF Board set a goal of $10 million to fully endow the program in perpetuity. The current value of the SURF endowment is close to $5 million in gifts and pledges.

New Endowments

The Associates' annual solicitation last year requested endowment funds for SURF. We are delighted to report that this group raised three endowments! Two of the endowments are named for the Associates. We thank the many individuals who contributed to these endowments.

Mr. and Mrs. Robert Roney contributed a SURF endowment in response to the Associates solicitation. We extend hearty thanks to the Roneys for this endowment! Their partnership with Caltech will richly benefit the students who will be supported by this fund.

We thank Gabrielle Adelman (SURF '85 and '86, BS '87) and her husband Kenneth Adelman (BS '86) for creating the Alain Porter Memorial Endowment for SURF. The endowment will support a student in astronomy each summer. The generous gifts from former SURF students are a strong testimony to the value of the program as part of their undergraduate experiences.

Mr. and Mrs. Robert Chapman established an endowment to support minority students to do undergraduate research at Caltech. This support was met with great enthusiasm and deep gratitude by Caltech and by the minority student community in particular. Thank you!

A donor who wishes to remain anonymous established the Victor Neher SURF Endowment. Professor of Physics Vic Neher was widely respected as an outstanding teacher and mentor, and this endowment is a fitting memorial to him. We deeply appreciate this memorial endowment.

A quasi-endowment was created by colleagues at Fortune Brands to honor the retirement of Thomas C. Hays (BS '57, MS '58). This retirement tribute will enable students to gain the undergraduate research advantage as they begin their careers.

We are extremely pleased to announce that George and MaryLou Boone have made arrangements through their estate plan to provide for a gift to SURF of $1 million. This generous addition to the SURF endowment will advance the SURF program significantly toward its endowment goal. We thank the Boones for their foresight and their investment in the futures of the students who will eventually benefit from this gift.

Dr. Paraskeva Danailov has established a charitable gift annuity at Caltech, which will eventually endow one or more SURF fellowships in biology. The Institute is deeply grateful for her investment in the futures of the students.

Individuals or groups may also support SURF through the establishment of an endowment. An endowment can be created for $100,000 and will support one student annually in perpetuity. Endowments will be named as the donors elect, and each year the student supported by the endowment will bear the endowment's designation in all SURF materials.

Annual Gifts

Individuals may support SURF through annual contributions. Those who contribute the amount of a stipend, which was $4,000 last summer, will have a student named as the donor directs. We are deeply grateful to the many individuals who made generous gifts to SURF this year. We also thank the foundations and corporations who provided support for our students, ensuring that this large group of students was able to gain the SURF advantage.

SURF Funding Profile

Institute sources	43%
Endowment	19%
JPL	13%
Corporations and foundations	12%
Individuals	5%
Minority programs	8%

"SURF has been quite an enjoyable experience for me! I have learned a great deal about condensed matter physics, and I now know the degree to which my studies are applicable in the lab."

— Martha-Helene Stapleton

The Associates SURF Fellow

Associated Programs

Minority Undergraduate Research Fellowships (MURF)

This year we celebrated the 10th anniversary of the MURF program! The program was expanded this year as we welcomed 28 MURF students to the SURF program. This number represents an almost 40 percent increase over last year, and we are grateful to the Howard Hughes Medical Institute; Amgen, Inc.; the Ford Motor Company; General Motors; and the James Irvine Foundation for their support of MURF.

The MURF program provides support for talented students underrepresented in the sciences and engineering to spend a summer doing research with Caltech faculty. MURF introduces students to the excitement and opportunities of a research career and provides excellent preparation for students interested in subsequently pursuing a Ph.D. Students are introduced to the life of the graduate student and to the environment of the research scientist and engineer. We thank graduate students Tashica Williams and Gilberto Hernandez for serving as MURF 2000 program associates.

Caltech–Huntington SURF

Four students SURFed at the Huntington Library this summer with Caltech faculty and Huntington curators. The collaboration between these two world-class institutions affords outstanding opportunities for our students, all of whom are science or engineering majors. These students can explore humanities disciplines and broaden their world views through these projects. We thank George and MaryLou Boone and Doug and Betty Nickerson for their encouragement and support of these projects.

Axline SURF

Twelve students participated in the Axline SURF program this summer. This program allows selected incoming students to do research with Caltech faculty or JPL technical staff members the summer prior to beginning their studies at Caltech. The students who have participated over the three years of the program have richly benefited from these summer opportunities, and most of them remain engaged in research as they progress through their Caltech curriculum. We thank Nitzan Roth and Andrew Coe who served as upperclass program associates this summer.

Caltech–Cambridge Exchange

Five students from the University of Cambridge in England participated in SURF as part of the Institute's special program with Cambridge. Last academic year five Caltech students spent a term studying at Cambridge. We appreciate the efforts of Lauren Stolper, director of fellowships advising and study abroad, for forging this program, which provides a rich experience for students at both institutions.

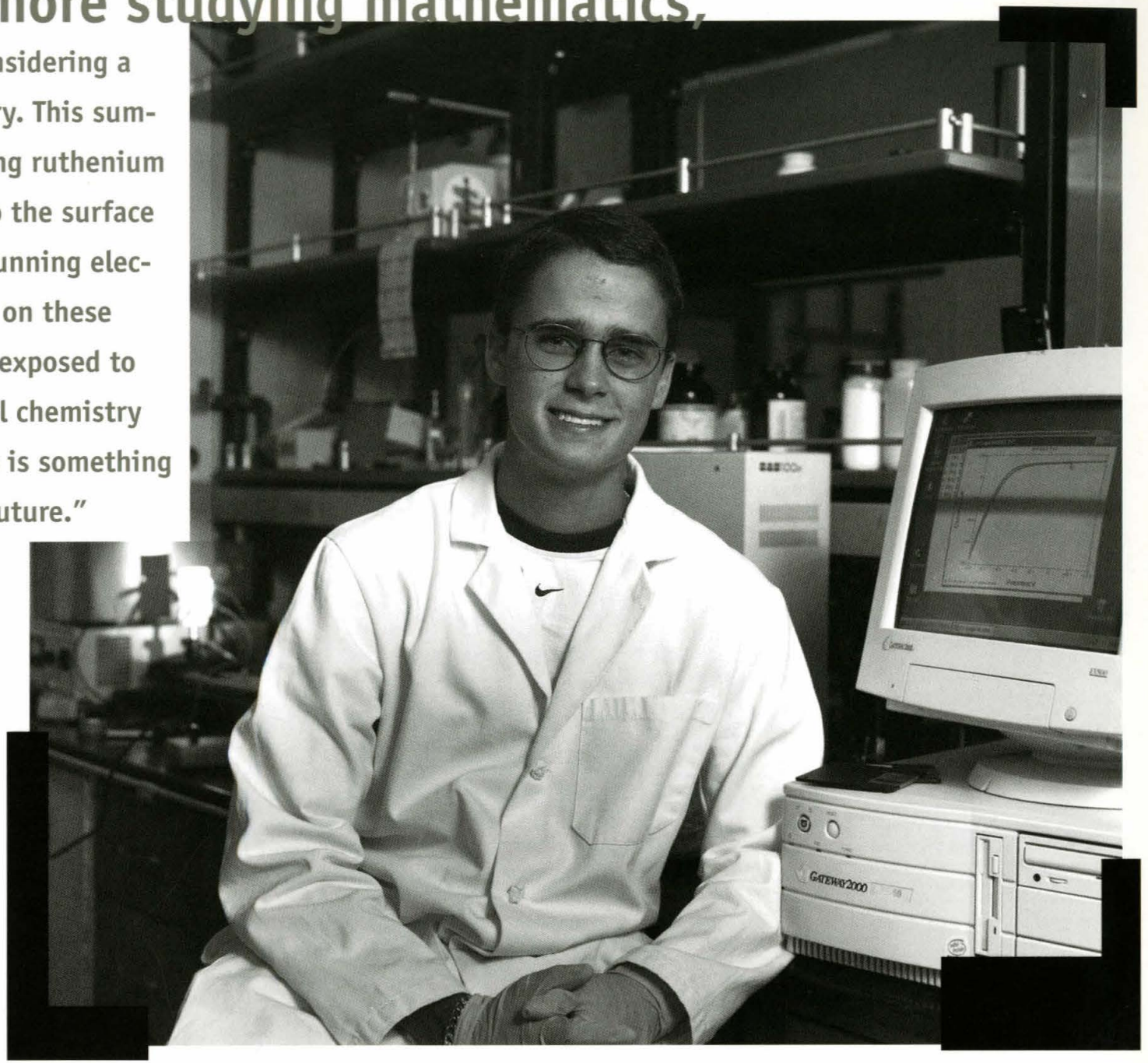
Caltech–National University of Singapore Exchange

This summer was the second exchange program with the National University of Singapore (NUS). Three NUS students SURFed at Caltech; one Caltech student, Emma Kang, did undergraduate research at NUS with Associate Professor Ho Juay Choy of the Mechanical Engineering Department on "Microturbine for Power and Cooling Applications." Unfortunately, a second Caltech student had to withdraw from the NUS opportunity. These exchange programs provide for participants the rich experience of living in another culture, experiencing a different academic setting while gaining the advantages of doing undergraduate research.

"I'm a sophomore studying mathematics, but have been considering a second major in chemistry. This summer I've been synthesizing ruthenium dyes, sensitizing them to the surface of TiO_2 electrodes, and running electrochemical experiments on these 'solar cells.' I have been exposed to the world of experimental chemistry and now realize that this is something I want to pursue in the future."

— Mark Bilinski

Arthur R. Adams SURF Fellow



SURF 2000 Program and Activities

Summer Activities

We thank George and MaryLou Boone for arranging for the SURF students and SURF Board members the annual tour at the Huntington Library, Art Collections, and Botanical Gardens, and for hosting a reception in the Boone family's sculpture garden following the tour. We also thank the docents and staff at the Huntington for the special "backstage" view of the facilities and for their articulate and informed telling of the story of the collections. The students greatly appreciate this event; it opens the doors to this magnificent institution, and many, perhaps most, attendees vow to return.

The SURF Student Advisory Council (SURFSAC) planned many social and cultural activities over the summer. They hosted an ice cream social the first weekend of the program to give students the chance to become acquainted. Other activities included a barbecue and water games on the Court of Man; a Dodgers game; a Galaxy game; a night at the Hollywood Bowl; a poetry night; and a trip to the Norton Simon Museum. SURFSAC also put on movie nights on the Olive Walk, showing films on large bedsheet screens for the entertainment of students.

Several years ago SURFSAC initiated the popular Wednesday evening SURFSAC suppers to allow students and faculty to get together informally outside the Caltech environment. Small groups of students meet with several mentors at local restaurants, and discussions range widely. There is no agenda, just conversation and good food, and students pay only $5. These dinners help to strengthen the undergraduate research community at Caltech. We thank the Master of Student Houses, Professor of Theoretical Physics Steve Frautschi, for providing funds to subsidize the cost of the dinners.

Profile of the SURF 2000 Class

Division	*Total Number of Students*	*Caltech Students*	*Non-Caltech Students*	*Research Mentors*
Biology	59	33	26	27
Chemistry and Chemical Engineering	51	37	14	21
Engineering and Applied Science	89	58	31	39
Geological and Planetary Sciences	25	18	7	16
Humanities and Social Sciences	6	5	1	6
Physics, Mathematics and Astronomy	59	40	19	34
Jet Propulsion Laboratory	43	16	27	24
Off Campus	14	14	0	14
International	3	3	0	3
Total	349	224	125	184

"Being a participant in the MURF program, I was able to meet students from all across the country. The people I encountered were the best part of my summer."

— Danya Walker

Amgen MURF Fellow

SURF Statistics From the 2000 Graduating Class

Percentage of graduating class participating in SURF: 51%

Percentage of the students receiving honors who participated in SURF: 69%

Percentage of the prize recipients at graduation who participated in SURF: 82%

Percent of alumni since 1980 who participated in SURF: 56%

SURF Summer Program

Seminars

Each Wednesday at noon during the summer, members of the faculty or JPL technical staff gave to the campus community an overview of their areas of research. Speakers and topics this year were:

JOHN M. ALLMAN
Hixon Professor of Psychobiology and Professor of Biology

The Evolution of Big Brains

HARRY A. ATWATER
Professor of Applied Physics and Materials Science

Guiding and Switching Light Below the Diffraction Limit

WARREN C. BROWN
Assistant Professor of History

What's "Middle" About the Middle Ages?

