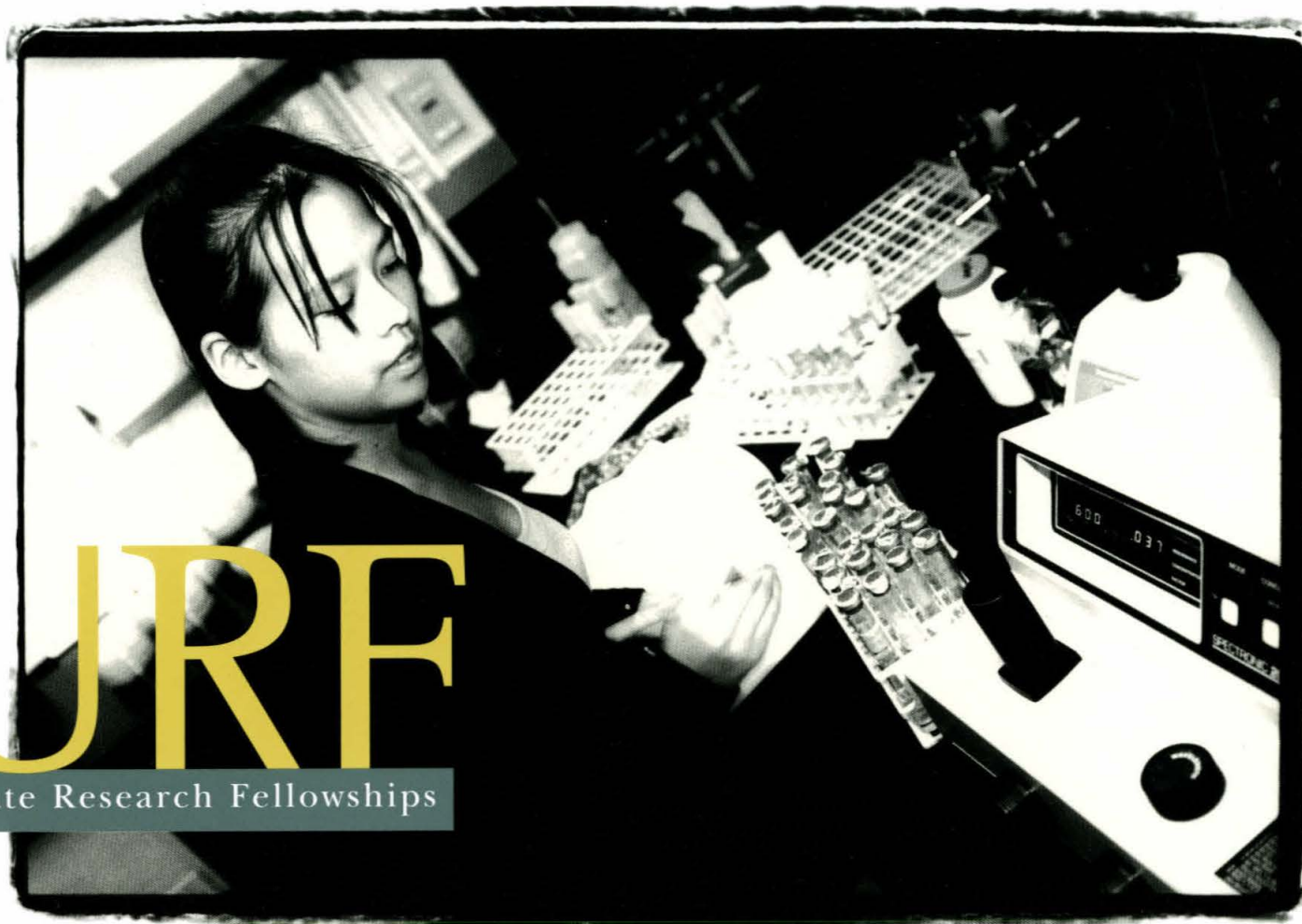


SURF

Summer Undergraduate Research Fellowships



Annual Report 2001

History of SURF

When then Professor of Chemical Engineering Fred Shair created SURF in 1979, he included important elements that remain at the core of the program. Students collaborate with mentors to define and develop a project prior to writing a research proposal. A faculty committee reviews the proposals and SURF awards are made on the basis of reviewer recommendations and available funds. Students work on their projects over ten weeks in the summer, and at the conclusion they submit technical papers and give oral presentations. The essence of SURF is the tutorial interaction between student and mentor.

Eighteen students worked with 17 mentors the first summer. Since then, the program has expanded to 346 students and 189 mentors.

Dedication

SURF 2001 is dedicated to Dr. William Whitney, Deputy Manager of Educational Affairs and Division Technologist in the Observational Systems Division at JPL. This dedication recognizes his extraordinary contributions to the program over the past twenty years. He has brought creativity, energy, and enthusiasm to the program and its students. SURF is richer because of his involvement. We are delighted to honor him through this dedication.

SURF has been dedicated to the following people:

1985	Dr. Ernest Swift	1994	Dr. Edward C. Posner
1986	Dr. Lee A. DuBridge	1995	Mr. Samuel P. Krown
1987	Dr. Robert P. Sharp	1996	Dr. Edward B. Lewis
1988	Dr. Ray D. Owen	1997	Dr. Harold Brown
1989	Dr. Hans W. Liepmann	1998	Dr. Thomas E. Everhart
1990	Dr. Fredrick H. Shair	1999	Dr. Ward Whaling
1991	Dr. Lew Allen Jr.	2000	Dr. Terry Cole
1992	Dr. John D. Roberts	2001	Dr. William Whitney
1993	Dr. Robert E. Bacher		

In Memoriam

We were saddened at the death of Dr. Glen Cass, Professor of Environmental Engineering Science at Caltech. As one of the foremost researchers in his field, he was known throughout the world and often was called upon to speak and collaborate. He was an outstanding mentor to nine SURF students and a charter member of the AdComm. Glen exhibited a deep commitment to the Institute, its students, and his colleagues. It is faculty like Glen that have made Caltech a recognized leader in research and education.

COVER

Jennifer Tung. Photo by Nina Pratt.

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his year SURF celebrates its 23rd program. I am proud of this program, which is one of the jewels in Caltech's crown. SURF helps to make Caltech a world leader in research and education.

Through SURF, students join the community of researchers and scholars. They have the unparalleled opportunity to probe nature's secrets or to create new devices or processes. Participants begin to learn the language and concepts of their disciplines. Their research roots develop in the environment of inquiry, analysis, and scientific ethics. The joys and struggles of solving new problems deepen their understanding of the process of science and engineering. Through their presentations on SURF Seminar Day, students are introduced to the importance and value of communicating their work.

I want to personally thank the large supportive, enthusiastic community that works to ensure that SURF remains a rich and dynamic program. The mentors and their research groups, the SURF Board, the SURF Administrative Committee, donors, alumni, volunteers, corporate and foundation representatives, and administrative staff—all of these individuals and groups contribute to the success of SURF. This cadre numbers over 1000! Thank you for your leadership, your support, your hard work, and your loyalty to SURF and to the Institute.

We will strive toward our goal of fully endowing the SURF program. The Institute will assure the continuity of the program and will remain responsive to the changing needs of our faculty and the undergraduate researchers with whom they work. SURF's future is bright with the creativity and synergy generated in the community of researchers and scholars. On to another great year!

A handwritten signature in black ink, appearing to read "David Baltimore", with a stylized flourish at the end.

David Baltimore
President

ROBERT C. PERPALL

Chairman, SURF Board



In the 1970s, Professor Fred Shair had a dream of Summer Undergraduate Research Fellowships at Caltech, and 1979 saw the first summer of funded student research under the new program known as SURF. Eighteen students collaborated with 17 faculty members that first year. Now in its twenty-third year, SURF has grown to almost 350 participants. Nearly a third of these come from other universities around the world!

The SURF Board was formed in the early days of the program as a voluntary support organization of individuals dedicated to the educational values of undergraduate research at Caltech, and who, through their advice, encouragement, and financial support, contribute to the vitality, continuity, and effectiveness of the SURF program.

This year the SURF Board began implementation of our Longer-Range Plan. John Gee led the effort to establish a SURF Alumni Network in cooperation with the Caltech Alumni Association. John Glanville, Ward Whaling, and Bill Whitney formed an ad hoc committee to study policy for funding SURF stipends for students from universities other than Caltech. Joanna Muir, aided by the able staff of the Caltech Student-Faculty Programs Office,

again organized an outstanding Donor Appreciation Dinner. Bill Whitney was chairman of the Membership/Nominations Committee that included Peter Mason and Doug Nickerson. They nominated John Glanville as Chairman and John Gee as Vice-Chairman for the next two years. Dr. Robert Ritchie, Vice President for Education, Huntington Art Gallery, and Sean Upchurch, a Caltech SURF alumnus, were nominated as new SURF Board members.

Carolyn Merkel conducted a pilot study for the Association of American Universities on "Undergraduate Research at Six Research Universities." Included in the study were Rutgers University, University of Washington, University of Illinois at Urbana-Champaign, Emory University, Massachusetts Institute of Technology, and Caltech. Carolyn was well qualified to conduct this study since she has been associated with SURF since its inception, serving as Director since 1989. She published her very interesting report in May of this year.

We were saddened this year by the passing of long-time Board member Victor Veysey. Vic was a personal inspiration to me as we worked together to emphasize the importance of good communi-

cation to the students. I miss his advice, encouragement, and friendship.