JOHN M. EILER
Assistant Professor of Geochemistry

Messages From the Underground: Chemical Evidence in Volcanic Lavas for the Origin and Fate of Earth's Seafloor

SOSSINA M. HAILE
Assistant Professor of Materials Science

Fuel Cells: Powering the Vehicles of the 21st Century

ANDREW E. LANGE
Professor of Physics

Images of the Early Universe

MICHAEL W. WERNER
SIRTF Project Scientist, JPL

SIRTF—The Space Infrared Telescope Facility

BARBARA J. WOLD
Professor of Biology

After the Human Genome

Each Friday, members of the JPL staff presented research seminars to the JPL SURF students. Speakers and their topics were:

PATRICIA M. BEAUCHAMP
Leader, Center for *in situ* Exploration and Sample Return

NEPTUNE: The Underwater Observatory

DIANA L. BLANEY
Earth and Space Sciences Division

Exploring the Planets With Rovers

JOHN L. CALLAS
Earth and Space Sciences Division

MGS: The Red Planet Revealed

JONATHAN P. DOWLING
Information Technologies and Software Systems Division

Quantum Computers

POLLY ESTABROOK
Telecommunications Science and Engineering Division

Communicating With Spacecraft: Past, Present, and Future

SARATH D. GUNAPALA
Avionic Systems and Technology Division

Sharp Infrared Eyes: The Journey of QWIPs From Concept to Large Inexpensive Sensitive Arrays in Hand-Held Infrared Cameras

ARTHUR L. LANE
Observational Systems Division

The Lake Vostok Story: Looking for Life on Earth

LESLIE K. TAMPPARI
Systems Division

Galileo: The Problem Child Makes Good

MICHAEL W. WERNER
SIRTF Project Scientist

SIRTF—The Space Infrared Telescope Facility

"In my opinion,

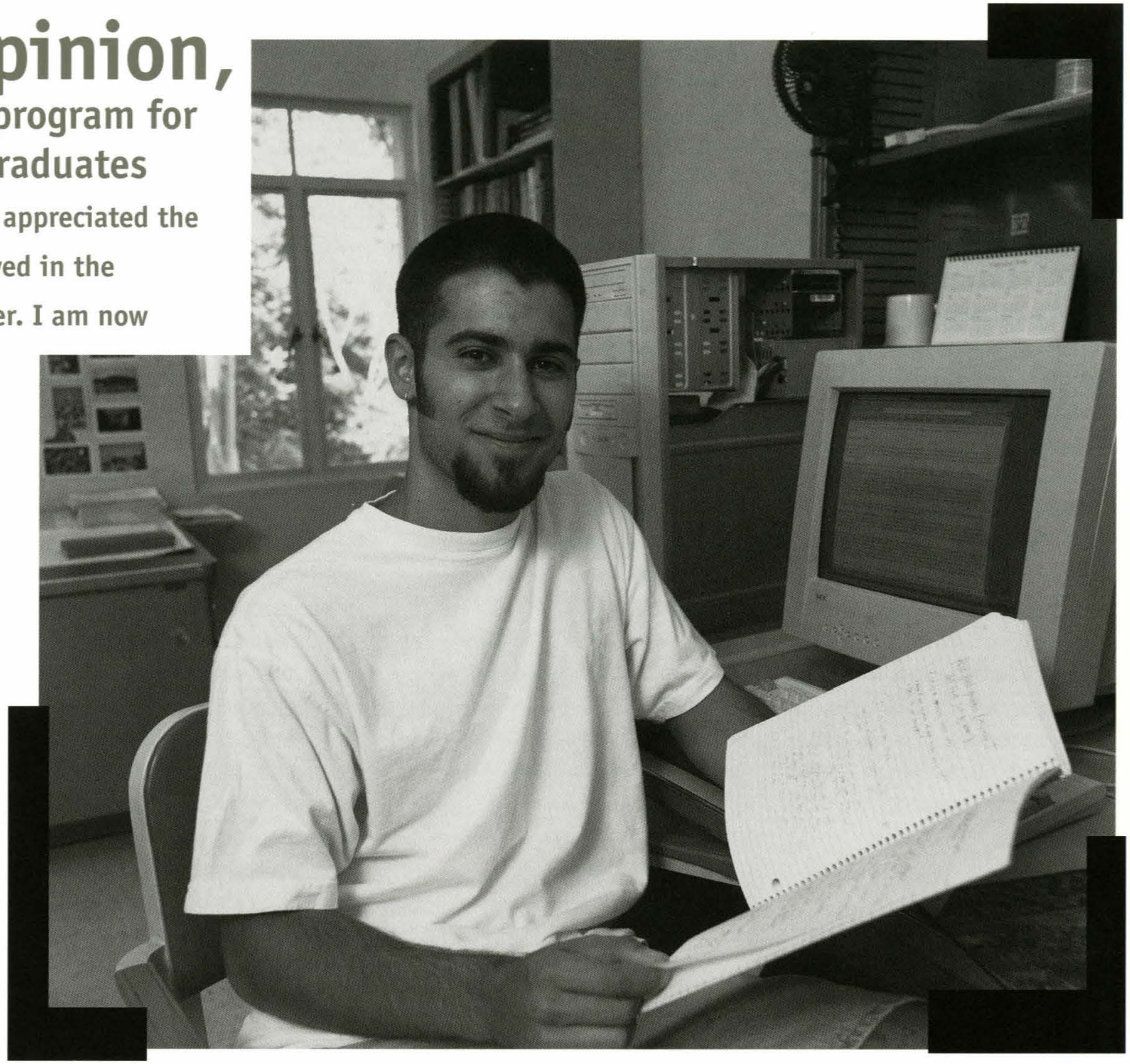
this is the best program for minority undergraduates

in the country. I really appreciated the interest everyone showed in the betterment of my career. I am now strongly considering a graduate school education."

— Omar Torrens

The James Irvine

Foundation MURF Fellow



Professional Development Workshops

Dr. William Whitney (BS '51), a division technologist and acting deputy manager of the Educational Affairs Office at JPL, created this series of workshops to help students strategically plan their careers. The sessions help students make short-term career decisions in the context of longer-term life and career goals. The series is a popular, informative, and interactive program, and portions of it have been presented at conferences and at other universities. We thank all the people who participated in these sessions.

Developing Credentials and Making Plans

Bill Whitney and Lloyd French, systems architect, JPL, discussed strategic career planning using the steps for developing a space mission to illustrate how one might apply similar principles to career planning.

Careers and Communication

Dr. Armand Tanguay (BS '71), associate professor of electrical engineering, materials sciences, and biomedical engineering at the University of Southern California, addressed the importance of clear communication and provided outstanding information for students preparing their first technical presentations. His talk was a superb model of an excellent presentation.

Creating a Community—Networking and Mentoring

Jo-Ann Fantino Ruffolo, registered professional career counselor in the Career Development Center, presented an excellent workshop on the value of developing a network. She demonstrated how students and why students should make and maintain these connections, and she gave attendees the chance to practice their skills. Also participating in the session were Dr. John Davis (SURF '91, Ph.D. '00) and Mark Duttweiler, graduate student in mechanical engineering.

Ethical Dilemmas in the Workplace

Thomas Schmitt, assistant vice president for human resources; Ann Bussone, staff, General Counsel's Office; and April White, co-manager of the Staff & Faculty Consultation Center and coordinator for the WorkLife Program, presided over this workshop addressing some of the ethical situations that students may face as they begin their careers.

The Nuts and Bolts of Applying to Graduate School

Jonie Watanabe Tsuji, career counselor in the Career Development Center, moderated a panel of graduate students for this workshop. The topic included the strategic thinking required in making the decision to apply to graduate school, the application process, and the personal statement. She also provided information about fellowships for which students can apply. Panel members included graduate students Magali Billen (geophysics), Greg Drummond (chemistry), and Adam Rasheed (aeronautics).

What Can You Do With a Technical Education?

This panel discussion highlighted the wide variety of careers that people with a technical background might pursue. Participants included Dr. Scott Carter, Office of Technology Transfer, Caltech; Dr. Jacklyn Green, imaging and spectrometry systems section, Observational Systems Division, JPL; Caltech Professor of Biology Paul Patterson; and David Rossum (BS '70), co-founder, E-mu Systems and chief scientist, Creative Technology Ltd.

Technical Communication

Since science not reported is essentially science not done, SURF requires that participants report orally and in writing on their projects. Students must submit detailed progress reports monthly during the summer, write an abstract for inclusion in the proceedings of SURF Seminar Day, and turn in a detailed final report at the conclusion of the program. Mentors are encouraged to use these reports as an opportunity to coach students in technical writing skills.

SURF Seminar Day

SURF holds two seminar days each year, both patterned after a professional technical meeting. During the last week of the summer program, over 100 non-Caltech students gave their oral presentations to audiences of mentors, friends, and staff in 11 sessions. This special seminar day is held so students can fulfill the oral report requirement before they leave the campus for their home institutions.

The third Saturday in October is traditionally designated as SURF Seminar Day. Close to 250 students presented their work to audiences of mentors and research group members, family, friends, alumni, donors, and staff. Seminar Day is a celebration of undergraduate research at the Institute and showcases the students' accomplishments and experiences.

The Doris S. Perpall SURF Speaking Competition

Robert C. Perpall (BS '52, MS '56) endowed a prize in memory of his late wife, Doris S. Perpall, to encourage students to prepare excellent SURF presentations. SURF Seminar Day is the first round of the Perpall Speaking Competition. The best presentations in each session are nominated for advancement to a second round, held in November. The final round is held in January.

Last year, eight students advanced to the final round. They were Ming Chen, Marc Favata, Peter Freese, Juna Kollmeier, Katherine Noyes, Tim Raub, Kathryn Todd, and Eric Tuttle. We congratulate all the finalists and particularly the four winners: Peter Freese (first place), Ming Chen (second), and Katie Noyes and Eric Tuttle (third)!

The Marcella and Joel Bonsall Prize for Technical Writing

The late Marcella Bonsall, a long-time member of the SURF Board, endowed the Marcella and Joel Bonsall Prize for Technical Writing in 1998 as an incentive for students to develop strong technical writing skills. Last year 53 papers were nominated by mentors for the prizes. Each paper was reviewed by two faculty members, and the papers receiving the highest evaluations were judged by a faculty committee. Five students were awarded the 1999 Bonsall Prizes. First prize went to Jason Marshall, a UCLA student. The committee awarded a second place tie to four students: Orkun Akin, Christopher Hirata, Bryan Tiedemann, and Eva Vielmetter, also a UCLA student.

Southern California Conference on Undergraduate Research (SCCUR)

The annual SCCUR conference was held at Loyola Marymount University in November 1999. Because SCCUR is a multidisciplinary conference including the sciences, math, engineering, the humanities, the social sciences, art, and performance, students from the Southern California region have the opportunity to see how research is carried out and reported in various disciplines. SURF conferees included Keshav Dani, Heather Dean, Crystal Gama (a MURF student from California State University at Los Angeles), Encarnacion Gutierrez (a JPLUS student from Los Angeles Valley College), Eric Hayne (a JPLUS student from PCC), Vit Hradecky, Nick Knouf, Lily Lan (UCLA), and Veronica Savu. SCCUR was started at Caltech in 1993.

National Conference on Undergraduate Research (NCUR)

Six of the finalists for the Perpall Prize attended the NCUR conference at the University of Montana at Missoula in April 2000. Like SCCUR, this conference is broadly multidisciplinary, with over 1,500 students from colleges and universities nationwide participating each year. The conference provides the opportunity for students to meet and share information with their peers. Bill Whitney has served on the NCUR Board of Governors since 1995; he served as treasurer from 1996–1998 and as chair from 1998–2000. Caltech hosted NCUR in 1991.

Special Thanks

SURF requires a large, committed, and loyal community of faculty, students, staff, and friends. The names of the individuals and groups who give time and provide resources are listed throughout the annual report. It is an impressive list, and I am personally deeply grateful to each one.

In particular, I acknowledge Fred Shair, SURF's founder. Fred's vision and early leadership were vital to the program. Because of his efforts, close to 3,000 students have added undergraduate research as an important credential to their résumés. I am delighted that he remains an active member of the SURF team, serving on both the AdComm and the SURF Board.

Bill Whitney, a member of the SURF AdComm and the SURF Board, serves as the JPL point of contact for SURF. In that role he oversees the myriad details of the program at the Lab. In addition, he coordinates the professional development series, counsels students, and provides wise advice to the program. I deeply appreciate his dedication to SURF and its students.

Frances Arnold has been an excellent chair of the SURF AdComm. She is an enthusiastic SURF mentor (she has had 30 SURF students since 1987), is a strong proponent of the undergraduate research experience, and has brought strong leadership to the program.

Bob Perpall, a long-time SURF supporter, took over the chairmanship of the SURF Board this year. His ideas will enhance the program, his vision will expand the community, and his leadership will increase the visibility of SURF.

I give most hearty thanks to Carol Casey, Cheryl Gause, and Ryan Tischler, the staff in the Student-Faculty Programs Office. They are an outstanding team, dedicated to the success of SURF, and committed to the undergraduate research community. Their efforts ensure the smooth day-to-day operation of SURF.

SURF is a rich and dynamic program because of the hard work, deep commitment, and loyalty of so many people. Thank you all!

2000 SURFers

HAITHAM ABD EL-MOATY
Senior, Astrophysics; The University of Oklahoma

Ultrafast Laser Pulse Technique

Mentor: Ahmed H. Zewail, *Linus Pauling Professor of Chemical Physics and Professor of Physics*

ALYS ADAMSKI
Junior, Bioch; California Polytechnic State University, San Luis Obispo

Classification of Microbes Isolated From the Spacecraft Assembly Facility Using Various Commercial Identification Systems

Mentor: Cecilia Basic, *Research Scientist, JPL*

ROMEO AHOHE
Sophomore, Ph/CS; University of Pittsburgh

ICETOP, a Trajectory Optimizer for Low-Thrust Spacecraft

Mentor: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL*

ORKUN AKIN
George F. Smith SURF Fellow
Senior, Bi

Development of Single-Molecule Spectroscopy

Mentor: Hideo Mabuchi, *Assistant Professor of Physics*

MEREDITH ALDEN
R. Gregory Jenkins SURF Fellow
Senior, Ch

Site-Directed Mutagenesis by Design: DNA Sequencing Polymerases

Mentor: John H. Richards, *Professor of Organic Chemistry and Biochemistry*

THOMAS ALDERSON II
Junior, Ch; University of Kansas

Sonochemical Degradation of TCE in the Presence of Aqueous Surfactant Solutions

Mentor: Michael R. Hoffmann, *James Irvine Professor of Environmental Science*

RICHARD ALLAN
Howard Hughes Medical Institute SURF Fellow
Junior, Molecular Bi; Princeton University

Time-Lapse Microscopy of mRNA-Transporting Staufen-GFP Fusion Protein in Cultured Hippocampal Neurons

Mentor: Erin M. Schuman, *Associate Professor of Biology; Assistant Investigator, Howard Hughes Medical Institute*

RICKY AMII
Senior, Ch; Occidental College

A Supermolecular Assembly for Solar Energy Conversion

Mentor: Harry B. Gray, *Arnold O. Beckman Professor of Chemistry*

ERIKA ANGEL
Howard Hughes Medical Institute MURF Fellow
Junior, Ch/Bioch; Cabrillo College

Endothelin Melanoma Cancer

Mentors: Paul H. Patterson, *Professor of Biology*, and Ronit Lahav, *Postdoctoral Scholar in Biology*

SHAHRAM ARDALAN
Richter Scholar
Junior, Ch/Ph

Optimization of Gene Visualization by MRI Contrast Agents

Mentor: Thomas J. Meade, *Senior Research Associate in Biology*

MARK ARNESEN
George F. Smith SURF Fellow
Senior, Ph

Thermal Entanglement in the 1D Heisenberg Model

Mentors: Vlatko Vedral, *Fellow of Merton College, University of Oxford*, and John P. Preskill, *Professor of Theoretical Physics*

THOMAS BAEHR-JONES
Dr. Edward C. Posner SURF Fellow
Senior, Ph

Distributed Finite-Difference Time Domain Simulation of a Photonic Crystal Waveguide

Mentor: Kerry Vahala, *Professor of Applied Physics*

MATTHEW BALLARD
Richter Scholar
Junior, Ma/Ph

The Topological Properties of the Poset of p-Subgroups of F_4 (q)

Mentor: Michael Aschbacher, *Shaler Arthur Hanisch Professor of Mathematics*

LERONE BANKS
Center for Neuromorphic Systems Engineering MURF Fellow
Junior, CS; Norfolk State University

Artificial Neural Networks and Consciousness in Autonomous Robotics

Mentors: Rodney M. F. Goodman, *Professor of Electrical Engineering*, and Alcherio Martinoli, *Postdoctoral Scholar in Electrical Engineering*

SANGEETA BARDHAN

Richter Scholar
Sophomore, Ch

Analysis of the Role of the Nuclease Activity of the Yeast Dna2 Protein in Determining Longevity in *Saccharomyces cerevisae*

Mentor: Judith L. Campbell, *Professor of Chemistry and Biology*

WALTER BARMAK

Junior, Biomedical Eng; Johns Hopkins University

Determination of Numbers of Signaling Molecules in the Postsynaptic Density of One Brain Excitatory Synapse

Mentor: Mary B. Kennedy, *Professor of Biology*

MARK BARRETT

Junior, Aeronautical Eng

A Study of Potential Commercial Lunar Missions

Mentors: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL*, and Curtis Potterveld, *Lecturer in Aerospace Engineering, Embry-Riddle Aeronautical University*

JEFFREY BARRICK

Arthur A. Noyes SURF Fellow
Senior, Ch

Adaptive Radiation of RNA Loop Binding Peptides by Molecular Selection

Mentor: Richard W. Roberts, *Assistant Professor of Chemistry*

BROCK BEAUCHAMP

Richter Scholar
Junior, ECE

Computer-Aided Instruction

Mentor: Glen A. George, *Lecturer in Computer Science and Electrical Engineering*

PHILIP BELL

William N. Lacey SURF Fellow
Senior, ChE

The Effects of Nucleant on Shear-Induced Crystallization of Semicrystalline Polymers

Mentor: Julia A. Kornfield, *Associate Professor of Chemical Engineering*

MARK BILINSKI

Arthur R. Adams SURF Fellow
Sophomore, Ma

TiO_2 Solar Energy Project

Mentors: Nathan S. Lewis, *Professor of Chemistry*, and Harry B. Gray, *Arnold O. Beckman Professor of Chemistry*

ADAM BLAKE

Codexa SURF Fellow
Junior, Ph

Stock Price Bubbles

Mentor: Colin F. Camerer, *Rea A. and Lela G. Axline Professor of Business Economics*

ALEXANDER BOBBS

Sophomore; Harvey Mudd College

Why is the Full Moon So Bright?

Mentor: Bonnie J. Buratti, *Principal Research Scientist, JPL*

FLORIAN BOHN

Fred Hameetman SURF Fellow
Senior, EE

Dual-Band Power Amplifiers

Mentor: Seyed-Ali Hajimiri, *Assistant Professor of Electrical Engineering*

JEFFREY BOLZ

Paracel, Inc. SURF Fellow
Sophomore, EAS/CS

Gene Finding With Decision Trees

Mentor: Glen A. George, *Lecturer in Computer Science and Electrical Engineering*

ABELARDO BOURBOIS

Warren and Katharine Schlinger SURF Fellow
Sophomore, ChE/ACM

Temperature-Dependent Switching Speed Characterization of Side-Group Liquid Crystal Polymer (SGLCP) Solutions

Mentor: Julia A. Kornfield, *Associate Professor of Chemical Engineering*

BRANDON BOZEK

Mrs. Edwin L. Cline SURF Fellow
Junior, Ph/Ma; Florida State University

Photometry of Near Earth Asteroids 1999 JD6 and 2000 GK137

Mentor: Eleanor F. Helin, *Research Scientist, JPL*

JESSICA BROWN

Junior, Molecular Bi; Pomona College

Characterization of the Association Between Trf4, Trf5, and Pol2

Mentor: Judith L. Campbell, *Professor of Chemistry and Biology*

MARIA BRUMM

Dr. and Mrs. George N. Boone SURF Fellow
Sophomore, Ph

An Astronomer's Tools During the Scientific Revolution

Mentor: Alison Winter, *Associate Professor of History*

TIMOTHY BUSCHMAN

Mr. Robert M. Abbey SURF Fellow
Junior, Bi

Implementation of a Maximum Operation Utilizing Neural Mechanisms

Mentor: Christof Koch, *Professor of Computation and Neural Systems*

SASCHA CALKINS

Honeywell SURF Fellow
Junior, ME

Shape Memory Alloys

Mentor: Kaushik Bhattacharya, *Professor of Applied Mechanics and Mechanical Engineering*

JEFFREY CAMARILLO

The James Irvine Foundation MURF Fellow
Senior, Urban Studies; University of Pennsylvania

Compton Project

Mentor: William Deverell, *Associate Professor of History*

EDWARD CAMPBELL

Cambridge Exchange
Senior, Ph; University of Cambridge

The Applications of Classical Physics

Mentor: Roger D. Blandford, *Richard Chace Tolman Professor of Theoretical Astrophysics*

OSBALDO CANTU, JR.

The James Irvine Foundation MURF Fellow
Senior, Geographic Information Science; Texas A&M University–Corpus Christi

Geographic Information Science (GIS) in Earthquake Geology

Mentors: Kerry E. Sieh, *Professor of Geology*, and Yann Klinger, *Postdoctoral Scholar in Geophysics*

SCOTT CARNAHAN

Shirley and Carl Larson SURF Fellow
Senior, Ma

Smale Conjecture Equivalents

Mentor: David Gabai, *Professor of Mathematics*

JOEL CARRANZA

J. Weldon Green SURF Fellow
Junior, CS

A New Method for Quality Mesh Extraction From Volume Data

Mentor: David E. Breen, *Assistant Director, Computer Graphics Lab*

AUDREY CARSTENSEN

Mr. and Mrs. Robert L. Noland SURF Fellow
Sophomore, Ay

Looking for Proper Motion Companions Using the Digitized Sky Survey

Mentor: Shrinivas R. Kulkarni, *Professor of Astronomy and Planetary Science*

MARIA CEJA

The James Irvine Foundation MURF Fellow
Junior, Pre-Engineering; University of Washington

Gravitational Forces by Far a Drag-Free Technology Demonstration

Mentor: William M. Folkner, *Principal Engineer, JPL*

JULIE CHA

Ernest H. Swift SURF Fellow
Sophomore, ChE

Dynamics of Mismatch Containing DNA Duplexes and Its Implications in Electron Transfer Chemistry

Mentor: Jacqueline K. Barton, *Arthur and Marian Hanisch Memorial Professor and Professor of Chemistry*

ELISA CHAN

Dr. Paraskeva N. Danailov SURF Fellow
Junior, Bi

Effects of Acetyl-Carnitine on Mitochondrial Oxidative Phosphorylation in Human Cultured Cells

Mentor: Giuseppe Attardi, *Grace C. Steele Professor of Molecular Biology*

TWIGGY CHAN

Senior, CS/Nuclear Eng; Massachusetts Institute of Technology

Automated Selection of Probabilistic Models

Mentor: Michael Turmon, *Senior Member of the Technical Staff, JPL*

JONATHAN CHANG

Richter Scholar
Sophomore, ECE

Developing a C++ Layer for the Neuron Simulation Program

Mentor: Christof Koch, *Professor of Computation and Neural Systems*

JITESH CHAUHAN

NSF REU SURF Fellow
Senior, Physics With Astrophysics; University of Leicester

The Global Diagnostic System

Mentor: Alan J. Weinstein, *Professor of Physics*

CINDY CHEN

Arthur R. Adams SURF Fellow
Sophomore, Bi

In vitro Selection of Peptide Regulators of G Protein Signaling

Mentor: Richard W. Roberts, *Assistant Professor of Chemistry*

EUGENE CHEUNG

Richter Scholar
Sophomore, EAS/ME

Detection of Cosmic Rays: The California High School Cosmic Ray Observatory (CHICOS)

Mentor: Robert D. McKeown, *Professor of Physics*

TYLER CHEUNG

Senior, Molecular Bioch/Bioph; Yale University

Computational Modeling of the Martian Atmosphere

Mentor: Yuk L. Yung, *Professor of Planetary Science*

WENDY CHING

Richter Scholar
Sophomore, Bi

Neural Crest Migration Patterns in *Dll-1* Mutant Mice

Mentor: Marianne Bronner-Fraser, *Professor of Biology*

RICHARD CHIU

Thomas Hunt Morgan SURF Fellow
Sophomore, Ch

Generation of a Cell-Line Expressing Proteins of the Yellow Fever Virus

Mentor: James H. Strauss, *Ethel Wilson Bowles and Robert Bowles Professor of Biology*

PAUL CHOI

Peter A. Lindstrom SURF Fellow
Sophomore, Ch

Structural Effects on the Acidity of Organic Diacids in Solution

Mentor: John D. Roberts, *Institute Professor of Chemistry, Emeritus*

FARIA CHOWDHURY

Arthur E. Lamel SURF Fellow
Senior, EE

Construction of a Sample Probe for Electrical Impedance Measurements Under High Temperature Conditions

Mentor: Sossina M. Haile, *Assistant Professor of Materials Science*

VINCENT CHU

Howard Hughes Medical Institute SURF Fellow
Sophomore, Bioch; Harvard University

A Search for Iron Sensitive Genes in *Magnetospirillum magnetotacticum*

Mentor: L. Elizabeth Bertani, *Visiting Associate in Biology*

JASON CHUA

The Associates SURF Fellow
Senior, Bi

Functional Investigation of a Novel bHLH Gene

Mentor: Barbara J. Wold, *Professor of Biology*

WEE KANG CHUA

Richter Scholar
Sophomore, Ch

Femtosecond Studies and Theoretical Calculations on the Intramolecular Reaction Dynamics of the 1-, 2-, and 1,3-Bromopropanes

Mentors: Ahmed H. Zewail, *Linus Pauling Professor of Chemical Physics and Professor of Physics*, and John D. Roberts, *Institute Professor of Chemistry, Emeritus*

JOSÉ CLASS-ESTÉVEZ

Howard Hughes Medical Institute MURF Fellow
Senior, Industrial Biotechnology; University of Puerto Rico, Mayagüez

Screening of the Activation or Repression of the Yeast Heat Shock Transcription Factor

Mentor: Carl S. Parker, *Professor of Biochemistry*

HELEN CLAUDIO

Sidney R. and Nancy M. Petersen SURF Fellow
Senior, EAS

The Kinetics of U(VI) Sorption on Montmorillonite Clay

Mentor: Janet G. Hering, *Associate Professor of Environmental Engineering Science*

PATRICK CODD

Axline SURF Fellow
Freshman

The Spatial Determination of Gene Transcription Using Fluorescence RNA *in situ* Hybridization

Mentors: Scott E. Fraser, *Anna L. Rosen Professor of Biology*, and Cyrus Papan, *Postdoctoral Scholar in Biology*

ANDREW COE

Samuel P. and Frances Krown SURF Fellow
Junior, Ma

Image Sets of a Piecewise Continuous Toral Endomorphism

Mentor: Henk P. Bruin, *Olga Taussky-John Todd Research Instructor in Mathematics*

ROBERT COMSTOCK

Senior, Ph; Central Washington University

Gravity Studies of Venusian Stealth Coronae

Mentor: Suzanne Smrekar, *Research Scientist, JPL*

SARAH COOKE

Samuel P. and Frances Krown SURF Fellow
Junior, Ge/Ph

H_2O Content in Mauna Kea Pillow Glasses

Mentors: Edward M. Stolper, *William E. Leonhard Professor of Geology*, and Michael Baker, *Member of the Professional Staff in Geology*

CRAIG COUNTRYMAN

Dave and Karen Rossum SURF Fellow
Sophomore, Ch

The Application of Site-Directed Mutagenesis of the Taq Polymerase Enzyme to Improving the Quality of DNA Sequencing

Mentor: John H. Richards, *Professor of Organic Chemistry and Biochemistry*

LISA COWAN

Millard W. Jacobs SURF Fellow
Senior, ChE

Synthesis and Characterization of Proton Conducting Solids

Mentor: Sossina M. Haile, *Assistant Professor of Materials Science*

TIMOTHY CROSBY

Richter Scholar
Junior, Ph

Electric Ice Needles: Voltage and Supersaturation Dependence of Growth Rate

Mentor: Kenneth G. Libbrecht, *Professor of Physics*

PATRICIA CRUZ

Center for Neuromorphic Systems Engineering MURF Fellow
Junior, Ma/CS; East Los Angeles College

Java Interface for Mobile Robots

Mentors: Joel W. Burdick, *Professor of Mechanical Engineering,* and Richard J. Mason, *Graduate Student in Mechanical Engineering*

FERNANDO CRUZ-GUILLOTY

Howard Hughes Medical Institute MURF Fellow
Junior, Industrial Biotechnology; University of Puerto Rico, Mayagüez

The Regulation of Gene Targeting in Somatic Cells

Mentors: David Baltimore, *President of Caltech and Professor of Biology,* and Matthew Porteus, *Postdoctoral Scholar in Biology*

JOHN DABIRI

The James Irvine Foundation MURF Fellow
Senior, Mechanical and Aerospace Engineering; Princeton University

Ejection Mechanisms and Vortex Dynamics During Hydrozoan Jelly Locomotion

Mentor: Morteza Gharib, *Professor of Aeronautics*

DANIEL DALY

Senior, APh

Development of Bismuth Telluride Thermoelectric Devices

Mentor: G. Jeff Snyder, *Member of the Technical Staff, JPL*

JONATHAN DAMA

Ford Motor Company SURF Fellow
Sophomore, EE

Improving AC Motor-Drive Efficiency Through Randomized Modulation Techniques

Mentor: Glen A. George, *Lecturer in Computer Science and Electrical Engineering*