SURF 2001 was dedicated to Dr. William Whitney at the annual Kickoff Dinner in April when Dr. Ed Stone, retired director of JPL, was our speaker. This dedication recognizes Bill's many contributions to SURF.

Our endowment continues to grow with the equivalent of three endowed stipends provided from the estate of Dr. Marcella Bonsall, a long-time Board member; a full stipend endowment in memory of Dr. Terry Cole; and the establishment of the Rossum Family SURF Endowment. We have reconfirmed our long-range goal of a \$10 million endowment and are about half way there.

It has been a real honor and pleasure to be chairman of the SURF Board for the past two years. My association with the very bright students in the program has been particularly rewarding. Thank you to all the Board members who have made my term of office gratifying. I look forward to continuing to serve on the Board under the chairmanship of John Glanville.

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.

In recognition of the growth of the SURF program and our continuing desire to provide the highest quality research experience, in June we held our second "Mentor Orientation" session on the opening day of SURF. Some of Caltech's most thoughtful mentors—Harry

Gray and Melany Hunt—shared their thoughts and experiences with a large group of new and returning SURF mentors. Many of the graduate students and faculty who participated have never worked with undergraduates before. The message they received is that good mentoring is a skill worth perfecting and can be very rewarding for the mentor as well as the student.

As I complete my term as AdComm chair, I would like to thank the committee, the faculty and graduate students who served as SURF mentors or who reviewed proposals and presentations, the SURF staff, and particularly Director Carolyn Merkel for yet another very successful SURF summer. I am very pleased that Fred Shair has agreed to chair the committee. Fred's strong leadership in the founding and development of SURF brought the program national recognition, and the program will continue to benefit from his vision and energy.

UNDERGRADUATE RESEARCH THROUGH SURF

Since 1979, the SURF program has grown from 18 students working with 17 mentors the first summer, to 346 students and 189 mentors. The program has expanded to include students working on campus and at JPL, the addition of non-Caltech student participants, and Caltech students doing SURFs at other universities in the US and abroad. The SURF model—with its rigorous application, proposal, and review procedures; its broad range of professional development activities and social events; and its oral and written reporting requirements—has been adopted, not only at other institutions, but also within Caltech itself. SURF now comprises six other programs that provide funding for particular groups. The focus of all the programs under the SURF umbrella is undergraduate research, the collaboration between mentor and protégé.

The MURF (Minority Undergraduate Research Fellowships) program provides support for talented non-Caltech students underrepresented in the sciences and engineering to spend a summer doing research with faculty on the campus. This year 33 students participated in the program.

The Beckman Scholars program, funded by a grant from the Arnold and Mabel Beckman Foundation, allows two biology or chemistry students to do research over two sum-

mers and the intervening academic year. The grant also provides money for students to attend conferences and buy the supplies and equipment they need for their research.

The purpose of the JPL Undergraduate Scholars (JPLUS) program is to recognize and encourage scholarly achievement and creativity in students majoring in engineering, mathematics, computer science, and the physical sciences at 25 local community colleges. The students have the opportunity to apply for a SURF during their undergraduate careers. This summer seven JPLUS students participated in SURF.

Six students participated in the Axline SURF program this summer. The program allows selected incoming freshmen to do research with Caltech faculty or JPL technical staff.

Caltech-National University of Singapore Exchange program brought three NUS students to the campus while three Caltech students are doing research at NUS. Students gain the undergraduate research experience while broadening their perspectives through living and working in another country.

Caltech-Cambridge Exchange brought nine students from Cambridge to the campus this summer. Nine Caltech students attended classes at Cambridge during the 2000-01 academic year.

The essence of SURF is the interaction between mentor and protégé. Carolyn Merkel interviewed four groups of mentors and students. These are their stories.

ERIK POUNDERS and BOB ANDERSON

Erik Pounders is a student at Pasadena City College. He received a JPLUS award in 1999, which gave him the chance to apply for a SURF and fulfill one of his goals: to get involved in research.

Erik had many connections at both JPL and PCC, and that helped him find his SURF mentor. His astronomy teacher at PCC, John Sepikas, encouraged Erik to do such extracurricular activities as working at Griffith Observatory and participating in the VESTA (Visiting Educational Scholars and Teachers Alliance) program at JPL. Through VESTA, community college students help answer questions sent to JPL by the public. Students enhance their knowledge base and develop good searching skills. Through his VESTA experience, Erik was introduced to JPL.

Erik met his mentor, Dr. Robert Anderson, a member of the technical staff at JPL, when Anderson taught a course Erik took at PCC. When it came time to look for a mentor, Anderson was a natural choice. They are working on a digital analysis of the geologic structures of the eastern hemisphere of Mars.

Bob Anderson came to JPL in 1997 as a postdoctoral fellow working on the Mars Pathfinder Project. He has a long-time interest in education, has been a teacher, and has been involved in outreach. When Erik contacted him, Bob already had several ideas for good SURF projects.

Bob said, "I enjoy working with Erik, and the program is a real benefit. I didn't have to worry about doing the administrative work to bring Erik in because the SURF office took care of that. The JPLUS program pays his stipend, so I have no financial obligation. The work is valuable, and it is important that we get this project done." Bob often invites Erik to join him and

his colleagues for lunch in the cafeteria. Erik has learned a lot about the project, about science and engineering, and about JPL through these lunchtime conversations.

In his spare time, Erik works at the Griffith Observatory as an interpretive guide to help educate the public on science in general and on the telescope in particular. At PCC he works in the geology stockroom supplying minerals and rocks for faculty, and he helps prepare teaching labs. He is also president of the Geology Club. Erik enjoys travel and has been to Australia, Europe, and many parts of the U.S.



Above: Sossina Haile, Assistant Professor of Materials Science (left), and Lala Espinosa, The James Irvine Foundation MURF Fellow (right).

Page 7 (left to right): Claus Wilke, Postdoctoral Scholar in Computation and Neural Systems; Chris Adami, Faculty Associate in Computation and Neural Systems; and Jialan Wang, The Associates SURF Fellow.





JIALAN WANG and CHRIS ADAMI

Jialan Wang completed her freshman year at Caltech in June. As a 2000 Axline SURFer, she worked with Dr. Christoph Adami, a faculty associate and lecturer in computation and neural systems. Jialan is extremely pleased to be the second author of an article in the July 19, 2001, issue of *Nature*, "Evolution of Digital Organisms at High Mutation Rates Leads to Survival of the Flattest," which resulted from her project last summer.

Jialan explains that digital "life" is governed by the same general principles as organic life. The software she worked with creates an environment that propagates populations of digital organisms (as opposed to populations of other organisms, say, bacteria). Digital organisms are little computer programs, and the software creates a virtual world in which they live.

Digital organisms share many features of biochemical organisms. As Chris explains, "We find more similarity than we find differences, and we can often predict a novel effect that will likely also exist in biochemical organisms. I believe that Jialan's project will be the first time that an effect has been seen in

'alien life' rather than terrestrial life."

Chris Adami came to Caltech in 1992 as a postdoctoral fellow in the lab of Steve Koonin, Caltech Provost and a professor of theoretical physics. That experience also was his introduction to the SURF program because Professor Koonin always has undergraduates working in his lab. Chris has mentored SURFers most summers since then. He didn't know about the Axline program when he got a call from the Student-Faculty Programs Office asking whether he would be willing to work with a pre-freshman, but one look at Jialan's application convinced him that he should work with her. "I guess I was shown to be right!" he says.

The offer to do research the summer prior to her freshman year was definitely part of Jialan's decision to come to Caltech. She had done research at the University of Memphis the year before, and knew she wanted to continue with it. She has decided to major in math and physics. A semi-finalist in the 2000 Doris S. Perpall SURF speaking competition, Jialan also won a Marcella and Joel Bonsall prize for technical writing. She was a member of the award-winning Caltech cheerleading squad, and also plays chamber music. She has maintained

her Axline connection as a program associate this year and continues to work with Dr. Adami as a SURF.

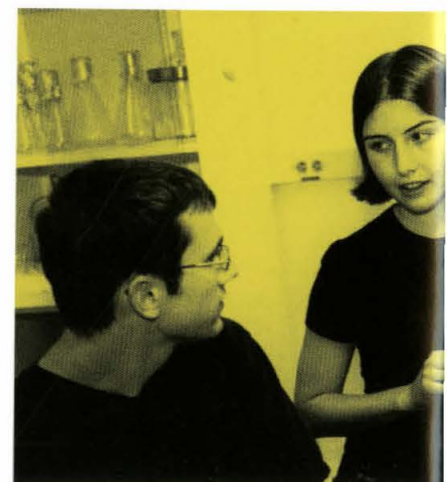
Jialan says, "The *Nature* article is the most exciting thing that has ever happened to me. I didn't really believe that what I was doing was so important. I was just glad to be part of something. It has been fantastic. I hope I can live up to that promise."





Above: Jamii St. Julien, Howard Hughes Medical Institute MURF Fellow.

Lower right: John Joern, graduate student in chemical engineering (left), and Lillian Pierce (right).



LILLIAN PIERCE and FRANCES ARNOLD

Lillian Pierce, a junior math major at Princeton University, worked this summer with Frances Arnold, Dickinson Professor of Chemical Engineering and Biochemistry, and John Joern, third-year graduate student in chemical engineering.

When she started her SURF, Lillian's career goals included earning an M.D./Ph.D. and working on some aspect of the protein-folding problem in order to investigate diseases like cancer and Alzheimer's. Lillian wanted to have a research experience before she applied to medical school, but now that she has done research, her plans have changed. She is thinking about obtaining a Ph.D. in mathematics and becoming a math professor. She has discovered that although she enjoys being in a laboratory, she loves math and wants to make it her career.

A current research focus of the Arnold group is directed protein evolution, a promising method for breeding novel molecules in the laboratory for biotechnological uses. One of the key steps in the directed-evolution process is making a "library"—a population of millions of related DNA sequences

from which the useful ones will be extracted. Lillian's SURF project focuses on how to make optimal libraries for directed evolution by recombining parental genes that have been discovered in nature.

This summer *Glamour* magazine notified Lillian that she was a winner of its Top Ten College Women award for her significant academic achievements and her outstanding contributions to the community. This award lengthened an already impressive list of awards including *USA Today's* All-USA College Academic First Team for outstanding intellectual achievement and leadership, and a Goldwater Scholarship. She was also a co-winner of the Class of 1939 Princeton Scholar Award for having the highest grades at Princeton for her first three years.

This is John's first mentoring experience, and he enjoys it. Teaching Lillian helps him identify holes in his own understanding. "It is fun to work closely with someone and to share the ups and downs of research," he says.

Frances Arnold likes having undergraduates in her research group. "They are a breath of fresh air in the lab. They bring enthusiasm to science, and they offer a new perspective. Older graduate students and postdocs get to practice

mentoring, to explain their research to younger people," she says.

Frances has chaired the SURF Administrative Committee for the past two years, a demonstration of her belief in the value of undergraduate research and of her support of the SURF program. She says, "Caltech is a tough place, and sometimes students lose their passion for science through the rigorous course work. SURF helps make up for that."



(Left to right): Lillian Pierce, John Joern, and Frances Arnold.





Above: James Hone, postdoctoral scholar in physics, and Joseph de Jesus, Richter Scholar.



Upper right: Alexis Lueras, Howard Hughes Medical Institute MURF Fellow, and Claire Mitchell, Caltech-Cambridge Exchange student.

THE BARTON GROUP

Jacqueline Barton, Arthur and Marian Hanisch Memorial Professor and Professor of Chemistry, mentors several SURF and MURF students, and her group represents a microcosm of the SURF program.

"I have had undergraduates in my lab every year. I got excited about chemistry in the first place when I did research at Barnard College and then at Hunter College when I was a student," she says. She makes sure that every student she takes into her lab has his or her own project. "They are almost always small projects, but students need to have a project so they have ownership." She also notes that although she does not do the daily supervising of students, she carefully selects the graduate students in the group who will do it. She thinks the resulting relationships are an important benefit for both the graduate students and the undergrads.

Dr. Eric Stemp, a former post-doctoral fellow in the Barton group, is now a visiting associate at Caltech as well as an associate professor of chemistry at Mount St. Mary's College. He, too, did research as an

undergraduate student at the University of Denver. He enjoyed working independently, and he gained confidence through his research experiences. As a graduate student at Northwestern, he began to mentor undergraduates, found it to be a great experience, and knew he wanted to help students do research when he became a professor.

Alexis Lueras and Eunice Rivas are both MURF students from Mount St. Mary's College. Alexis was a MURF student last year. "It was exhausting!" she exclaims. "I was not sure what I was doing, and I had to work very hard, but everyone in the lab was so supportive. It made the experience rewarding. At the end of the summer I asked to come back this year."

Alexis discovered one of the benefits of doing undergraduate research in her biochemistry class at Mount St. Mary's. "The course was a lot easier. Everything seemed to make sense right away. I already knew the techniques and got to practice them in the lab course," she says. She plans to go to graduate school and eventually to become a research scientist.

Eunice, who is planning to attend medical school, didn't really think she would like doing research. She was surprised to dis-

cover she enjoys it. "It is fun. It is a lot easier to do research when it is the only thing you are doing; you are not balancing it around classes and homework," she said. "It has changed my view of research. I am now thinking about doing an M.D./Ph.D."

Claire Mitchell, a participant in the Caltech-Cambridge Exchange program, says undergraduate research is not a common activity for British students, although she did work in a lab in Germany last summer for two weeks as a research assistant. She likes the SURF scheme better. "The other people in the lab are prepared to work with students and they are helpful and supportive. I have learned a lot," she says. She enjoys having her own project to work on.

Kim Copeland, a fifth-year graduate student, supervised Alexis last summer, and this summer she is working with both Alexis and Claire. Helping to direct a student's research program is a valuable learning experience for her. "I realize all the things I do without really understanding why I do them," she says. She hopes to teach chemistry, perhaps in a small college, and mentoring students is great preparation for her own career.

Koun Han, a Caltech freshman, started working with graduate

student Sarah Delaney during third term. She has learned a lot and has already gotten some good results. When she tells people what she is doing, they often comment, "You are a freshman and you are doing research?"

"I feel like a SURFer myself!" says Sarah Delaney. "Sometimes Koun and I work on experiments together that neither of us has done before. Though I don't know any more than she does, I can give her some perspective on how to approach the work." Sarah is greatly impressed with what Koun is able to do on her own and at the results she has obtained already.

Jackie Barton maintains there is no program like SURF. "It is the best program in the country!" she says.



HIGHLIGHTS OF SURF 2001

Profile of the SURF 2001 Class

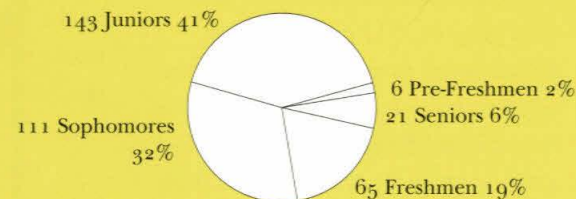
<i>Division</i>	<i>Total # of Students</i>	<i>CIT Students</i>	<i>Non-CIT Students</i>	<i>Research Mentors</i>
Biology	49	29	20	22
Chemistry and Chemical Engineering	51	34	17	28
Engineering and Applied Science	82	54	28	34
Geological and Planetary Sciences	23	18	5	15
Humanities and Social Sciences	11	8	3	9
Physics, Mathematics, and Astronomy	50	31	19	23
Jet Propulsion Laboratory	51	16	35	34
Off Campus	24	24	0	19
International	5	5	0	5
Total	346	219	127	189

Women 42%

Minorities 14%

Average Grade Point Average = 3.53/4.0*

* Caltech students only, excluding pre-fresh and freshmen



SURF statistics from the 2001 Graduating Class

Total number graduating: 202

Number of SURFers: 104 = 51%

Total number of graduates receiving honors: 89 = 44% of the graduating class

Number of SURFers receiving honors: 61 = 69% of the students receiving honors

Total number of prizes awarded: 103

Number of SURF students receiving prizes: 84 = 82%

SURF SUMMER PROGRAM

Caltech Wednesday Noon Seminars

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

R. MICHAEL ALVAREZ
Associate Professor of Political Science
Voting Project

DIANA BARKAN
Associate Professor of History
The Einstein Papers Project at Caltech

MARIANNE BRONNER-FRASER
Albert Billings Ruddock Professor of Biology
Molecular Analysis of Neural Crest Formation

CHARLES ELACHI
Director, Jet Propulsion Laboratory
Earth and Space Exploration in This Decade

SOSSINA M. HAILE
Assistant Professor of Materials Science
Fuel Cells: Powering Progress in the 21st Century

JULIA KORNFELD
Professor of Chemical Engineering
Biomedical Hydrogels via Self-Assembly

JARED LEADBETTER
Assistant Professor of Environmental Microbiology
Termites and Their Gut Microbes

KEN LIBBRECHT
Professor of Physics
Morphogenesis and the Physics of Snow Crystals

JPL Friday Noon Seminars

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

CLAUDIA ALEXANDER
Earth and Space Sciences Division
Non-Terrestrial Worlds as a Habitat for Life

CAGATAY BASDOGAN
Information Technologies and Software Systems Division
Multimodal Virtual Environments for Robust Remote Manipulation

BONNIE BURATTI
Earth and Space Sciences Division
Identification of the Lunar Flash of 1953
With a Fresh Crater on the Moon's Surface

KEVIN DELIN
Sensor Web Projects
The Sensor Web: A New Instrument Concept

LLOYD C. FRENCH
Observational Systems Division
Subsurface Exploration Technologies and Strategies for Europa

MARGIE HOMER
Telecommunications Science and Observational Systems Division
Operation of an Electronic Nose Aboard the Space Shuttle

A. LONNE LANE
Observational Systems Division
Development of Extreme Environment Systems for Seeking Out Extremophiles

MELORA LARSON
Mechanical Systems Engineering and Research Division
Low Temperature Research on the International Space Station

FRANK MILLS
Earth and Space Sciences Division
Atmospheric Measurements Above JPL's Table Mountain Facility 1997-2000

SUE SMREKAR
Earth and Space Sciences Division
Water on Mars

Professional Development

Workshops

The purpose of these sessions is to help students make short-term career decisions in the context of longer-term life and career goals. Topics address a variety of issues students will encounter as they enter graduate school or the workplace.