KAREN DAUGHERTY

Junior, Bi

Pierre as Pulp Fiction: The Popularity of Melville's Seventh Novel

Mentor: Cindy Weinstein, *Associate Professor of Literature*

THOMAS DAULA

Samuel P. and Frances Krown SURF Fellow
Senior, ACM

Estimating Unconditional VaR Using a Bootstrap Method

Mentor: Gary A. Lorden, *Professor of Mathematics*

AARON DAVIES

Richter Scholar
Junior, Ph

High Frequency Measurements on 2-D Electron Systems

Mentor: James P. Eisenstein, *Professor of Physics*

CHARLES DeBOER

Senior, ME

A Study of Potential Commercial Lunar Missions

Mentors: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL,* and Curtis Potterveld, *Lecturer in Aerospace Engineering, Embry-Riddle Aeronautical University*

PETER DENNEDY-FRANK

Arthur R. Adams SURF Fellow
Junior, PlSc

Topographic Compensation on Venus and the Moon: Studies at High *l*

Mentor: Mark Simons, *Assistant Professor of Geophysics*

D'ANTONI DENNIS

Howard Hughes Medical Institute MURF Fellow
Junior, Ch; Dillard University

Novel Genes Expressed in the Neural Crest

Mentors: Marianne Bronner-Fraser, *Professor of Biology,* and Carole LaBonne, *Postdoctoral Scholar in Biology*

ERIK DILL

Dr. Terry Cole SURF Fellow
Senior, Ch

Electron Transfer Through DNA Crossover Junctions

Mentor: Jacqueline K. Barton, *Arthur and Marian Hanisch Memorial Professor and Professor of Chemistry*

TIMOTHY DOLCH

Flintridge Foundation SURF Fellow
Sophomore, Ay

Alternative Interpretations of Mars Global Surveyor Magnetic Field Data

Mentor: David J. Stevenson, *George Van Osdol Professor of Planetary Science*

JAMES DONALD

NSF REU SURF Fellow
Junior, EE/CS; University of California, Berkeley

Measuring Low Frequency Vertical Isolators

Mentor: Riccardo DeSalvo, *Member of the Professional Staff in Physics*

GREGORIO DRAYER

Junior, Power Eng; Simón Bolívar University

Modular Telecommunication Satellite Network Using On-Orbit Assembly

Mentor: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL*

JOVANA DRINJAKOVIC

Howard Hughes Medical Institute SURF Fellow
Sophomore, Bi; Oxford University

Activation Tagging in *Arabidopsis* and Cloning of a New Gene Possibly Involved in Trichome Initiation Pathway

Mentor: Elliot M. Meyerowitz, *Professor of Biology*

BERTRAND DuBOIS

Senior, Mechanics; ENSIETA

DrawCraft

Mentor: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL*

FRANK DUCHENEAUX

Howard Hughes Medical Institute MURF Fellow
Senior, Ch; Fort Lewis College

Femtosecond Studies of the Gas-Phase Reaction Dynamics of Selected Bromopropanes

Mentors: Ahmed H. Zewail, *Linus Pauling Professor of Chemical Physics and Professor of Physics,* and Spencer Baskin, *Senior Research Fellow in Chemistry*

IAIN DUNLOP

Cambridge Exchange
Senior, Ph; University of Cambridge

Simultaneous Extracellular Recording From the Antennal and Alpha Lobes, During Olfactory Stimulation, in *Schistocerca americana*

Mentor: Gilles J. Laurent, *Associate Professor of Biology and Computation and Neural Systems*

BRYAN EASTIN

Hugh F. and Audy Lou Colvin International SURF Fellow
Senior, Ph

Fiber Optic Interferometry

Mentors: Jun Nishikawa, *Assistant Professor of Optical and Infrared Astronomy, National Astronomical Observatory, Japan,* and Peter Halverson, *Member of the Engineering Staff, JPL*

CHRISTOPHER ELION

Richter Scholar
Junior, ACM

Fast Computational Methods for the Non-Linear Schrödinger Equation

Mentors: Oscar P. Bruno, *Professor of Applied Mathematics,* and David Amundsen, *von Kármán Instructor in Applied Mathematics*

TIMOTHY ELLING

Soft Tech SURF Fellow
Junior, EAS/CS

Compile-Time Inferred Parallelism for Distributed Computing

Mentor: Jason J. Hickey, *Instructor in Computer Science*

SCOTT ENGLAND

Junior, Physics With Space Science and Technology; University of Leicester

Modular Telecommunication Satellite Network Using On-Orbit Assembly

Mentor: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL*

ROBERT ENRIGHT

Arthur Rock SURF Fellow
Senior, EE

Odor Sensor Interface for Autonomous Robots

Mentors: Rodney M. F. Goodman, *Professor of Electrical Engineering,* and Alcherio Martinoli, *Postdoctoral Scholar in Electrical Engineering*

JOSE ESCALADA

Sophomore, Ch

Synthesis of Tris(8-quinolinyl)methane as a Potentially Tetradentate Chelating Ligand

Mentor: Jonas C. Peters, *Assistant Professor of Chemistry*

JOHN ESTES

Junior, Ph

Earth Mass Changes Over Months Through Years as Predicted by the ECCO Model

Mentor: Victor Zlotnicki, *Research Scientist, JPL*

WILL FARR

Dr. and Mrs. Lew Allen Jr. SURF Fellow
Sophomore, Ph

Detection of Supernova Neutrinos via Neutrinos-Proton Elastic Scattering in the KamLAND Detector

Mentors: Petr Vogel, *Senior Research Associate in Physics and Lecturer in Physics,* and John F. Beacom, *Sherman Fairchild Postdoctoral Scholar in Physics*

JOSEPH FASSLER

Fred Wells SURF Fellow
Junior, Ch

Crossbridged Tetraazamacrocycle Metal Complexes as Stronger Contrast Agents for MRI

Mentor: Thomas J. Meade, *Senior Research Associate in Biology*

ERICK FERRAN

Howard Hughes Medical Institute MURF Fellow
Senior, Biochemistry/Criminology; University of California, Irvine

Determination of Functional Domains in TBK1, a Novel IKK-Related Kinase

Mentors: David Baltimore, *President of Caltech and Professor of Biology,* and Joel L. Pomerantz, *Postdoctoral Scholar in Biology*

WILLIAM FINDLEY

Richter Scholar
Sophomore, Ch

Investigation of Co(III)-Substituted Cytochrome *c* Folding

Mentor: Harry B. Gray, *Arnold O. Beckman Professor of Chemistry*

NATHAN FLOWERS-JACOBS

Mr. and Mrs. Robert L. Noland SURF Fellow
Senior, Ph

Data Analysis of Particle Trajectories in the CLEO III Detector

Mentor: Alan J. Weinstein, *Professor of Physics*

DENNIS FONG

Senior, Ph

Characterization of Backscattered Radiation From Particle Detectors

Mentor: Bradley W. Filippone, *Professor of Physics*

ARIAN FOROUHAR

Senior, Cybernetics; University of California, Los Angeles

In vitro Hemodynamic Analysis of the Developing Zebrafish Heart

Mentor: Morteza Gharib, *Professor of Aeronautics*

JUSTIN FOX

Sophomore, CS

Visual Clustering Across Images

Mentor: Rebecca Castaño, *Member of the Technical Staff, JPL*

ROBIN FRIEDMAN

SURF Alumni SURF Fellow
Senior, Ch

PRO_FOLD: A Software Implementation of a Non-Iterative Algebraic Algorithm for Protein Folding

Mentor: William A. Goddard III, *Charles and Mary Ferkel Professor of Chemistry and Applied Physics*

ILYA FUSHMAN

Dr. and Mrs. Peter S. Cross SURF Fellow
Sophomore, Ph

The Implementation of a Variable-Mesh FDTD Algorithm and Its Application to the Modeling of Optical Devices

Mentors: Axel Scherer, *Bernard Neches Professor of Electrical Engineering, Applied Physics, and Physics,* and Jelena Vuckovic, *Graduate Student in Electrical Engineering*

DAVID GAGNE

Senior, EAS

The Synthesis of a Versatile Robot Chassis Based on a Modular Design

Mentor: Sanza T. Kazadi, *Graduate Student in Computation and Neural Systems*

ALEXANDRE GALMICHE

Senior, Electronics; ENSIETA

Integrated Concurrent Engineering Driver (ICEDriver)

Mentor: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL*

LU GAN

Senior, Ph

Purification and Crystallization of Rat Wild Type and Mutant Non-Binding Fc

Mentor: Pamela J. Bjorkman, *Professor of Biology; Investigator, Howard Hughes Medical Institute*

DANIEL GARGAS

Senior, Ch; University of Puget Sound

Photodecomposition Studies of Fluorescent Dyes

Mentor: Paul E. Dimotakis, *John K. Northrop Professor of Aeronautics and Professor of Applied Physics*

JANE GARRITY

Richter Scholar
Senior, Bi

Analysis of Regulatory Genes Involved in Chemotaxis in *Shewanella oneidensis* MR-1

Mentor: Kenneth H. Nealson, *Faculty Associate in Geobiology and Environmental Engineering Science; Lecturer in Environmental Engineering Science*

ELAINE GEE

Axline SURF Fellow
Freshman

Extreme Electronics: Cold Capacitor Characteristics

Mentors: Gary S. Bolotin, *Deputy Manager of Avionic Equipment Section, JPL,* and Michael A. Newell, *Cognizant Engineer for MUSES-CN, JPL*

PETER GERDES

Senior, Ma

Computer Assisted Proofs

Mentor: James R. Arvo, *Associate Professor of Computer Science*

NICHOLAS GEROVAC

Junior, APh

Accurate Phase Measurement Method for Space Gravitational Wave Observation

Mentor: William M. Folkner, *Principal Engineer, JPL*

CAROLINE GIBBS

Dr. Holt Ashley SURF Fellow
Junior, Ch

Incorporation of Histidine and Fluorohistidine Using the Unnatural Amino Acid Method

Mentor: Dennis A. Dougherty, *Professor of Chemistry*

LISA GOGGIN

NSF REU SURF Fellow
Senior, Ph; University College Cork

Parameters for All Optical Components for the 40m LIGO Prototype

Mentor: Alan J. Weinstein, *Professor of Physics*

ARCELIA GONZALEZ

Howard Hughes Medical Institute MURF Fellow
Senior, Bi; Mount St. Mary's College

DNA-Protein Crosslinking by the Flash-Quench Technique: Dependence Upon Proteins and Tripeptides

Mentor: Eric D. A. Stemp, *Visiting Associate in Chemistry*

EMILIO GRAFF

Lester Lees Aeronautics SURF Fellow
Junior, Ae

Egyptian Wind Power: Using Kites to Erect Egyptian Obelisks

Mentor: Morteza Gharib, *Professor of Aeronautics*

JULIA GREISSL

Sophomore, Ph

Superlattices of $YBa_2Cu_3O_7$ and $La_{2/3}Ca_{1/3}MnO_3$

Mentors: Bernhard Keimer, *Professor, Director, Max-Planck-Institut fur Festkoerperforschung,* and Axel Scherer, *Bernard Neches Professor of Electrical Engineering, Applied Physics, and Physics*

MARTIN GRUNTHANER

Junior, Ae/EAS

JPL Mars Discovery Mission Development: LATIS—Landed Arctic Terrain and Ice Surveyor Mechanisms and Structure

Mentor: Lloyd C. French, *Systems Architect, JPL*

NICHOLAS GUISE
Sophomore, Ph

Bose-Einstein Condensation in Dilute Rubidium Vapor

Mentor: Robert Thompson, *Member of the Technical Staff, JPL*

DINKAR GUPTA
Richter Scholar
Junior, ECE

Gesture Recognition Using the Constellation Model

Mentor: Demetri Psaltis, *Thomas G. Myers Professor of Electrical Engineering*

RYAN GUTENKUNST
Richter Scholar
Junior, Ph

An Alternate Description of an Interferometric Gravitational Wave Detector

Mentors: Kenneth G. Libbrecht, *Professor of Physics,* and Eric D. Black, *Postdoctoral Scholar in Physics*

SIINA HAAPANEN
Junior, Ae/EAS

LATIS—Mission to the North Pole of Mars: Thermal Subsystems and Entry, Descent, and Landing

Mentor: Lloyd C. French, *Systems Architect, JPL*

FRASER HAMILTON
Senior, Ph; University of Leicester

A Study in Potential Commercial Lunar Missions

Mentors: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL,* and Curtis Potterveld, *Lecturer in Aerospace Engineering, Embry-Riddle Aeronautical University*

GIAO HANG
Howard Hughes Medical Institute SURF Fellow
Junior, Bi/Lit

Downstream Genes of the C Class Gene AG in *Arabidopsis thaliana*

Mentors: Elliot M. Meyerowitz, *Professor of Biology,* and Toshiro Ito, *Postdoctoral Scholar in Biology*

ANNE HANNA
Senior, Ph

Gravitational Correlations in Lyman Alpha Spectra

Mentors: Uros Seljak, *Assistant Professor of Physics, Princeton University,* and Marc Kamionkowski, *Professor of Theoretical Physics and Astrophysics*

JAMES HANSEN
Richter Scholar
Sophomore, Ph/Ma

Backgrounds and Solar Neutrinos at KamLAND

Mentor: Robert D. McKeown, *Professor of Physics*

ABRAHAM HARTE
Junior, Ph

Solution-Phase Alignment of Carbon Nanotubes

Mentors: Yuen-Ron Shen, *Professor of Physics, University of California, Berkeley,* and Kenneth G. Libbrecht, *Professor of Physics*

GREGORY HATHER
Senior, Ph; California Polytechnic State University, San Luis Obispo

Thermodynamics of Current Carrying Wires and Observation of Electromigration-Induced Stress

Mentor: Rosa Leon, *Senior Staff Member, JPL*

KRISTOF HELLE
Senior, CS; Budapest University of Technology and Economics

Automated Model Learning for Object Recognition

Mentor: Pietro Perona, *Professor of Electrical Engineering*

JESSICA HELLER
Richter Scholar
Junior, Ch

Detection of Biogenic Amines Using Polyaniline/Carbon Black Sensors

Mentor: Nathan S. Lewis, *Professor of Chemistry*

WILLIAM HELTSLEY
Axline SURF Fellow
Freshman

The Development of an Effective Bonding Method for Digital Micro-Thrusters

Mentor: Erik K. Antonsson, *Professor of Mechanical Engineering*

TRAVIS HIME
Richter Scholar
Senior, Ph

Tunneling Spectroscopy Studies of $YBa_2Cu_3O_{7-\delta}$ Superconducting Crystals