Session topics and participants:

COMMUNICATION IN CAREERS: Dr. William Whitney, Deputy Manager, Educational Affairs, JPL, and Ms. Carolyn Merkel, Director, Student-Faculty Programs

DEVELOPING CREDENTIALS AND MAKING CAREER PLANS: Dr. Jerry Houser, Director, Career Development Center, and Dr. Whitney

INTELLECTUAL PROPERTY: Dr. Richmond Wolf, Office of Technology Transfer

SCIENTISTS AS SPEAKERS: Dr. Kenneth Nealson, JPL Technical Staff

CREATING A COMMUNITY: NETWORKING AND MENTORING: Dr. Jo-Ann Fantino Ruffolo, Career Counselor, and Dr. John Davis, JPL Technical Staff

CAREER PANEL: WHAT CAN YOU DO WITH A TECHNICAL EDUCATION? Caltech alumni Ms. Jennifer Herman, Dr. Jason Hickey, Mr. Jonathan Little, Ms. Bonnie Wallace, and Dr. Whitney

THE NUTS AND BOLTS OF APPLYING TO GRADUATE SCHOOL: Ms. Jonie Watanabe Tsuji, Career Counselor; and graduate students Chris Boxe, Cynthia Hunt, Ellis Meng, Alex Tobias, and Tashica Williams.

Special Events

Dr. and Mrs. George Boone sponsored a special tour of the Huntington Library, Art Collection, and Botanical Gardens for SURF students. They also hosted a reception in their sculpture garden following the tour. We deeply appreciate the Boones' commitment to SURF and its students.

Jet Propulsion

Laboratory Tour

Dr. Whitney organized an excellent behind-the-scenes tour of JPL for SURF students.

COMMUNICATION PROGRAM

Awards and Prizes

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. Winners of the 2000 Doris S. Perpall SURF prize for oral presentation:

Kathryn Todd	1st prize
Loren Hoffman	2nd prize
Robb Rutledge	3rd prize
Benson Muite	3rd prize

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. Winners of the 2000 Marcella and Joel Bonsall prize for technical writing:

Jeff Barrick	Jesse Pino
Ilya Fushman	Molly Swanson
Po Loh	Jialan Wang
John Oh	

Conferences

SURF SEMINAR DAY was held on October 20, 2001, on the Caltech campus. The oral or poster presentation is a requirement of the SURF program. Students give their talks to an audience of peers, faculty,

mentors, alumni, donors, families, and prospective students in close to 20 parallel sessions.

NATIONAL CONFERENCE ON UNDERGRADUATE RESEARCH (NCUR) drew over 2,000 undergraduates, faculty, and administrators to the University of Kentucky in April 2001. Students presented their research, scholarly, and creative activities in oral and poster sessions.

Presenters in 2001:

Elisa Chan
Robb Rutledge
Lakshminarayan "Ram" Srinivasan

SOUTHERN CALIFORNIA CONFERENCE ON UNDERGRADUATE RESEARCH (SCCUR) is a multidisciplinary conference including the sciences, math, engineering, the humanities, the social sciences, art, and performance. Students from the region have the opportunity to see how research is carried out in various disciplines.

Presenters in 2000:

Haitham Abd El-Moaty, *University of Oklahoma*
Mark Bilinski
Arcelia Gonzalez, *Mount St. Mary's College*
Michelle Koutnik, *University of California, Los Angeles*
Kristina Kurbanyan, *Mount St. Mary's College*
Alexis Lueras, *Mount St. Mary's College*
Elaine Ou
Robb Rutledge
Sindy Tang

SURFSAC EVENTS and ACTIVITIES

SURFSAC

The role of the SURF Student Advisory Council is to provide student input in the planning and implementing of the SURF program and to serve as liaison between the students and the Student-Faculty Programs office.

Caroline A. Gibbs, *Chair*
Craig E. Countryman, *Vice Chair*
Randie H. Kim, *Secretary*
Qi "Janet" Zhou, *Secretary*
Jialan Wang, *Treasurer*
Derek M. Shannon, *Movie Coordinator*
Lerone D. Banks, *MURF representative*
Abelardo Bourbois, *Caltech Y representative*
Ted E. Jou
Basit A. Khan
Suhaz R. Nayak
Tod A. Pascal, *MURF representative*
Curtis W Pehl
Mona A. Sheikh
Neha G. Soni, *Caltech Y representative*
Victoria "Tory" C. Sturgeon
Jennifer P. Tung
Marcus R. Williams
Merrett T. Wong



SURFSAC's mission is to strengthen the research community by coordinating social and cultural activities to bring SURF students and mentors together informally. Activities this summer included:

Ice cream social
Water games
Contact at the Ahmanson Theater
Girls-only sleepover
Extreme bowling
4th of July celebrations at Hollywood Bowl and at Lacey Park
Galaxy game
Dodger game
Getty museum
Walking tour of Pasadena
Universal City Walk
Magic Mountain
Tour of Union Station and downtown
Ice skating
Miniature golf
Beach trip
Full moon hike

SURFSAC Suppers

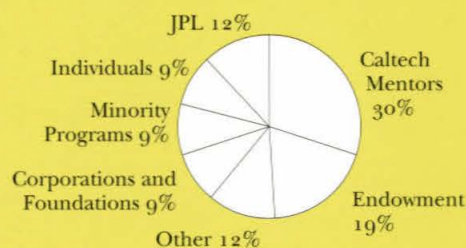
Among the most popular events were the SURFSAC Suppers. Each week two faculty members went to dinner with ten to twelve SURF students at local restaurants. These events give students and faculty the chance to converse informally away from the academic environment.

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SURF stipends are supported by gifts from individuals, private foundations, corporations, and endowment. The annual cost of one stipend is \$5,000. Research mentors pay all research costs and frequently fund a portion of a student's stipend. The stipend budget for this year was \$1.7 million. We thank the 127 annual donors for their generosity and support.

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Psychophysics of Configural Aftereffects in Visual Object Categorization

Mentor: Christof Koch, *Lois and Victor Troendle Professor of Cognitive and Behavioral Biology and Professor of Computation and Neural Systems*

MEGUMI ABE

Freshman, Ch

An Approach Toward the Enantioselective Oxidation of Aromatic Diols

Mentor: Brian M. Stoltz, *Assistant Professor of Chemistry*

ALYS ADAMSKI

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

Detecting Bio-Organic Molecules Using Scanning Fluorescence

Mentor: Arthur Lane, *Research Scientist, JPL*

MINTA C. AKIN

Sophomore, Ch

Corks, Crowns, and Acids: The Journey Toward Molecular Recognition of Arginine

Mentor: Jesse L. Beauchamp, *Mary and Charles Ferkel Professor of Chemistry*

JORGE I. ALARCON

NSF Center for the Science and Engineering of Materials MURF Fellow
Sophomore, ME; California State University, Los Angeles

Walking Machine for Gait Lab Calibration

Mentors: Joel W. Burdick, *Professor of Mechanical Engineering*, and Samuel Landsberger, *Professor, College of Engineering and Technology, California State University, Los Angeles*

MICHELLE K. ALLIS

NASA USRP
Sophomore, EAS (ME)

Absolute Differential Cross Sections for XE/XE Charge-Transfer Scattering at keV Energies

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

CATHERINE C. ALPAS

NSF Center for the Science and Engineering of Materials MURF Fellow
Freshman, EE/CS/Ma; California State University, Los Angeles

Establishing an Advanced Mobile Arm Support (MAS) for People With Muscular Weaknesses

Mentors: Joel W. Burdick, *Professor of Mechanical Engineering*, and Samuel Landsberger, *Professor, College of Engineering and Technology, California State University, Los Angeles*

MIHAIL AMARIE

Sophomore, Ph

Data Analysis in LIGO

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

ERIC K. ANDERSON

Sophomore, EAS

Real-Time Structural Health Monitoring

Mentor: James L. Beck, *Professor of Applied Mechanics and Civil Engineering*

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Junior, Lit; University of California, Santa Cruz

Chemistry Animation Project

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

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Junior, ISP

Encoding Sequences of Rules for Coordinated Collective Building

Mentor: Rodney M. Goodman, *Professor of Electrical Engineering*

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Howard Hughes Medical Institute MURF Fellow
Junior, Ch; University of California, Santa Cruz

Investigating the Effects of Endothelin Receptor B and a Possible Novel Endothelin Receptor Subtype in Metastasis and Angiogenesis

Mentor: Paul H. Patterson, *Professor of Biology*

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Richter Scholar
Junior, Ec/Ch

Financial Analysis of Historical Data Using Economic Principles Verified at Caltech

Mentor: Peter L. Bossaerts, *Professor of Finance*

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Junior, Ch

Selective Oxidation of Methane to Methanol

Mentor: John E. Bercaw, *Centennial Professor of Chemistry*

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Axline SURF Fellow
Pre-Freshman

Optical Tracking With Base-Pair Resolution of a Single RNA Polymerase Molecule During Transcription

Mentors: Stephen R. Quake, *Associate Professor of Applied Physics*, and Charles F. Spence, *Graduate Student in Applied Physics*

CLAIRE L. BADGER

Caltech-Cambridge Exchange
Junior, Ch; University of Cambridge

NMR Studies of 3-Methylglutaric Acid

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

BRIAN K. BAIRSTOW

Freshman, EAS (Ae)

Mars Surface Mobility Study: Polar Rover Concept Design

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

LERONE D. BANKS

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

Internal Representations and Consciousness in Autonomous Robotics

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

ZHAOSHENG BAO

SeeBeyond SURF Fellow
Junior, EAS

Deformable Models for 3D MRI Heart Segmentation

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

SANGEETA BARDHAN

Beckman Scholar
Sophomore, Bi

Searching for the cis-Regulatory Region of SpKrox1: An Endomesodermal Transcription Factor in the Purple Sea Urchin

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

JOSE L. BARRAGAN

NSF Center for the Science and Engineering of Materials
MURF Fellow
Junior, ME; California State University, Los Angeles

Ductility of Vitreloy 106 Metallic Glass

Mentors: Ersan Üstündag, *Assistant Professor of Materials Science*, and Neda S. Fabris, *Professor, Department of Mechanical Engineering, California State University, Los Angeles*

SUMMERDALE BECKSTRAND

Senior, Ph/Ay; Brigham Young University

Satellite Studies of the Polar Regions and Climate Variability: Synthesis and Development of Outreach Material

Mentor: Benjamin Holt, *Member of the Technical Staff, JPL*

TEODORA N. BELORESHKA

Junior, ACM

Relativistic Particle Physics Models and Cosmological Inflation

Mentors: Mark Trodden, *Assistant Professor of Physics, Syracuse University*, and Marc P. Kamionkowski, *Professor of Theoretical Physics and Astrophysics*

GIORGIO BERTOLOTTI

Senior, EE; Università degli Studi di Modena e Reggio Emilia

Background and Foreground Segmentation

Mentors: Pietro Perona, *Professor of Electrical Engineering*, and Arrigo Benedetti, *Staff Member in Electrical Engineering*

NAEEM BHATTI

Junior, Ma/Ph; University of Glasgow

Mechanical Losses in LIGO Mirror Coatings

Mentor: Phil Willems, *Staff Member in Physics*

IRAM P. BILAL

Thomas E. Everhart SURF Fellow
Freshman, EAS (Env)/Ec

Fabrication of DNA Bridges

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

MARK BILINSKI

Mr. and Mrs. Fred M. Wells SURF Fellow
Sophomore, Ma

Investigating Causes for the Fall of the Euro

Mentor: Simon J. Wilkie, *Assistant Professor of Economics*

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Sophomore, Ph

Discovering Distant Clusters of Galaxies

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

JEFFREY A. BLACKBURNE

Sophomore, Ph

Development of a Plate Solution Fitting Package for the Palomar Large Format Camera

Mentor: Fiona A. Harrison, *Assistant Professor of Physics and Astronomy*

JORDAN L. BOYD-GRABER

Richter Scholar
Freshman, EAS (CS)/H

Internet Film as an Evolutionary Medium

Mentor: Robert Rosenstone, *Professor of History*

AYANNA C. BRADSHAW-SYDNOR

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

The Role of Notch on the Ras/MAPK Pathway in T Lymphocyte Development

Mentors: José Alberola-Ila, *Assistant Professor of Biology*, and Gabriela Hernandez-Hoyos, *Postdoctoral Scholar in Biology*

JESSICA C. BROWN

Howard Hughes Medical Institute SURF Fellow
Junior, Molecular Bi; Pomona College

Characterization of Polymerase Epsilon in Sister Chromatid Cohesion

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

MATTHEW R. BUCKLEY

NASA USRP
Junior, Ph; Kenyon College

Construction of High Resolution Thermometers

Mentor: Melora Larson, *Senior Member of the Technical Staff, JPL*

SASCHA B. CALKINS

Honeywell SURF Fellow
Junior, ME

C-TOS: Thermal Control

Mentor: Joel C. Sercel, *Lecturer in Aeronautics*

NATALIA CAPORALE

Howard Hughes Medical Institute SURF Fellow
Junior, Bi; Universidad de Buenos Aires

Encoding of Hedonic Valence in Olfaction

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Proteolysis in Neurons Through the Ubiquitin-Proteasome Pathway

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

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Synthesis and Reactivity of ((2-tertbutoxy-phenyl)-QA)platinum(II)triflate

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

AISHA J. CHAMBLISS

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

Support of Mobile Robotics and Neuroprosthetics Circuit Design

Mentors: Joel W. Burdick, *Professor of Mechanical Engineering*, and Kristopher Kriechbaum, *Graduate Student in Mechanical Engineering*

NATHANIEL CHAN

Freshman, ME; Massachusetts Institute of Technology

A Biomorphic Robot Arm With Air Muscle Actuation, Sensor Array, and Neural Net Control

Mentor: Chris Assad, *Member of the Technical Staff, JPL*

CATHERINE E. CHANG

Freshman, EE/CS; Massachusetts Institute of Technology

Speed of Face Processing Under Conditions of Ultra-Rapid Visual Categorization

Mentor: Christof Koch, *Lois and Victor Troendle Professor of Cognitive and Behavioral Biology and Professor of Computation and Neural Systems*

EUGENE C. CHEUNG

Hugh F. and Audy Lou Colvin SURF Fellow
Sophomore, EAS (ME)

Digital Micro-Propulsion Design

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

ALISA M. CHING

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Junior, ChE

Identification and Characterization of
Long-Life Mutants in *Drosophila*
melanogaster

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

WENDY M. CHING

Junior, Bi

A Genetic Analysis of Human Disease
Genes Using *Drosophila* Homologs

Mentors: Ethan Bier, Professor of Biology,
University of California, San Diego, and
Marianne Bronner-Fraser, Albert Billings
Ruddock Professor of Biology

RICHARD CHIU

Richter Scholar
Junior, Ch

The Development of Fluorescence
Energy Transfer Probes for Cytochrome
P450cam

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Organic Chemistry and Biochemistry

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Sophomore, Ch

Investigation of Alkoxy Radical
Reactions Using Cavity Ringdown
Spectroscopy

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Professor of Chemical Physics

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Sophomore, Ge

A Structural and Chemical Analysis of
Green Lake, Kilauea Volcano, Hawaii

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Geology

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NASA USRP
Junior, Ay, Williams College

The Lightcurves and Opposition Phase
Curve of Triton in 2000

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Scientist, JPL

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Freshman, Bi/Ch

The Characterization of the Interaction
Between pol ϵ and pol K

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Chemistry and Biology

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Howard Hughes Medical Institute SURF Fellow
Junior, Bi

Characterization of the Distribution
Pattern of the Rat Staufer Protein
During the Expression of Synaptic
Plasticity

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

KATHY COOKSEY

Junior, Ph/Ch; Valparaiso University

Gravitational-Wave Signal Simulation for
LIGO

Mentor: Hiroaki Yamamoto, Member of the
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LONIQUE B. COOTS

Junior, Ph/Ay; The University of Texas at Austin

Acoustic Detection and Triangulation of
Thunders Around the LIGO Detector

Mentor: Szabolcs Marka, Postdoctoral
Scholar in Physics

DANIEL CORBETT

Caltech-Cambridge Exchange
Junior, Ph; University of Cambridge

Search for High Proper Motion Stars

Mentor: Michael E. Brown, Assistant
Professor of Planetary Astronomy

THOMAS R. CORBITT

Senior, Ph; Georgia Institute of Technology

Automated Measurement of Sideband
Power in the 2K Interferometer

Mentor: David Ottaway, Staff Member in
Physics

CRIS J. CORNELL

Honeywell SURF Fellow
Sophomore, EAS (Ae)

Digital Micro-Propulsion Design

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Mechanical Engineering

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The James Irvine Foundation MURF Fellow
Sophomore, ECE; Fullerton College

Localized Charge Injection in SiO₂ Films
Containing Silicon Nanocrystals

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

CRAIG E. COUNTRYMAN

Beckman Scholar
Sophomore, Ch

New Strategies for the Synthesis of
Pharmaceuticals: The First
Enantioselective Total Synthesis of
(S)-Ketorolac

Mentor: David W. MacMillan, Associate
Professor of Chemistry

EMILY M. CRAPARO

NASA USRP
Junior, Aeronautics and Astronautics;
Massachusetts Institute of Technology

Evaluations of Scanning Patterns for
Deep Space Network Antenna Control

Mentor: Wodek Gawronski, Principal
Engineer, JPL

PATRICIA L. CRUZ

The James Irvine Foundation MURF Fellow
Sophomore, Ma/CS; University of California, Berkeley

Optimization and Inverse Problems in
OCM

Mentors: Oscar P. Bruno, Professor of
Applied and Computational Mathematics,
and Mario J. Chaubell, Graduate Student
in Applied and Computational Mathematics

STEPHANIE J. CULLER

Sophomore, ChE; University of California, San Diego

Rheological Properties of a
Photopolymerizable Low Molecular
Weight Macromer in a
Polydimethylsiloxane Network

Mentor: Julia A. Kornfield, Professor of
Chemical Engineering

MARCO CURRELI

NSF Center for the Science and Engineering of Materials
MURF Fellow
Sophomore, Ch; California State University, Los Angeles

Synthesis and Characterization of
Zeolitic Inclusive Tin Nanoclusters

Mentors: Harry A. Atwater, Professor of
Applied Physics and Materials Science, and
Yong Ba, Professor, Department of Chemistry
and Biochemistry, California State
University, Los Angeles

MIAN DAI

Richter Scholar
Sophomore, EAS

Segmenting and Morphing Models
From Volumetric Datasets

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

MARY-HALL H. DALE

Dr. Chandler C. Ross SURF Fellow
Freshman, EAS (ME)

An Investigation of the Validity of
Surface Temperature Measurements
Using High-Strain-Rate Deformation