Mentor: Nai-Chang Yeh, *Professor of Physics*

CHRISTOPHER HIRATA
Richter Scholar
Senior, Ph

Magnetohydrodynamic Turbulence in Interstellar Clouds

Mentor: Peter M. Goldreich, *Lee A. DuBridge Professor of Astrophysics and Planetary Physics*

JUSTIN HO
Hugh F. and Audy Lou Colvin SURF Fellow
Junior, ChE

Engineering of the Mevalonate-Independent Polyprenyl Diphosphates Biosynthetic Pathway

Mentors: Jay D. Keasling, *Associate Professor of Chemical Engineering, University of California, Berkeley,* and Frances H. Arnold, *Dick and Barbara Dickinson Professor of Chemical Engineering and Biochemistry*

MICHAEL HOCHBERG
Thomas E. Everhart SURF Fellow
Junior, Ph

Toward Batch Fabrication of Nanoscale, Surface Mount Inductors

Mentor: Axel Scherer, *Bernard Neches Professor of Electrical Engineering, Applied Physics, and Physics*

LOREN HOFFMAN
Mr. and Mrs. Richard M. Rosenberg SURF Fellow
Junior, Ph

Natural Radioactivity Background Reduction for the KamLAND Neutrino Detector

Mentor: Robert D. McKeown, *Professor of Physics*

ELIZABETH HONG
Robert K. and Alice L. Roney SURF Fellow
Junior, Bi/APh

Developmental Timing and Selection Mechanism of Odorant Receptor Gene Expression in Mammalian Olfactory Neurons

Mentor: David Baltimore, *President of Caltech and Professor of Biology*

VIT HRADECKY
Senior, Ph

CO(3-2) Observations of Clusters of Galaxies

Mentors: Dennis Zaritsky, *Associate Professor of Astronomy, Steward Observatory, University of Arizona,* and S. George Djorgovski, *Professor of Astronomy*

CINDY HSU
Howard Hughes Medical Institute SURF Fellow
Junior, Bi/Psy; Johns Hopkins University

Behavior-Dependent Neurogenesis in Adult Mice

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

FRANK HUMPHREY
Senior, Ae/EAS; Iowa State University

LATIS Mars North Polar Mission: CDS/ACS

Mentor: Lloyd C. French, *Systems Architect, JPL*

SARAH HUNYADI
Erika C. Vote SURF Fellow
Junior, PlSc

LATIS Mars Polar Mission: Traverse

Mentor: Lloyd C. French, *Systems Architect, JPL*

KATHARINE IP
Arthur R. Adams SURF Fellow
Sophomore, PlSc

Monitoring Frost Disappearance in Spring and Summer on Mars

Mentor: Andrew P. Ingersoll, *Professor of Planetary Science*

GEOFFREY IRVING
Richter Scholar
Sophomore, Ma

Programming Hunting Behavior Using a Primate Brain Model

Mentor: Alan H. Bond, *Lecturer in Computer Science*

JENNY IVES
Mr. Eugene L. Scott SURF Fellow
Senior, Ge

Characterization of Banding in the Benthic Coral *Desmophyllum cristagalli*

Mentor: Jess F. Adkins, *Assistant Professor of Geochemistry and Global Environmental Sciences*

SENKA JEREMIC
Sophomore, Ch; University of Cambridge

Determination of the Conformational Equilibrium of Succinamic Acid in Polar and Nonpolar Solvents via NMR Spectroscopy and Altona-Haasnoot Equation

Mentor: John D. Roberts, *Institute Professor of Chemistry, Emeritus*

NICHOLAS JOHNSON
Junior, ME; California Polytechnic State University, San Luis Obispo

LATIS Mars Polar Mission: Electronic Power Subsystem (EPS)

Mentor: Lloyd C. French, *Systems Architect, JPL*

SARAH JOHNSON
Senior, Ma/PlSc; Washington University

LATIS Mars Polar Mission: Science Rationale and Mission Management

Mentor: Lloyd C. French, *Systems Architect, JPL*

NICHOLAS JONES
Cambridge Exchange
Senior, Ph; University of Cambridge

The Advantages of Using Quantum Protocols in Distributed Computing

Mentor: Hideo Mabuchi, *Assistant Professor of Physics*

TED JOU
HMC Architects Group SURF Fellow
Sophomore, Ph

Determining Lengths and Optical Parameters for Dual Recycling at the 40m LIGO Prototype

Mentor: Alan J. Weinstein, *Professor of Physics*

JOY JUSTICE
Senior, EAS

Measurement of Reaction Kinetics Using Diffraction

Mentor: Ersan Üstündag, *Assistant Professor of Materials Science*

LISA KALTENEGGER
NSF REU SURF Fellow
Junior, Ph; University of Technology Graz

CREEP of Materials

Mentor: Riccardo DeSalvo, *Member of the Professional Staff in Physics*

JUSTIN KAO
Sophomore, ACM

Vision Based Obstacle Detection for Rovers on Terrain

Mentor: Ayanna Howard, *Member of the Technical Staff, JPL*

BRIAN KAPPUS

NSF REU SURF Fellow
Junior, Ph/CS; Harvey Mudd College

Wavefront Sensing for the 40m LIGO Prototype

Mentor: Alan J. Weinstein, *Professor of Physics*

RICHARD KARNESKY, JR.

Donald S. Clark SURF Fellow
Junior, EAS/MS

Development of Web-Based Tools for Neutron Diffraction

Mentor: Ersan Üstündag, *Assistant Professor of Materials Science*

JAMES KEEF, JR.

NSF REU SURF Fellow
Senior, Ph/Ma; University of Arizona

TDT, a Tool for the Analysis of Non-Stationary Noise

Mentor: Frederick J. Raab, *Member of the Professional Staff in Physics*

BASIT KHAN

Mr. and Mrs. Donald M. Alstadt SURF Fellow
Sophomore, EE/Ph

Replication and Fabrication of Diffractive Optical Elements

Mentor: Axel Scherer, *Bernard Neches Professor of Electrical Engineering, Applied Physics, and Physics*

HANNAH KIM

Richter Scholar
Sophomore, Bi

Gene Expression Patterns in Developing Meristems: A GAL4 Enhancer Trap Screen

Mentor: Elliot M. Meyerowitz, *Professor of Biology*

ILJIE KIM

Doug and Betty Nickerson SURF Fellow
Senior, Bi/Lit

Sir Kingsley Amis: The Man and Writer Revealed Through His Library

Mentors: Alan Jutzi, *Avery Chief Curator of Rare Books, Huntington Library, Art Collections, and Botanical Gardens,* and William Deverell, *Associate Professor of History*

RANDIE KIM

Richter Scholar
Sophomore, Ch

Site-Directed Mutagenesis by Design: DNA Sequencing Polymerases

Mentor: John H. Richards, *Professor of Organic Chemistry and Biochemistry*

ELISE KLEEMAN

Sophomore, Ge

Understanding Banding in the Benthic Coral *Desmophyllum cristagalli*

Mentor: Jess F. Adkins, *Assistant Professor of Geochemistry and Global Environmental Science*

NICHOLAS KNOUF

Mrs. Vernon L. Barrett SURF Fellow
Junior, Ph/CNS

Subordinate-Level Categorization and the Human Fusiform Gyrus

Mentors: Nancy Kanwisher, *Associate Professor of Brain and Cognitive Science, Massachusetts Institute of Technology,* and Christof Koch, *Professor of Computation and Neural Systems*

KATHARINA KOHLER

Mr. and Mrs. Alan Bagley SURF Fellow
Junior, Ay

White Dwarf Oscillations

Mentor: Roger D. Blandford, *Richard Chace Tolman Professor of Theoretical Astrophysics*

RORY KONDRAD

Junior, Eng; Swarthmore College

A Graphical User Interface for a Program Modeling Seismic Wave Propagation

Mentor: Jeroen Tromp, *Professor of Geophysics*

JOSEPH KOO

Sophomore, EE

Paleoseismology of the Burro Flats Region

Mentor: Kerry E. Sieh, *Professor of Geology*

MICHELLE KOUTNIK

Senior, Astrophysics; University of California, Los Angeles

Assembling Stratigraphic Columns of the Polar Layered Terrain

Mentor: Bruce C. Murray, *Professor of Planetary Science and Geology*

ADAM KRAUSE

Senior, Ph; College of Charleston

The Simulation of Micro-Inductors

Mentor: Udo Lieneweg, *Avionic Systems and Technology Division, JPL*

KRISTINA KURBANYAN

Junior, Bioch; Mount St. Mary's College

DNA-Protein Crosslinks Generated by the Flash-Quench Technique: Dependence Upon DNA Sequence

Mentor: Eric D. A. Stemp, *Visiting Associate in Chemistry*

GORDON KWAN

Junior, Molecular and Cell Biology; University of California, Berkeley

Gene Expression Profile of Stress Responsive Genes in *Drosophila*

Mentor: Seymour Benzer, *James G. Boswell Professor of Neuroscience, Emeritus*

HELEN LAIRD
Junior, Ph With Space Science and Technology; University of Leicester

Modular Telecommunication Satellite Network Using On-Orbit Assembly

Mentor: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL*

BALTAZAR LAM
Cambridge Exchange
Sophomore, Eng; University of Cambridge

Improving Wall Mass Transfer in a Cloud Condensation Nucleus Instrument

Mentor: John H. Seinfeld, *Louis E. Nohl Professor and Professor of Chemical Engineering*

CHRISTINA LAM
Mr. and Mrs. Fred M. Wells SURF Fellow
Sophomore, ECE

Characterizing the Diversity of a Library of Chimeric Cytochrome P450 2E1 Proteins

Mentor: Frances H. Arnold, *Dick and Barbara Dickinson Professor of Chemical Engineering and Biochemistry*

JOHNNY LAM
Richter Scholar
Sophomore, ChE

Analysis of Low-Molecular-Weight Organic Acids in Soils Exposed to Elevated Carbon Dioxide Concentrations

Mentor: Janet G. Hering, *Associate Professor of Environmental Engineering Science*

TIN YIU LAM
Sophomore, Ch

A Screen for Mutations That Affect Heat Shock Response in Yeast Cells

Mentor: Carl S. Parker, *Professor of Biochemistry*

CRYSTAL LEACH
Center for Neuromorphic Systems Engineering MURF Fellow
Junior, Ph/Pre-Engineering; Dillard University

Distributed Stigmergic, Multi-Agent Construction of Two-Dimensional Architectures

Mentors: Rodney M. F. Goodman, *Professor of Electrical Engineering*, and Alcherio Martinoli, *Postdoctoral Scholar in Electrical Engineering*

ANDREW LEE
Senior, ACM; Brown University

A Molecule Migration Simulation for Ganymede and the Moon

Mentor: Yuk L. Yung, *Professor of Planetary Science*

BENJAMIN LEE
Mark A. Sturza SURF Fellow
Junior, APh

Diffractive Optical Elements—Fabrication Using Electron-Beam Lithography and Replica Molding

Mentor: Axel Scherer, *Bernard Neches Professor of Electrical Engineering, Applied Physics, and Physics*

CHRISTINA LEE
Senior, Astrophysics/Ph; University of California, Berkeley

LATIS: A Mission to the North Polar Cap of Mars; Science, Autonomous Navigation and Hazard Avoidance, and Optics

Mentor: Lloyd C. French, *Systems Architect, JPL*

STEVEN LEE
Senior, Astrophysics; Edinburgh University

Geometrical Mechanics—A New Tool for Astrophysics

Mentor: Jerrold E. Marsden, *Professor of Control and Dynamical Systems*

ADAM LICHTL
Senior, Ph

Ultracold Neutron Trapping

Mentor: Bradley W. Filippone, *Professor of Physics*

YEE FUN LIM
Sophomore, Ph

Tuning of Photonic Waveguides

Mentor: Axel Scherer, *Bernard Neches Professor of Electrical Engineering, Applied Physics, and Physics*

JONATHAN LIN
Axline SURF Fellow
Freshman

Neuron Correlations in Human Sleep Phases

Mentors: Christof Koch, *Professor of Computation and Neural Systems*, and Gabriel Kreiman, *Graduate Student in Biology*

RALPH LIN
Junior, EAS

Comparison of Spike Sorting Algorithms

Mentor: Christof Koch, *Professor of Computation and Neural Systems*

SAMUEL LINDSAY-LEVINE
Axline SURF Fellow
Freshman

A Capacitance Dew-Point Hygrometer

Mentor: Kenneth G. Libbrecht, *Professor of Physics*

MICHAEL LIU
Junior, CS

Developing a Spacecraft Rendering Tool With Object-Oriented Design Principles

Mentor: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL*

PO-SHEN LOH
Axline SURF Fellow
Freshman

Dijkstra Revisited and Revised: A Bidirectional Multitarget Extension to Hadlock's Algorithm

Mentor: Alain J. Martin, *Professor of Computer Science*

NITA LOSOPONKUL
Senior, Env

Surface Oxidation Reactions—Testing the Benner Hypothesis

Mentor: Frank J. Grunthaner, *Senior Research Scientist, JPL*

THEA LU
Junior, Bi

Characterization and Detection of Bacterioferritin

Mentor: L. Elizabeth Bertani, *Visiting Associate in Biology*

ALEXIS LUERAS

Howard Hughes Medical Institute MURF Fellow
Junior, Biochemistry; Mount St. Mary's College

Investigation of Crosslinking Between DNA and Ruthenium-Peptide Conjugates Using the Flash-Quench Technique

Mentors: Jacqueline K. Barton, *Arthur and Marian Hanisch Memorial Professor and Professor of Chemistry,* and Kimberly D. Copeland, *Graduate Student in Chemistry*

FRANCIS MACDONALD

Richter Scholar
Senior, Ge

The Paleomagnetics of Martian Meteorite ALH84001

Mentor: Joseph L. Kirschvink, *Professor of Geobiology*

SARAH MAHONEY

Mr. and Mrs. Downie D. Muir III SURF Fellow
Junior, Bi

Screen for Full-Length Chick *Zic* Genes

Mentors: Marianne Bronner-Fraser, *Professor of Biology,* and Sara Ahlgren, *Postdoctoral Fellow in Biology*

SAMUEL MAKONNEN

Paracel, Inc. SURF Fellow
Junior, EE

The Evolution of Finite State Machines

Mentor: Glen A. George, *Lecturer in Computer Science and Electrical Engineering*