Mentor: Guruswaminaidu Ravichandran,
Professor of Aeronautics and Mechanical
Engineering

THERESA M. DANIELS

Junior, Geobi

Characterization of Potential Mineral
Biomarkers in Banded Iron Formations

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

KAREN M. DAUGHERTY

Richter Scholar
Junior, Bi

Hot Stuff: The Role of Heat Shock Factor in Transcription in Stressed Cells

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

AARON D. DAVIES

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

A New Method for Measuring the Shear Modulus of Living Cells

Mentor: John C. Crocker, *Assistant Professor of Applied Physics*

LILLI M. DAVIS

Howard Hughes Medical Institute SURF Fellow
Sophomore, EAS

Chemistry Animation Project

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

JOSEPH F. DE JESUS

Richter Scholar
Freshman, ECE

Suspended Single-Walled Carbon Nanotube Fabrication

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

ANDREA DE MICHELE

Senior, Ph; University of Pisa

The Pre-Stabilized Laser for the LIGO Caltech 40m Interferometer: Stability Controls and Characterization

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

RACHEL M. DECO

Bob and Carole Chapman Minority SURF Fellow
Freshman, Ch

Synthesis of Enantioselective Organic Catalysts

Mentor: David W. MacMillan, *Associate Professor of Chemistry*

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Richter Scholar
Freshman

Equilibrium Water Content of Olivine at High Pressure

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Senior, Ph/Ay; University of Victoria

CCD Studies of Asteroids and Comets

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

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Junior, Ch

Detection of Telomere Repeats by Polyamide-Dye Conjugates

Mentor: Peter B. Dervan, *Bren Professor of Chemistry*

PARSA DORMIANI TABATABAEI

Junior, ECE

Flocking in Embedded Robotic Systems

Mentor: Rodney M. Goodman, *Professor of Electrical Engineering*

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Senior, Power Eng; Universidad Simón Bolívar

Design, Fabrication, and Testing of a High Performance Single Cell Fuel Cell Utilizing a Solid Acid Based Proton Conductor Membrane

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

OLIVIER P. DREVET

Junior, ME; ENSIETA

Measuring the Dynamics of Combustion

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

MELISSA E. DUAN

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

Isolation of PMC Specific Genes

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

MIROSLAV DUDIK

Xencor Corporation SURF Fellow
Junior, EAS

Automated Multielectrode Analysis of Neural Activity in vitro

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

MONICA DUS

Sophomore, Molecular and Cell Bi; University of Redlands

Study of the Role of the Ecdysone Pathway in Aging: Effects of Inducible Expression of EcR dsRNA on Lifespan

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

KATHRYN A. DYL

Richter Scholar
Freshman, Geoch

Microwave Spectroscopy and the Search for Interstellar Biological Molecules

Mentor: Geoffrey A. Blake, *Professor of Cosmochemistry and Planetary Sciences and Professor of Chemistry*

RICHARD D. EAGER

Axline SURF Fellow
Pre-Freshman

Errors in Quantum Circuits With a Finite Environment Memory Time

Mentors: Hideo Mabuchi, *Associate Professor of Physics*, and Andrew C. Doherty, *Postdoctoral Scholar in Physics*

FREDERIK H. EATON

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

Userland File Systems in Linux

Mentor: Jason J. Hickey, *Assistant Professor of Computer Science*

MOHAMED ELGHEFARI

JPLUS SURF Fellow
Sophomore, Ph; Pasadena City College

The Effects of Hole-Doping Level on Anisotropic Properties of YBa₂Cu₃O_x High T_c Superconductors

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

TAMBREA T. ELLISON

Howard Hughes Medical Institute MURF Fellow
Sophomore, Bi; Valdosta State University

Behavioral Assay to Screen for Spastin Excisions

Mentors: Kai G. Zinn, *Professor of Biology*, and Anna M. Salazar, *Graduate Student in Biology*

BRIAN H. ENG

Caltech-NUS Exchange
Senior, Ph

Forced Oscillators in Control Circuits

Mentor: Ai Poh Loh, *Associate Professor, Department of Electrical and Computer Engineering, National University of Singapore*

DIRK R. ENGLUND

Samuel P. and Frances Krown SURF Fellow
Junior, Ph

Using an Optical Cavity to Observe Conformational Changes in Bacteriochlorophyll-a

Mentor: Hideo Mabuchi, *Associate Professor of Physics*

JOSÉ M. ESCALADA

General Motors Minority SURF Fellow
Sophomore, Ch

Chemistry of Zwitterionic Nickel Compounds

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

WILHELMINA TISHA P. ESPINOSA

The James Irvine Foundation MURF Fellow
Junior, Materials Eng. California State Polytechnic University,
Pomona

Non-Stoichiometry of Doped Barium Cerate and Its Impact on Physical Properties

Mentors: Sossina M. Haile, *Assistant
Professor of Materials Science*, and Jian Wu,
Graduate Student in Materials Science

WILL M. FARR

William M. Whitney SURF Fellow
Sophomore, Ph

Self-Similar Ultra-Relativistic Jets

Mentor: Re'em Sari, *Sherman Fairchild
Senior Research Fellow in Astrophysics*

ANN C. FISHER

Junior, Ch; Austin College

Conformational Analysis of 3- Mercaptopropionic Acid

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

NATHAN A. FITZGERALD

NASA USRP
Junior, Ae; Massachusetts Institute of Technology

Microwave Desorption Sail

Mentor: Celeste M. Satter, *Senior
Engineering, JPL*

CHRISTOPHER S. FLATT

Ford Motor Company SURF Fellow
Freshman, EAS

Programming an Optical Input Output Stream and Graphical User Interface for the Study of the Movement of RNA Polymerase Along a Strand of DNA

Mentor: Stephen R. Quake, *Associate
Professor of Applied Physics*

GRAHAM N. FREE

Marcella Bonsall SURF Fellow
Freshman

The Effect of Time Delays on Decision Making in Economic Ultimatum Games

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

ANDREW D. GADTKE

Sophomore, Geobi

Chromium Speciation: Removal, Solid Phase Characterization, and Ion- Exchange Separation

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

ELAINE P. GEE

Erika C. Vate SURF Fellow
Freshman, Ph

Investigations Into Hot Carrier Injection Effects on the Life of Power MOSFETs at Cryogenic Temperatures: Implications for MOSFET Redesign for Spacecraft Suitability

Mentor: Michael A. Newell, *Senior Member
of the Technical Staff, JPL*

RICHARD E. GEORGE

Caltech-Cambridge Exchange
Junior, Ph; University of Cambridge

Simulation of the Advanced LIGO Sensing and Control System

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

NICHOLAS M. GEROVAC

Sophomore, APh

Thermoelectric Properties of Polycrystalline $\text{Bi}_2\text{Te}_3\text{-Sb}_2\text{Te}_3$ Alloys

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

BENJAMIN R. GRANETT

Freshman, Ay

Stars That Go Bang in the Night!

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

JONATHAN E. GREEN

JPLUS SURF Fellow
Junior, Ch; University of California, Irvine

Multiangle and Multispectral Remote Sensing of Atmospheric Aerosols

Mentor: Franklin P. Mills, *Postdoctoral
Fellow, JPL*

SIMON J. GREEN

Caltech-Cambridge Exchange
Junior, Ph; University of Cambridge

Generalization of the Femto-Newton Force Spectroscopy Technique, With Applications to the Study of Molecular Motors

Mentor: Stephen R. Quake, *Associate
Professor of Applied Physics*

DAVID S. GUSKIN

Northern California Associates SURF Fellow
Junior, Ph

Quantum Entanglement Through Interactive Multimedia

Mentor: Hideo Mabuchi, *Associate Professor
of Physics*

RYAN N. GUTENKUNST

Lester Lees Aeronautics SURF Fellow
Junior, Ph

A Study of Vortex-Induced Vibration

Mentor: Anthony Leonard, *Theodore von
Kármán Professor of Aeronautics*

JEANETTE C. HAGAN

Richter Scholar
Junior, Ph

Limestone Fault Scarps in Western Turkey

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

KOUN HAN

Richter Scholar
Freshman, Bi

Reducing DNA Using Flash-Quench Technique

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

NADIA HAQ

Professor Fredrick H. Shair SURF Fellow
Junior, Ch

A Highly Sequence-Specific Pyrrole- Imidazole Polyamide That Targets the HER2/neu Promoter

Mentor: Peter B. Dervan, *Bren Professor of
Chemistry*

SEAN S. HARDESTY

Freshman, Ph

Analysis of Correlated Ground Motion at the LIGO Livingston Observatory

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

ABRAHAM I. HARTE

Richter Scholar
Junior, Ph

Self Force on a Scalar Charge in de Sitter Spacetime

Mentor: Lee A. Lindblom, *Visiting Associate
in Theoretical Astrophysics; Lecturer in
Physics*

CHRISTA A. HASENKOPF

NASA USRP
Sophomore, Ay; Pennsylvania State University

Developing Coadded Flat Field Masks for Mid-Infrared Images of Jupiter Taken by MIRLIN From 6/99-10/99

Mentor: Glenn Orton, *Senior Research
Scientist, JPL*

STEVEN H. HASSANI

Alain Porter Memorial SURF Fellow
Sophomore, Ma

A Model for the Evolution of Supermassive Black Holes and Their Corresponding Galaxies

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

GARRETT C. HEFFNER

Rossum Family SURF Fellow
Junior, Bi

Role of the Endothelin Receptor B, and Possible Novel Endothelin Receptor Subtype, in Melanoma Angiogenesis and Metastasis

Mentor: Paul H. Patterson, *Professor of
Biology*

JANICE A. HESTER

Junior, Ph; Arizona State University

Analysis of Lightning Events

Mentor: Daniel Sigg, *Senior Scientist in
Physics*

KENNETH F. HIGA

William N. Lacey SURF Fellow
Junior, ChE

Robustness and Evolvability of Interaction Networks

Mentor: Zhen-Gang Wang, *Associate Professor of Chemical Engineering*

ERIC J. HILTON

NASA USRP
Sophomore, Ph; Carnegie Mellon University

Time-Varying Oceanic Mass Using Topex/Poseidon and Angular Momentum

Mentor: Dimitris Menemenlis, *Research Scientist, JPL*

HOANG MINH HO DAC

JPLUS SURF Fellow
Junior, Interdisciplinary Ch/Ph; University of California, Irvine

Contribution to Space Mission and System Design

Mentor: Joel C. Sercel, *Lecturer in Aeronautics*

CUONG G. HOANG

Richter Scholar
Junior, ChE

Formation Flight of Satellites

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

MICHAEL J. HOCHBERG

Junior, Ph

Polarization Selective Optical Modulation Observed in a Micromachined Silicon Membrane

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

KATHERINE A. HOMANN

Edward W. Hughes SURF Fellow
Freshman, Bi

The Effects of Kinase Suppressor of Ras (KSR) Mutants on the Ras Signaling Cascade in Mature Murine T Cells

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

TAI-RENEE E. HOOKER

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

VEPs and Experimental Allergic Encephalomyelitis (EAE) Mice

Mentors: Carol W. Readhead, *Senior Research Associate in Biology*, and Russell E. Jacobs, *Member of the Beckman Institute*

DUSTIN HSU

Freshman, Optics/EE; University of Rochester

Quantum Entanglement Through Interactive Multimedia

Mentor: Hideo Mabuchi, *Associate Professor of Physics*

DI HU

Richter Scholar
Freshman, Bi

Chimeric Peptide Binding

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

HERMES C. HUANG

Freshman, APH

The Fabrication of Microscale Thermoelectric Devices

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

SARAH L. HUNYADI

Junior, PSc

Science Objectives for a Mars Polar Mission

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

RICHARD PATRICK HUTCHINSON

Junior, CS; Wofford College

Incorporating Cost-Benefit Analyses Into Software Assurance Planning

Mentor: Burt C. Sigal, *Software Quality Assurance Supervisor, JPL*

THOMAS S. JACKSON

Sophomore, Ph; Princeton University

Filamentary Structure in the Interstellar Medium

Mentor: Michael W. Werner, *Senior Research Scientist, JPL*

APRIL D. JEWELL

Senior, Ch; George Washington University

Evaluation and Comparison of Electronic Noses for Air Quality Monitoring of Crew Habitat on a Spacecraft

Mentor: M.A. Ryan, *Senior Member of the Technical Staff, JPL*

CAOYU JING

Caltech-NUS Exchange
Sophomore, EE; National University of Singapore

Vibrating Retina: Feature Detection for a Vibrating Visual Sensor

Mentors: Christof Koch, *Lois and Victor Troendle Professor of Cognitive and Behavioral Biology and Professor of Computation and Neural Systems*, and Ania Mitros, *Graduate Student in Computation and Neural Systems*

GRETA S. JO

Richter Scholar
Freshman, ISP

The Effect of Quorum Signal Biodegradation on *Pantoea* Biofilms

Mentor: Jared R. Leadbetter, *Assistant Professor of Environmental Microbiology*

EMILY G. JOHNSEN

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

Women and Minorities in Environmental Engineering

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

JESS A. JOHNSON

Junior, Ph; Lehigh University

Quantum Entanglement Through Interactive Multimedia

Mentor: Hideo Mabuchi, *Associate Professor of Physics*

NICHOLAS J. JOHNSON

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

Lander and Delivery System Analysis for Mars Polar Mission

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

TYLER J. JOHNSON

Hugh F. and Audy Lou Calvin International SURF Fellow
Junior, Ph

Quantum Teleportation With Entangled Coherent States

Mentors: Barry C. Sanders, *Assistant Professor of Physics, Macquarie University*, and Hideo Mabuchi, *Associate Professor of Physics*

DUNCAN R. JOHNSTON

Caltech-Cambridge Exchange
Junior, Ph; University of Cambridge

Adaptive Phase Measurement and Application to Squeezed State Quantum Key Distribution

Mentor: Hideo Mabuchi, *Associate Professor of Physics*

TED E. JOU

Robert L. Blinkenberg SURF Fellow
Sophomore, Ph

Velocity Dispersions of Star Clusters in Andromeda

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

THOMAS J. JULIANO

Freshman, EAS (Ae)

Porous Graphite Combustion Experiment

Mentors: Fletcher J. Miller, *Principal Researcher, National Center for Microgravity Research*, and Harvey B. Newman, *Professor of Physics*

KRISTINA M. JUTZI

Mr. and Mrs. Douglas B. Nickerson SURF Fellow
Freshman, Modern H; University of St. Andrews

The Arroyo Seco Project

Mentor: William F. Deverell, *Associate Professor of History*

ELLIOTT M. KARPILOVSKY

Freshman, ECE

Resolving Problems in Thermoelectric Nanowire Preparation

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

HELENA M. KAUPPILA

Freshman, Ph

Novel Thermoelectric Materials: Synthesis and Characterization of the Filled Skutterudite $\text{Yb}_x\text{Co}_5\text{Sb}_{12}$

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

MEGAN R. KENNEDY

Freshman, PISc

Investigation and Evaluation of Landing Sites for the 2003 Mars Land Rover Expedition

Mentor: Matthew P. Golombek, *Principal Scientist, JPL*

BASIT A. KHAN

Arthur Rock SURF Fellow
Sophomore, EE

Design and Characterization of Form-Birefringent Multilayer Polarizing Beam Splitter

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

HANNAH K. KIM

Howard Hughes Medical Institute SURF Fellow
Sophomore, Bi

Analysis of Dauer Formation Mutations in *C. briggsae*

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

RANDIE H. KIM

Dr. Terry Cole SURF Fellow
Sophomore, Ch

Ortho Substituent Chelating Effects on the Oxidative Kinetic Resolution of Secondary Alcohols

Mentor: Brian M. Stoltz, *Assistant Professor of Chemistry*

REBECCA S. KIM

Freshman, EAS (ME)

Radiometer Design and Test

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

JUSTIN B. KINNEY

Junior, Ph/Ma; Cornell University

Dynamics of r-Modes in Accreting Neutron Stars With Superfluid Interiors

Mentor: Gregory Mendell, *Scientist, LIGO Hanford Observatory*

ELISE B. KLEEMAN

Richter Scholar
Sophomore, Ge

Determination of the Internal Structure of Species of Benthic Coral

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

STEPHANIE A. KOVALCHIK

Arthur R. Adams SURF Fellow
Sophomore, Bi

Economic Decision Making in Older Adults

Mentor: John M. Allman, *Frank P. Hixon Professor of Neurobiology*

AKASH KUMAR

Caltech-NUS Exchange
Sophomore, Computer Eng; National University of Singapore

Sensor Based Motion Planning

Mentor: Joel W. Burdick, *Professor of Mechanical Engineering*

WILLIAM A. KUMBERGER

JPLUS SURF Fellow
Sophomore, CS; Citrus College

MISR Validation

Mentor: Franklin P. Mills, *Postdoctoral Fellow, JPL*

ABRAHAM KUO

Howard Hughes Medical Institute SURF Fellow
Junior, Ch

Localization of 26S Proteasome Subunits Using Fluorescent Microscopy

Mentor: Raymond J. Deshaies, *Associate Professor of Biology; Assistant Investigator, Howard Hughes Medical Institute*

DAVID M. KURTZ

Axline SURF Fellow
Pre-Freshman

Synthesis of Zirconocene Catalysts for Polyolefin Polymerization

Mentors: John E. Bercaw, *Centennial Professor of Chemistry*, and Sara B. Klamo, *Graduate Student in Chemistry*

GHEE XIONG LAI

Freshman

Synthesis and Activity of Rhodium and Iridium Complexes Coordinated With N-Heterocyclic Carbene Ligands

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

JOHNNY N. LAM

Sophomore, EAS (ME)

Design and Construction of an Oxygen-Free Gas Mixing/Dispensing Station and Anoxic Test Tube Preparation Unit

Mentor: Jared R. Leadbetter, *Assistant Professor of Environmental Microbiology*

TIN YIU LAM

Joseph B. Koepfli SURF Fellow
Sophomore, Ch

Progress Toward the Development and Discovery of a Catalytic Enantioselective ortho-Aldol Reaction

Mentor: Brian M. Stoltz, *Assistant Professor of Chemistry*

JOLENE L. LAU

J. Kent Clark SURF Fellow
Freshman, Ch

The Pen Is Mightier Than the Pendulum: A History of Caltech Student Literary Publications

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

NICHOLAS M. LAW

Sophomore, Natural Science; University of Cambridge

Gravitational Lensing and Galaxy Mass Profiles

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

ERIC E. LAWRENCE

Sophomore, Ma/Ph; Reed College

A Study of Heat Sink Performance in Air and Soil for Use in a Thermoelectric Energy Harvesting Device