KAISEY MANDEL

William E. Zisch Memorial SURF Fellow
Sophomore, Ay

Application of Difference Imaging to Optical Observations of Gamma Ray Bursts

Mentor: Shrinivas R. Kulkarni, *Professor of Astronomy and Planetary Science*

JIA MAO

Richter Scholar
Junior, EAS

Morphing Volume Datasets With Deformable Implicit Models

Mentor: David E. Breen, *Assistant Director, Computer Graphics Lab*

CHRISTOPHE MAQUESTIAUX

Victor Neher SURF Fellow
Junior, Ph

A Physical Emulator for Hardware Evolution

Mentor: Sanza T. Kazadi, *Graduate Student in Computation and Neural Systems*

JOEL MARTINEZ

General Motors MURF Fellow
Senior, Bi/Ch; University of Puerto Rico, Rio Piedras

Enhancement of Probe Use in DNA Microarray Hybridization

Mentors: Stephen R. Quake, *Associate Professor of Applied Physics,* and James Brody, *Senior Research Fellow in Applied Physics*

ROSS MASSEY

Richter Scholar
Sophomore, Ch

Mastoparan: A Model for G Protein-Coupled Receptors

Mentor: Richard W. Roberts, *Assistant Professor of Chemistry*

BRETT MAUNE

NSF REU SURF Fellow
Senior, Ph; University of Missouri–Rolla

Active Feedback Control System for the Seismic Attenuation System for Gravity Wave Interferometers

Mentor: Riccardo DeSalvo, *Member of the Professional Staff in Physics*

DANIELLE McCALL

Senior, Ph; Principia College

Integrated Concurrent Engineering Driver (ICEDriver)

Mentor: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL*

JAMES McCARTHY

Freshman, Washington University

Synthesis of Higher Oxidation States of Iron as Related to the Martian Surface

Mentors: Michael G. Goldfeld, *Staff Member in Geological and Planetary Sciences,* and Alexandre I. Tsapin, *Research Scientist, JPL*

CAROLYN McCOMBS

Senior, Ph; Purdue University

Visualizing Output From a Spectral-Element Method for Seismic Wave Propagation

Mentor: Jeroen Tromp, *Professor of Geophysics*

RYAN McDANIEL

Sophomore, EAS

LATIS Mars Polar Mission: Systems Engineering

Mentor: Lloyd C. French, *Systems Architect, JPL*

PETER MEILSTRUP

Junior, EAS

Tools for Real Time Data Analysis of Cultured Neural Nets

Mentor: Steven M. Potter, *Senior Research Fellow in Biology*

GEOFFREY MEISSNER
Senior, Bi

Genetic Analysis of Microbial Diversity of Spacecraft Assembly Facility

Mentor: Cecilia Basic, *Research Scientist, JPL*

JASON MELTZER
J. Kent Clark SURF Fellow
Senior, EAS

Simulating Planets: Historical and Modern Models

Mentor: Alison Winter, *Associate Professor of History*

ARJUN MENON
Øistein and Rita A. Skjellum SURF Fellow
Senior, Ay

Efficient Atom Trapping Using Magnetic Traps

Mentor: Hideo Mabuchi, *Assistant Professor of Physics*

REMY MENU
Senior, Ocean Engineering; Institut des Sciences de l'Ingenieur de Toulon et du Var. (ISITV)

Cryobot Project

Mentor: Lloyd C. French, *Systems Architect, JPL*

FLORIAN MERKLE
Junior, Bi

Backpropagation in a Compartmental Model of an Intrinsically Bursting Layer V Pyramidal Neuron

Mentors: Terrence Sejnowski, *Professor, Salk Institute; Professor of Biology, University of California at San Diego; Investigator, Howard Hughes Medical Institute,* and Christof Koch, *Professor of Computation and Neural Systems*

SEBASTIEN MICOLAU
Senior, Ocean Engineering; Institut des Sciences de l'Ingenieur de Toulon et du Var. (ISITV)

Cryobot Project

Mentor: Lloyd C. French, *Systems Architect, JPL*

VIKRAM MITTAL
Toshi Kubota SURF Fellow
Sophomore, Ae

Development and Evaluation of a Novel Neutron Detector

Mentors: Phyllis A. Russo, *Technical Staff Member, Los Alamos National Laboratory,* and Douglas R. Mayo, *Technical Staff Member, Los Alamos National Laboratory*

FARISA MORALES
JPLUS SURF Fellow
Senior, Ma; University of California, Los Angeles

LATIS—Mission to Mars Northern Polar Cap

Mentor: Lloyd C. French, *Systems Architect, JPL*

ERIC MORGANSON
Class of '36 SURF Fellow
Junior, Ph

Developing an Optical Setup for Analyzing Transcriptional Logic Circuits

Mentor: Hideo Mabuchi, *Assistant Professor of Physics*

BENSON MUITE
Toshi Kubota Aeronautics SURF Fellow
Senior, EAS/Ec

Particle Flows in Liquid Filled Hourglasses

Mentor: Melany L. Hunt, *Associate Professor of Mechanical Engineering*

JONATHAN MULIANG
Honeywell SURF Fellow
Sophomore, Ph

Mössbauer Spectroscopy and X-Ray Diffraction Studies on Ferrite Content of Welded Stainless Steel

Mentor: Brent T. Fultz, *Professor of Materials Science*

MATTHEW MYERS
Meta Probe SURF Fellow
Sophomore, ChE

Ring-Opening Metathesis Polymerization of Dicyclopentadiene: Investigation of the Polymerization Mechanism

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

JASVINDER NANGIANA
Howard Hughes Medical Institute SURF Fellow
Senior, Bi; University of California, Berkeley

Design and Preparation of Transferrin Receptor Mutants to Localize the Transferrin Binding Site

Mentor: Pamela J. Bjorkman, *Professor of Biology; Investigator, Howard Hughes Medical Institute*

ARJUN NARAYANAN
Bristol-Myers SURF Fellow
Sophomore, Bi/Ch

Binding Studies of Various HLA-DR1-Peptide Complexes

Mentor: Theodore Jardetzky, *Associate Professor, Department of Biochemistry, Molecular Biology, and Cell Biology, Northwestern University*

SUHAS NAYAK
Carel and Mary Otte SURF Fellow
Junior, Ch

A Study of the Mass-Independent Isotope Effect in Ozone Formation Using a Hindered Rotor Transition State

Mentor: Rudolph A. Marcus, *Arthur Amos Noyes Professor of Chemistry*

JOSHUA NEUBERT
Sophomore, PlSc; Massachusetts Institute of Technology

LATIS Mars North Pole Mission: Instruments

Mentor: Lloyd C. French, *Systems Architect, JPL*

NHIEN NGUYEN
Senior, Bi

Local Protein Synthesis in Dendrites of Pyramidal Neurons

Mentor: Erin M. Schuman, *Associate Professor of Biology; Assistant Investigator, Howard Hughes Medical Institute*

ROGER O'BRIENT
Dian Anderson SURF Fellow
Senior, APh

Spontaneous Emissions From Two-Dimensional Photonic Band Gap Crystals

Mentor: Amnon Yariv, *Martin and Eileen Summerfield Professor of Applied Physics*

CASEY O'DONNELL
Senior, Ma/CS; Drake University

3D Visualization Tool Creation Using OpenGL and Java

Mentor: Lee Elson, *Research Scientist, JPL*

JASON OH

Axline SURF Fellow
Freshman

Optical Switches: Computer Modeling of Nonlinear Optical Materials

Mentor: Thomas A. Tombrello, *William R. Kenan, Jr., Professor and Professor of Physics*

JONG C. OH

Rita A. and Øistein Skjellum SURF Fellow
Sophomore, Bi

Genetic Analysis of Pain in *Drosophila melanogaster*

Mentor: Seymour Benzer, *James G. Boswell Professor of Neuroscience, Emeritus*

ANNA ORIENT

Howard Hughes Medical Institute SURF Fellow
Senior, Bi/Genetics; Eotvos Lorand University of Sciences, Budapest

Search for Negative Regulators of LET-23 Signaling Pathway Using the RNAi Method

Mentor: Paul W. Sternberg, *Professor of Biology; Investigator, Howard Hughes Medical Institute*

ELAINE OU

Mr. and Mrs. Bert Fishman SURF Fellow
Sophomore, EE

Optimizing the Architecture of Field Programmable Gate Arrays Using Versatile Place and Route

Mentor: André DeHon, *Assistant Professor of Computer Science*

MELINDA OWENS

Axline SURF Fellow
Freshman

Isolation of the Male Tail Promoter Element for Acetylcholine Biosynthesis in *C. elegans*

Mentor: Paul W. Sternberg, *Professor of Biology; Investigator, Howard Hughes Medical Institute*

WYNN PADULA

Junior, Liberal Arts; Sarah Lawrence College

Kinematic Visualizations of Virtual Patients on a Programmable Stepper Device

Mentor: Antal Bejczy, *Senior Research Scientist, JPL*

BRIAN PALMER

Mr. and Mrs. Clifford Cooper SURF Fellow
Junior, Ch

Physical Properties of Fullerene-Antibody Interaction and Predictions of Various Fullerene Binding Sites

Mentor: William A. Goddard III, *Charles and Mary Ferkel Professor of Chemistry and Applied Physics*

SUSHA PARAMESWARAN

Cambridge Exchange
Senior, Ph; University of Cambridge

A Theoretical Study of the Monolithic GAS Blade for the LIGO Seismic Attenuation System

Mentor: Riccardo DeSalvo, *Member of the Professional Staff in Physics*

JULIE PARRA

The James Irvine Foundation MURF Fellow
Junior, Ge; California State University, Northridge

Volcanic Hazards Assessment Using Remote Sensing Data From the Tres Virgenes Volcanic Complex, Baja California Sur, Mexico

Mentors: Joann Stock, *Professor of Geology and Geophysics*, and Jane Dmochowski, *Graduate Student in Geophysics*

SEEMA PATEL

Junior, Ph; Harvey Mudd College

Study of Graben Slopes and Boulder Size-Frequency Distributions Through the Use of Mars Orbiter Camera Images

Mentor: Matthew Golombek, *Principal Scientist, JPL*

MARQUETTE PATTERSON

Center for Neuromorphic Systems Engineering MURF Fellow
Senior, ECE; Tennessee State University

Humanoid Detection Algorithm

Mentor: Pietro Perona, *Professor of Electrical Engineering*

CURTIS PEHL

Mr. and Mrs. John E. Young SURF Fellow
Junior, Ge

Magnetostratigraphy of the Permian Triassic Boundary

Mentor: Joseph L. Kirschvink, *Professor of Geobiology*

BENOIT PEUDON

Senior, Electronics; ENSIETA

Integrated Concurrent Engineering Driver (ICEDriver)

Mentor: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL*

JESSE PINO

William H. and Helen Lang SURF Fellow
Sophomore, Ph

What You Don't See: Measuring Implicit and Explicit Memory for Fixated but Ignored Words

Mentor: Geraint Rees, *Wellcome Advanced Fellow in Biology*

KARTIK PRABHAKARA

National University of Singapore Exchange
Senior, EE; National University of Singapore

Encryption Based Hardware Random Number Generator

Mentors: Christof Koch, *Professor of Computation and Neural Systems*, and Peter N. Steinmetz, *Postdoctoral Scholar in Biology*

PIYUSH PRAKASH

Richter Scholar
Junior, ECE

Mathserve: An All-Purpose Math Server

Mentor: James R. Arvo, *Associate Professor of Computer Science*

MADELEINE PRICE

Samuel P. and Frances Krown SURF Fellow
Junior, Bi

Quantifying Levels of SpKrox1 mRNA in Purple Sea Urchin Embryos

Mentor: Eric H. Davidson, *Norman Chandler Professor of Cell Biology*

JAMES PSOTA

Junior, EE/CS; Cornell University

Minimal Data Set Optimal Classification

Mentor: Yaser S. Abu-Mostafa, *Professor of Electrical Engineering and Computer Science*

JAMES PUGH

Sophomore, EE

Tracking and Control of a Collective Robotic System via an External Digital Camera

Mentors: Rodney M. F. Goodman, *Professor of Electrical Engineering*, and Alcherio Martinoli, *Postdoctoral Scholar in Electrical Engineering*

RYAN QUADRI

Senior, Ph; Harvey Mudd College

Reduction of One-Dimensional Astronomical Spectra With IRAF

Mentor: Lee K. Johnson, *Research Scientist, JPL*

SARA QUAN

Xencor SURF Fellow
Junior, Ch

Expression of a Horseradish Peroxidase Mutant in *Pichia pastoris*

Mentor: Frances H. Arnold, *Dick and Barbara Dickinson Professor of Chemical Engineering and Biochemistry*

DARIN RAGOZZINE

Junior, Ph/Astrophysics; Harvard University

A Study of Potential Commercial Lunar Missions

Mentors: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL*, and Curtis Potterveld, *Lecturer in Aerospace Engineering, Embry-Riddle Aeronautical University*

DAVID RAHMLOW

Junior, Ph

Construction and Use of a Heliostat for Studying Atmospheric Composition

Mentor: Paul O. Wennberg, *Associate Professor of Atmospheric Chemistry and Environmental Engineering Science*

JUAN RAMÍREZ

Amgen MURF Fellow
Senior, Bi; University of Puerto Rico, Mayagüez

Sharpening the Expression Profile: Using Ara-C to Suppress Cell Division During Differentiation of a Myogenic Cell Line

Mentors: Barbara J. Wold, *Professor of Biology*, and Brian Williams, *Postdoctoral Scholar in Biology*

TIMOTHY RAUB

The Associates SURF Fellow
Junior, Geobi

Paleomagnetic Tests for Intermediate Paleolatitudes From Late Cretaceous Sediments of the Insular Superterrane: Where Did the Western Cordillera Form?

Mentor: Joseph L. Kirschvink, *Professor of Geobiology*

KIM REECE

Junior, Ph/CS; New Mexico State University

Mars Rover Reliability Simulation

Mentor: Robert Shishko, *Senior System Engineer, JPL*

NEAL REEVES

Mr. and Mrs. Richard M. Rosenberg SURF Fellow
Senior, ACM

Numerical Solutions to Partial Differential Equations Using Multigrid and Adaptive Mesh Refinement Techniques

Mentor: Daniel I. Meiron, *Professor of Applied Mathematics*

CHRISTIAN REICHARDT

Senior, Ph

Optimal Recovery of Physical Parameters Governing Galaxy Spectra

Mentor: Marc Kamionkowski, *Professor of Theoretical Physics and Astrophysics*

MISTY RICHARDS

Howard Hughes Medical Institute SURF Fellow
Senior, Psy/Bi; University of California, Los Angeles

Perception and Auditory-Visual Localization in Human Infants

Mentor: Shinsuke Shimojo, *Professor of Biology*

ADITI RISBUD

Senior, MS/Eng; University of California, Davis

Synthesis of Nanoporous Alumina for High-Pressure α-Sn Nanowire Formation

Mentor: Harry A. Atwater, Jr., *Professor of Applied Physics and Materials Science*

RICHARD AARON ROBISON

Richter Scholar
Junior, Bi

Isolation of Immature Yellow Fever Virus

Mentor: James H. Strauss, *Ethel Wilson Bowles and Robert Bowles Professor of Biology*

ERIC ROMO

Senior, ME; The Cooper Union

Modular Telecommunication Satellite Network Using On-Orbit Assembly

Mentor: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL*

NITZAN ROTH

Mrs. J. Stanley Johnson SURF Fellow
Sophomore, ACM

A Survey for Low Surface Brightness Dwarf Galaxies

Mentor: S. George Djorgovski, *Professor of Astronomy*

MARK RUDNER

Samuel P. and Frances Krown SURF Fellow
Sophomore, Ch

In solvo Conformational Analysis of the β-Alanine Zwitterion Using *ab initio* Quantum Mechanics and Molecular Dynamics Simulations

Mentor: William A. Goddard III, *Charles and Mary Ferkel Professor of Chemistry and Applied Physics*

MICHAEL RUSSO

Richter Scholar
Junior, Ay

Studies of Polarized Noble Gas

Mentors: Emlyn W. Hughes, *Professor of Physics,* and David Pripstein, *Postdoctoral Scholar in Physics*

CHRISTOPHER RUTHERGLEN

Sophomore, APh

Investigating Neuronal Movement Within a Low Density Culture

Mentor: Jerome Pine, *Professor of Physics*

ROBB RUTLEDGE

Richter Scholar
Junior, Bi

Primate Language Acquisition by Statistical Learning

Mentors: Marc D. Hauser, *Professor of Psychology, Harvard University,* and Masakazu Konishi, *Bing Professor of Behavioral Biology*

GRAY RYBKA

Mr. and Mrs. Alan Bagley SURF Fellow
Junior, Ph

Design and Implementation of a Software Module to Detect Transient Signals in the LIGO Interferometer Datastream

Mentors: Kent Blackburn, *Member of the Professional Staff in Physics,* and Albert Lazzarini, *Member of the Professional Staff in Physics*

WENDY SAINTVAL

Center for Neuromorphic Systems Engineering MURF Fellow
Senior, Ma; Barry University

Optimizing Robotic Carangiform Propulsion

Mentors: Joel W. Burdick, *Professor of Mechanical Engineering,* and Richard J. Mason, *Graduate Student in Mechanical Engineering*

JULIA SALAS

Thomas C. Hays SURF Fellow
Sophomore, Ch

Electrochemical Studies of MutY Bound to DNA Films

Mentor: Jacqueline K. Barton, *Arthur and Marian Hanisch Memorial Professor and Professor of Chemistry*

TRISHA SANDO

Senior, Bi

Construction and Analysis of Yellow Fever Virus Subgenomic Replicons

Mentor: James H. Strauss, *Ethel Wilson Bowles and Robert Bowles Professor of Biology*

CHRISTIE SAYES

NSF REU SURF Fellow
Senior, Ch; Louisiana State University

Characterization of Amplitude Noise and Spatial Modes Associated with the Pre-Stabilized Laser (PSL)

Mentors: Kenneth G. Libbrecht, *Professor of Physics,* and Joseph M. Kovalik, *Staff Member in Physics*

BENJAMIN SCHMIDEL

Senior, Ph; Harvey Mudd College

Measurement of Plasma Densities Through Interferometric Detection of Plasma-Induced Phase Shifts

Mentor: Lee K. Johnson, *Research Scientist, JPL*

ELIZABETH SCHOENE

Senior, Ph; Harvey Mudd College

Photolysis and Ion Imaging of Methyl Vinyl Ketone

Mentor: Lee K. Johnson, *Research Scientist, JPL*

TODD SCHUMAN

Junior, Ae/Ec

Modular Telecommunication Satellite Network Using On-Orbit Assembly

Mentor: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL*

ISAAC SEE

Richter Scholar
Sophomore, Ma

Examining the Regulation of MAPK Pathways by HePTP in Thymocytes

Mentor: José Alberola-Ila, *Assistant Professor of Biology*

PETER SEIDEL

Sophomore, ChE

The Chemical Signatures of Life: An Experimental Program Searching for Organic Compounds That Could Withstand Martian Oxidation Environments

Mentor: Frank J. Grunthaner, *Senior Research Scientist, JPL*

ANNEMARIE SELAYA

Howard Hughes Medical Institute MURF Fellow
Junior, Life Sciences; University of California, Los Angeles

Characterization of Molecular Events in Aging *Drosophila melanogaster*

Mentors: Seymour Benzer, *James G. Boswell Professor of Neuroscience, Emeritus,* and Laurent Seroude, *Postdoctoral Scholar in Biology*

ELIZABETH SEWARD

Senior, Ph With Space Science and Technology; University of Leicester

A Study of Potential Commercial Lunar Missions

Mentors: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL,* and Curtis Potterveld, *Lecturer in Aerospace Engineering, Embry-Riddle Aeronautical University*

REBECCA SHAFEE

Junior, Ph

DPOSS and the Search for Type II Quasars

Mentor: S. George Djorgovski, *Professor of Astronomy*

KEVIN SHAND

Andrew W. Mellon Foundation SURF Fellow
Senior, ACM

A Revisitation of the Rijke Tube

Mentor: Fred E. C. Culick, *Richard L. and Dorothy M. Hayman Professor of Mechanical Engineering and Professor of Jet Propulsion*

DEREK SHANNON

Junior, Geobi/Ae

Testing the Stability of Key Organics in Mars Analogue Conditions

Mentor: Frank J. Grunthaner, *Senior Research Scientist, JPL*

CHARLES SHAPIRO

NSF REU SURF Fellow
Junior, Ph/Ma; Pennsylvania State University

Monitoring Power Line Induced Artifacts at LIGO Hanford Observatory

Mentors: Kenneth G. Libbrecht, *Professor of Physics,* and Daniel Sigg, *Senior Postdoctoral Scholar in Physics*

ELIZABETH SHARP

Howard Hughes Medical Institute MURF Fellow
Senior, Bi; Massachusetts Institute of Technology

Characterization of m144, a Viral Class I Major Histocompatibility Complex (MHC) Homolog

Mentors: Pamela J. Bjorkman, *Professor of Biology; Investigator, Howard Hughes Medical Institute,* and Benjamin Willcox, *Postdoctoral Scholar in Biology*

DENIS SHCHERBAKOV

Professor Fredrick H. Shair SURF Fellow
Senior, ChE

Directed Evolution of Peroxide-Mediated Cytochrome P450 BM-3 Heme Domain-Catalyzed Hydroxylation

Mentor: Frances H. Arnold, *Dick and Barbara Dickinson Professor of Chemical Engineering and Biochemistry*

MONA SHEIKH

Sophomore, EE

Simulation and Analysis of Financial Options

Mentor: Yaser S. Abu-Mostafa, *Professor of Electrical Engineering and Computer Science*

SAKEN SHERKHANOV

Junior, Bi

Purification of the Nuclear Cap Binding Protein Complex and Characterization of Its Role in Messenger RNA Precursor Splicing in *Saccharomyces cerevisiae*

Mentors: John N. Abelson, *George Beadle Professor of Biology,* and Scott W. Stevens, *Postdoctoral Fellow in Biology*

CINDY SHIH

Senior, Bi; University of California, Los Angeles

Lack of Ecdysone, a *Drosophila melanogaster* Steroid Hormone, Is Involved in Increasing Stress Resistance and Life Span of Adult Flies

Mentor: Seymour Benzer, *James G. Boswell Professor of Neuroscience, Emeritus*

VANESSA SIH

Richter Scholar
Senior, APh

Characterization of Tin Nanowires

Mentor: Harry A. Atwater, Jr., *Professor of Applied Physics and Materials Science*

RYAN SIMKOVSKY

Richter Scholar
Senior, Bi

Peptide Structure Prediction

Mentor: Niles A. Pierce, *Assistant Professor of Applied Mathematics*

AARON SIMONS

Mr. and Mrs. Ralph W. Jones SURF Fellow
Junior, Ma

Positive Tension Branes in the Randall-Sundrum Scenario

Mentor: Mark B. Wise, *John A. McCone Professor of High Energy Physics*

RONALD SIU

Senior, Bi

An Analysis of the Commitment of Neural Crest Cells and Their Sensitivity to Various Signaling Molecules Using a Novel *in vitro* Approach

Mentor: Marianne Bronner-Fraser, *Professor of Biology*

JOSHUA SMITH

NSF REU SURF Fellow
Junior, Ph; Syracuse University

OSEM Sensitivity Experiment and Test of the Suspension Controller Tuning Procedure

Mentors: Kenneth G. Libbrecht, *Professor of Physics,* and Peter Saulson, *Visiting Associate in Physics*

JUSTIN SMITH
Richter Scholar
Senior, EAS

Experiments in On-line Handwriting Recognition

Mentor: James R. Arvo, *Associate Professor of Computer Science*

MEGHAN SMITH
Howell N. Tyson, Sr., SURF Fellow
Junior, ME

Ultrasonic Actuation for Cavitation Control

Mentor: Timothy E. Colonius, *Associate Professor of Mechanical Engineering*

THOMAS SNYDER
Dave and Karen Rossum SURF Fellow
Junior, Ch

Psoralen Cross-Linking of mRNA Templates to Puromycin for the *in vitro* Selection of Proteins

Mentor: Richard W. Roberts, *Assistant Professor of Chemistry*

NEHA SONI
Samuel P. and Frances Krown SURF Fellow
Sophomore, CS

Extracting Geometric (3D) Models From CT and MRI Scans

Mentor: David E. Breen, *Assistant Director, Computer Graphics Lab*

LAKSHMINARAYAN SRINIVASAN
Junior, ECE

Wireless Electrophysiology Studies on Freely Moving Animals

Mentors: Markus Meister, *Jeff C. Tarr Professor of Biology, Harvard University,* and Christof Koch, *Professor of Computation and Neural Systems*

MARCIN STADNIK
NSF REU SURF Fellow
Senior, Photonics; Warsaw University of Technology

Conversion of LIGO Optical Metrology Data

Mentors: Kenneth G. Libbrecht, *Professor of Physics,* and GariLynn Billingsley, *Staff Member in Physics*

ERICA STANLEY
General Motors MURF Fellow
Junior, CS; Clark Atlanta University

Three-Dimensional Texture Functions

Mentor: David E. Breen, *Assistant Director, Computer Graphics Lab*

MARTHA-HELENE STAPLETON
The Associates SURF Fellow
Sophomore, Ph

The Fringe Field Region of Narrow Channels in 2-D Electron Systems

Mentor: James P. Eisenstein, *Professor of Physics*

ROBIN STEIN
Junior, Ch; Michigan State University

^{1}H NMR Studies of β-Alanine

Mentor: John D. Roberts, *Institute Professor of Chemistry, Emeritus*

IVICA STEVANOVIC
NSF REU SURF Fellow
Junior, Telecommunications; University of Belgrade

The LIGO 40m Optics Suspension Controller Electronics Design

Mentor: Alan J. Weinstein, *Professor of Physics*

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Dr. and Mrs. Samuel P. Morgan SURF Fellow
Senior, Ch

Comparing the Accuracy of Explicit and Continuum Solvation in Predicting the Conformational Equilibrium of Succinic Acid in Tetrahydrofuran

Mentor: William A. Goddard III, *Charles and Mary Ferkel Professor of Chemistry and Applied Physics*

DANIEL STICK
Robert L. Blinkenberg SURF Fellow
Junior, Ph

DNA Computing

Mentor: Hideo Mabuchi, *Assistant Professor of Physics*

MELISSA STRAUSBERG
Axline SURF Fellow
Freshman

Identification of Hydrogen Carriers in ALH84001 by Deuterium/Hydrogen Fractionation

Mentor: John M. Eiler, *Assistant Professor of Geochemistry*

VICTORIA STURGEON
Junior, EAS/ME/Ec

A Method for Finding Small-Scale Force-Displacement Curves

Mentors: George Barbastathis, *Assistant Professor of Mechanical Engineering, Massachusetts Institute of Technology,* and Melany Hunt, *Associate Professor of Mechanical Engineering*

CHRISTOPHER KAI SUNG

Axline SURF Fellow
Freshman

Synaptic Plasticity and NRSF Infection

Mentors: Henry A. Lester, *Professor of Biology,* and Eric Slimko, *Graduate Student in Biology*

MOLLY SWANSON

Carolyn Merkel SURF Fellow
Junior, Ph

Iodine Crystal Growth in Electric Fields

Mentor: Kenneth G. Libbrecht, *Professor of Physics*

ROBERT SWINNEY

Mrs. Harold P. Levy SURF Fellow
Junior, Ay

Spectral Analysis of Data From the Caltech Faint Galaxy Redshift Survey

Mentor: Judith Cohen, *Professor of Astronomy*

CHING SZE

Junior, ECE

Three Dimensional Numerical Analysis of Maxwell's Equations

Mentor: Amnon Yariv, *Martin and Eileen Summerfield Professor of Applied Physics*

SEAN SZEJA

Mr. and Mrs. Robert L. Noland SURF Fellow
Sophomore, Ph

Transport Between the Troposphere and Stratosphere and Preparation for Future CO_2 Studies

Mentor: Yuk L. Yung, *Professor of Planetary Science*

JENNIFER TAGGART

Samuel P. and Frances Krown SURF Fellow
Junior, Ph

Effects of Radiative Corrections in $e^+e^- \rightarrow \tau^+\tau^-(\gamma)$ at 10.58 GeV as Modeled by the KORALB and KK2f Monte Carlos

Mentor: Alan J. Weinstein, *Professor of Physics*

SINDY TANG

Sophomore, EE

A Computational Model for Visual Selection

Mentor: Pietro Perona, *Professor of Electrical Engineering*

CAREY TANNER

Junior, ChE; Massachusetts Institute of Technology

Reduced Charge Recombination by Oxidized Electrolyte Species in Dye-Sensitized Nanocrystalline TiO_2 Photoelectrochemical Solar Cells

Mentor: Nathan S. Lewis, *Professor of Chemistry*

MARTIN TCHERNOOKOV

Junior, Ph

Bayesian Methods for Estimating the Parameters of an SIR Model

Mentors: Elizabeth J. Kelly, *Deputy Group Leader for Statistical Sciences, Los Alamos National Laboratory,* and Thomas D. Gottschalk, *Member of the Professional Staff, Senior Research Scientist, CACR*

FARINAZ TEHRANI

Junior, EE; California Polytechnic State University, Pomona

Simulation of a Modular Robot Chassis

Mentor: Sanza T. Kazadi, *Graduate Student in Computation and Neural Systems*

CHRISTOPHE TERRASSON

Senior, Mechanics; ENSIETA

DrawCraft

Mentor: Joel C. Sercel, *Visiting Associate in Mechanical Engineering; Principal Investigator, JPL*

CHALITA THANYAKOOP

Junior, Bi

Cytochrome C Gene Hunt in Bacterium *Rhodopseudomonas palustris*

Mentor: Jay R. Winkler, *Member of the Beckman Institute*

ADAM THOMASON

Howard Hughes Medical Institute SURF Fellow
Junior, CS/Bi

Expanded Uses of Monte Carlo Techniques in Protein Design

Mentor: Stephen L. Mayo, *Associate Professor of Biology; Assistant Investigator, Howard Hughes Medical Institute*

BRYAN TIEDEMANN

Dr. and Mrs. William H. Pickering SURF Fellow
Junior, ChE

Solar Energy Conversion II

Mentor: Harry B. Gray, *Arnold O. Beckman Professor of Chemistry*

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Mr. and Mrs. Dean C. Daily II SURF Fellow
Sophomore, Ph

Precise Measurements of the Equation of State of ^{4}He Gas Using a Superconducting Microwave Cavity

Mentor: Nai-Chang Yeh, *Professor of Physics*

KATHRYN TODD

Dr. and Mrs. George N. Boone SURF Fellow
Senior, Ph/Lit

Civic and Domestic Virtue: Jane Austen and the Reaction to the French Revolution

Mentor: Kevin M. Gilmartin, *Associate Professor of Literature*

MELISSA TODD

Honeywell SURF Fellow
Junior, CS

A Modular, Object-Oriented Software Package for Steady, One-Dimensional Compressible Flow

Mentor: Timothy E. Colonius, *Associate Professor of Mechanical Engineering*

JEREMY TOLLEFSON

Northern California Associates SURF Fellow
Junior, Ay

A Closer Look at Galaxies From the Hubble Deep Field

Mentor: Roger D. Blandford, *Richard Chace Tolman Professor of Theoretical Astrophysics*

OMAR TORRENS

The James Irvine Foundation MURF Fellow
Junior, APh/Ma; Grove City College

Maxwell's Demon and Information Theory

Mentor: Chris Adami, *Senior Research Fellow in Computation and Neural Systems*

KEVIN TUBBS

NSF REU SURF Fellow
Senior, Ph; Southern University

Gravitational Gradient Measurements at LIGO Livingston Observatory (LLO)

Mentor: Mark Coles, *Member of the Professional Staff in Physics*

JENNIFER TUNG

Carel and Mary Otte SURF Fellow
Junior, Bi

The Isotopic Fractionation of Biologically Produced Nitrous Oxide

Mentor: Paul O. Wennberg, *Associate Professor of Atmospheric Chemistry and Environmental Engineering Science*

LISA TURNER

Junior, Molecular and Cell Bi; University of California, Berkeley

Functional Studies of the Human Neuronal Nicotinic Acetylcholine Receptor

Mentor: Henry A. Lester, *Professor of Biology*

MICHELLE VALDEZ

Sophomore, Ch

NMR Studies of Ruthenium Carbon Bond Forming Reactions

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

AL VALDIVIA

Bob and Carole Chapman Minority SURF Fellow
Junior, ChE

In vivo Site-Directed Incorporation of a Non-Natural Amino Acid

Mentor: David A. Tirrell, *Ross McCollum–William H. Corcoran Professor and Professor of Chemistry and Chemical Engineering*

LISA VAN HOOZER

Edward W. Hughes SURF Fellow
Senior, Ch

Protein Folding in Cytochrome b_{562}

Mentor: Jay R. Winkler, *Member of the Beckman Institute*

VIRGINIA VASSILEVSKA

Sophomore, Bi

Expression and Purification of r144 and MC080R

Mentor: Pamela J. Bjorkman, *Professor of Biology; Investigator, Howard Hughes Medical Institute*

PHILIP VENTURELLI

Junior, Ay

Integration, Test, and Documentation of the Blue Channel of the Low Resolution Imaging Spectrometer for the Keck Telescope

Mentor: Charles C. Steidel, *Professor of Astronomy*

ALLEN VICTOR

Senior, Ae/EAS; California Polytechnic State University, San Luis Obispo

LATIS Mars Polar Mission: Launch, Trajectory, Orbits, and Propulsion

Mentor: Lloyd C. French, *Systems Architect, JPL*

TRAVIS WADDINGTON

Richter Scholar
Junior, Ma

Triangle-Determined Isometries and a New Property of the Euler Line

Mentor: Alberto Candel, *Olga Taussky–John Todd Instructor in Mathematics*

GINGER WALDEN

Sophomore, EE; Rice University

Laser Interferometer Space Antenna: Understanding the Gravitational Forces on the Proof Mass

Mentor: William M. Folkner, *Principal Engineer, JPL*

DANYA WALKER

Amgen MURF Fellow
Senior, Bi; Xavier University

Muscle Movement in *C. elegans*

Mentor: Paul W. Sternberg, *Professor of Biology; Investigator, Howard Hughes Medical Institute*

CHENYANG WANG

NSF REU SURF Fellow
Junior, Ph

Wireless Electrostatic Mirror Actuating System

Mentor: Riccardo DeSalvo, *Member of the Professional Staff in Physics*

JIALAN WANG

Axline SURF Fellow
Freshman

Survival of the Fittest vs. the Flattest

Mentors: Chris Adami, *Senior Research Fellow in Computation and Neural Systems*, and Claus O. Wilke, *Postdoctoral Scholar in Computation and Neural Systems*

RUI WANG

Dave and Karen Rossum SURF Fellow
Junior, Ch

Perception and Auditory-Visual Localization in Human Infants

Mentor: Shinsuke Shimojo, *Professor of Biology*

SIDNEY WANG

Howard Hughes Medical Institute SURF Fellow
Junior, Ch

Disulfide Trapping of the Open State of the MscL Protein From *Mycobacterium tuberculosis*

Mentor: Douglas C. Rees, *Professor of Chemistry; Investigator, Howard Hughes Medical Institute*

YINGBING WANG

Mr. Robert E. Anderson SURF Fellow
Sophomore, ChE

Directed Evolution of the α-Amylase Gene from *Pyrococcus furiosus*

Mentors: Frances H. Arnold, *Dick and Barbara Dickinson Professor of Chemical Engineering and Biochemistry*, and Holger Berk, *Postdoctoral Scholar in Chemical Engineering*

RUSSELL WATSON

Senior, Ch; Clemson University

Synthesis and Crystallization of Cobalt (III) Schiff Base Complexes

Mentor: Thomas J. Meade, *Senior Research Associate in Biology*

MEGHA WATUGALA

Sophomore, CS

Modeling Terrain Exploration in Primates

Mentor: Alan H. Bond, *Lecturer in Computer Science*

KEISHA WILLIAMS

NSF REU SURF Fellow
Senior; Southern University

The Global Diagnostic System

Mentors: Kenneth G. Libbrecht, *Professor of Physics*, and Szabolcs Marka, *Postdoctoral Scholar in Physics*

LESLIE WILLIAMS

Howard Hughes Medical Institute SURF Fellow
Junior, ChE/ME; University of California, Davis

Determinations of the Conformations of Succinic Acid as a Function of Solvent Polarity via NMR Spectroscopy and the Altona-Haasnoot Equation

Mentor: John D. Roberts, *Institute Professor of Chemistry, Emeritus*

SETH WILSON

Junior, ACM; University of Colorado

CCD Observations of Asteroids and Comets

Mentor: Paul R. Weissman, *Senior Research Scientist, JPL*

FARRAH WONG

Howard Hughes Medical Institute SURF Fellow
Senior, Psy; University of California, Los Angeles

Characterization of the *TARANTULA* Gene and Mapping of the *shootmeristemless* Enhancer in *Arabidopsis thaliana*

Mentors: Elliot M. Meyerowitz, *Professor of Biology*, and Eva Ziegelhoffer, *Postdoctoral Scholar in Biology*

TUCK SENG WONG

National University of Singapore Exchange
Junior, ChE; National University of Singapore

Directed Evolution of Cytochrome P450 Catalysis

Mentor: Frances H. Arnold, *Dick and Barbara Dickinson Professor of Chemical Engineering and Biochemistry*

THEOPHOLIEUS WORRELL

Howard Hughes Medical Institute MURF Fellow
Senior, Ch; Xavier University

Characterization of the *OOKPIK* Mutant in *Arabidopsis* Flower Development

Mentors: Elliot M. Meyerowitz, *Professor of Biology*, and Carolyn K. Ohno, *Senior Research Fellow in Biology*

MARCUS WORSLEY

Ford Motor Company MURF Fellow
Senior, ChE; Michigan State University

Thin Film Growth of MgO by Ion Beam-Assisted Deposition

Mentors: Harry A. Atwater, Jr., *Professor of Applied Physics and Materials Science*, and Rhett T. Brewer, *Graduate Student in Chemical Engineering*

GILEAD WURMAN

Junior, Geoph

Exploration of Applications of a Vacuum-UV Laser-Ablation Microprobe to *in situ* Analysis of Stable Isotope Ratios in Geologic Samples

Mentor: John M. Eiler, *Assistant Professor of Geochemistry*

YUJIRO YAMADA

NSF REU SURF Fellow
Senior, Ph; Yale University

Commissioning the Tidal Compensation Servo

Mentor: Joseph Giaime, *Assistant Professor of Physics, Louisiana State University*

MUHAMMED YILDIRIM

Richter Scholar
Junior, EE

Understanding the Mechanism of the Electron Transfer in Photosynthesis

Mentor: Hideo Mabuchi, *Assistant Professor of Physics*

JESSICA YOHE

Junior, Bi

Spectroscopy of Leaves to Determine the Health of a Plant

Mentor: Arthur L. Lane, *Principal Staff Member, JPL*

JOHN YOUNG

Senior, Interdisciplinary Science; Purdue University

Design and Synthesis of a Precursor Compound for Co(III) Schiff-Base Complexes

Mentor: Thomas J. Meade, *Senior Research Associate in Biology*

KISHA YOUNG

Howard Hughes Medical Institute MURF Fellow
Junior, Bi/Premed; Florida A&M University

Project 2d12: The Constitution of an Endodermal Expressor

Mentors: Eric H. Davidson, *Norman Chandler Professor of Cell Biology*, and Albert Erives, *Postdoctoral Scholar in Biology*

ROUSSISLAVA ZAHARIEVA

Dr. Chandler C. Ross SURF Fellow
Senior, EAS

Investigation of the Deformation and Failure Properties of Dionysus-Pentelicon Marble

Mentor: Ares J. Rosakis, *Professor of Aeronautics and Applied Mechanics*

BRADLEY ZAMFT

NSF REU SURF Fellow
Senior, Applied and Engineering Physics; Cornell University

Laser Frequency Sensor Noise Using the LIGO End-to-End Software Package

Mentor: Richard L. Savage, Jr., *Member of the Professional Staff in Physics*

JACOB ZASADA

Mr. and Mrs. Victor V. Veysey SURF Fellow
Junior, Ec

Study of Siderophore Expression in *Shewanella oneidensis*

Mentor: Dianne K. Newman, *Clare Boothe Luce Assistant Professor of Geobiology and Environmental Engineering Science*

DAVID ZHANG

Axline SURF Fellow
Freshman

Spectral Hole Burning: Diffraction Efficiency and Multiplexing

Mentor: Demetri Psaltis, *Thomas G. Myers Professor of Electrical Engineering*

PEI ZHANG

Ford Motor Company SURF Fellow
Junior, EE

Micro-Controller Controlled Switching Power Converter

Mentor: Glen A. George, *Lecturer in Computer Science and Electrical Engineering*

SUMMER ZHANG

Senior, Ch

Statistical Analysis for Gene Expression Data

Mentors: Hongyu Zhao, *Associate Professor of Epidemiology and Public Health, Yale University School of Medicine,* and James M. Bower, *Professor of Biology*

LEGEND

Ae	Aeronautics
ACM	Applied & Computational Mathematics
APh	Applied Physics
Ay	Astronomy
Bi	Biology
Bioch	Biochemistry
Bioph	Biophysics
CE	Civil Engineering
Ch	Chemistry
ChE	Chemical Engineering
CNS	Computation & Neural Systems
CS	Computer Science
EAS	Engineering & Applied Science
Ec	Economics
ECE	Electrical & Computer Engineering
EE	Electrical Engineering
Eng	Engineering
Env	Environmental Engineering
Ge	Geology
Geoch	Geochemistry
Lit	Literature
Ma	Mathematics
ME	Mechanical Engineering
Ph	Physics
Psy	Psychology
PlSc	Planetary Science
SES	Science, Ethics, & Society
SS	Social Science

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SURF's mission supports Caltech's educational purpose: to train the creative type of scientist or engineer urgently needed in our educational, governmental, and industrial development. SURF provides a new dimension to the process of undergraduate education; program participants apply knowledge gained in the laboratories and classrooms toward finding solutions to problems at the frontiers of science and technology. SURF graduates, with their sophisticated and practical knowledge of how to conduct research, have a marked advantage as they begin their careers, apply to graduate schools, or look for jobs in industry.

SURF draws upon the world-renowned research resources and expertise available at Caltech. Indeed, it is the experienced faculty and technical advisors working with outstanding students who have helped to make SURF the excellent program that it has become since its beginnings in 1979.

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