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

BENJAMIN G. LEE

Robert K. and Alice L. Roney SURF Fellow
Junior, APH

Diffraction and Nonlinear Optics: Fabrication of Diffraction Optical Elements and Gratings for the Enhancement of Nonlinear Effects

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

CHRISTINA O. LEE

Senior, Astroph/Ph; University of California, Berkeley

Engineering Considerations for a Mars Polar Landing Site

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

DAVID R. LEIBRANDT

Sophomore, Engineering Ph; University of Michigan

Spatial Characterization of Optical Absorption of Synthetic Sapphire at 1064 nm

Mentor: Joseph M. Kovalik, *Staff Member in Physics*

JAIME A. LEIVA

NSF Center for the Science and Engineering of Materials
MURF Fellow
Senior, ME; California State University, Los Angeles

Determination of Residual Stresses in a Bulk Metallic Glass (BMG) Alloy by the Hole-Drilling Method

Mentors: Ersan Üstündag, *Assistant Professor of Materials Science*, and Neda S. Fabris, *Professor, Department of Mechanical Engineering, California State University, Los Angeles*

JORDAN M. LEMERANDE

Sophomore, Ch; Reed College

An NMR Analysis of the Conformational Equilibria of Methylsuccinic Acid and Its Salts

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

CLAIRE I. LEVAILLANT

Senior, Ma; École Normale Supérieure

Application of Pattern Recognition to Neuroscience

Mentor: Pietro Perona, *Professor of Electrical Engineering*

SHANNON D. LEWIS

Axline SURF Fellow
Pre-Freshman

Exploration of N-Substituted Glycine Containing Peptoids

Mentor: Mark E. Davis, *Warren and Katharine Schlinger Professor of Chemical Engineering*

JENNIFER X. LI

Axline SURF Fellow
Pre-Freshman

Mapping the SHREDDIE (SHD) Gene in *Arabidopsis thaliana*

Mentors: Elliot M. Meyerowitz, *Professor of Biology*, and Catherine Baker, *Graduate Student in Biology*

JIN LI

Richter Scholar
Junior, ACM

Combined Items Transaction: Model and Applications

Mentor: John O. Ledyard, *Professor of Economics and Social Sciences*

BENJIE N. LIMKETKAI

Sophomore, EE

Digital Signal Processor-Based DC Superconducting Quantum Interference Device Controller

Mentor: Inseob Hahn, *Research Scientist, JPL*

JONATHAN G. LIN

Ford Motor Company SURF Fellow
Freshman, Ph/Ma

The Role of Experimental Noise in the Interpretation of Phonon Density of States Through Optimization of Force Constants

Mentor: Brent Fultz, *Professor of Materials Science*

BINGHAI LING

Axline SURF Fellow
Pre-Freshman

Recombination of Cobalt "Picket-Fence" Porphyrin With Oxygen

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

JANESSA M. LINK

Hannah Bradley SURF Fellow
Sophomore, Ge

Thermochromic Cr-Rich Pyrope Garnets

Mentor: George R. Rossman, *Professor of Mineralogy*

STÉPHANE K. LINTNER

Junior, Ma; École Normale Supérieure

Second Kind Integral Equations in the Diffraction by Infinitely Thin Screens

Mentor: Oscar P. Bruno, *Professor of Applied and Computational Mathematics*

FU LIU

Arthur R. Adams SURF Fellow
Junior, Ma/EAS

Completely Disconnecting the Complete Graph

Mentor: Richard M. Wilson, *Professor of Mathematics*

YUAN LIU

Richter Scholar
Junior, Ph

Scale Model Measurement of a Broadband Submillimeter Waveguide Probe

Mentor: Jonas Zmuidzinas, *Professor of Physics*

PO-SHEN LOH

Shirley and Carl Larson SURF Fellow
Freshman, Ma

Finding Shortest Paths With Computational Geometry

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

JASPER LLEWELYN S. LOVERIO

Junior, APh; National University of Singapore

Synthesis and Characterization of the New $Cs_xRb_xHSO_4H_2PO_4$ Protonic Conductor

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

ALEXIS M. LUERAS

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

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

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

MITCHELL J. LUM

NASA USRP
Junior, EE; University of Washington

Autostereo and Haptic Rendering for Multimodal Virtual Environments

Mentor: Cagatay Basdogan, *Senior Member of the Technical Staff, JPL*

ZEYNEP MADAK

Junior, Bi; Bilkent University

Visualization of Signal Transduction in *C. elegans* Vulval Lineage and Egg-Laying Defective Mutant Screening in *C. briggsae*

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

SARAH J. MAHONEY

Carolyn Merkel SURF Fellow
Junior, Bi

Cloning and Functional Analysis of Chick *Zic* Genes

Mentor: Marianne Bronner-Fraser, *Albert Billings Ruddock Professor of Biology*

MICHAEL R. MAIRE

Arthur R. Adams SURF Fellow
Sophomore, Ma

Design and Implementation of a Real-Time Visual Feature Tracking System on a Programmable Video Camera

Mentors: Pietro Perona, *Professor of Electrical Engineering*, and Arrigo Benedetti, *Staff Member in Electrical Engineering*

JAMES R. MALONEY

Junior, Ph; University of Florida

Sensitivity Limitations of NEMS Devices for Use in Single-Molecule Detection

Mentor: Michael L. Roukes, *Professor of Physics*

BENJAMIN B. MATHEWS

Sophomore, Ph

Widening the Corrected Field of View Using Ground-Layer Adaptive Optics

Mentor: Richard Dekany, *Member of the Professional Staff in Astronomy*

RYAN D. MCDANIEL

Sophomore, EAS

Mars Orbit, Lander, and Entry Analysis (MOLEA)

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

PAUL L. MCFADDEN

Caltech-Cambridge Exchange
Junior, Ph: University of Cambridge

Tripartite Bell Inequalities and the Statistical Physics of Quantum Error Correction

Mentor: John P. Preskill, *Professor of Theoretical Physics*

TIFFANY J. MCGINN

NASA USRP
Junior, Microbi: University of California, San Diego

Detection and Spectral Mapping of Polycyclic Aromatics by UV Fluorescence

Mentor: Arthur Lane, *Research Scientist, JPL*

FLORIAN T. MERKLE

Mr. and Mrs. A.A. Burnand SURF Fellow
Junior, Bi

Towards a Fundamental Brain Scaling Relationship

Mentor: John M. Allman, *Frank P. Hixon Professor of Neurobiology*

CLAIRE E. MITCHELL

Caltech-Cambridge Exchange
Junior, Ch: University of Cambridge

Cleavage Properties and Cytotoxicity of Metallointercalators Which Specifically Recognise DNA Mismatches

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

JOSEPH D. MOHNKE

Samuel P. and Frances Krown SURF Fellow
Sophomore, Ph

Development of Wire Detector for Cold Electrons in a Magnetic Field

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

NATHAN P. MOORE

NASA USRP
Sophomore, Ph/Ma: Harvard University

Orbital Lifetime and the Martian Upper Atmosphere

Mentor: Jack B. Barengoltz, *Principal, Planetary Protection Technologies Group, JPL*

ERIC P. MORGANSON

Donald S. Clark SURF Fellow
Junior, Ph

Forming Microsphere Crystals Using DNA Hybridization

Mentor: John C. Crocker, *Assistant Professor of Applied Physics*

ALEJANDRO D. MUÑOZ

General Motors Minority SURF Fellow
Freshman, Ph

The Effects of Fire on the Global Carbon Cycle

Mentor: James T. Randerson, *Assistant Professor of Global Environmental Science*

GAUTHAM P. NAIR

Freshman, Ch

Conformational Analysis of Carboxysuccinic Acid

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

ANTHONY R. NANNINI

Richter Scholar
Sophomore, EAS

Electro-Optic Polymer Coupled Waveguides Using Micromolding in Capillaries (MIMIC) Fabrication Techniques

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

SUHAS R. NAYAK

Samuel P. and Frances Krown SURF Fellow
Junior, Ch/Ma

A Study of Schrödinger Operators

Mentor: Barry M. Simon, *International Business Machines Professor of Mathematics and Theoretical Physics*

OR NEEMAN

Arthur R. Adams SURF Fellow
Freshman, Ma

Recursive Reconstruction on Regular Trees

Mentor: Leonard J. Schulman, *Associate Professor of Computer Science*

DANIELLE NEFF

Senior, Ch: Claremont McKenna College

Expanding the Use of Enantioselective Organocatalysts

Mentor: David W. MacMillan, *Associate Professor of Chemistry*

PETER J. NEUBAUER

Senior, Computer Eng: Arizona State University

Analysis of Safety Critical Spacecraft Software Anomalies

Mentor: John C. Kelly, *Principal Engineer, JPL*

NHA C. NGUYEN

Caltech-NUS Exchange
Freshman, ChE: National University of Singapore

Determination of Anion/Cation Composition of Termite Gut Fluid

Mentor: Jared R. Leadbetter, *Assistant Professor of Environmental Microbiology*

MATTHEW O. NORMAN

The Aerospace Corporation SURF Fellow
Sophomore, EAS

Electron Beam Induced Current Analysis of Polycrystalline Silicon Films

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

NKECHI A. NZEREM

Howard Hughes Medical Institute MURF Fellow
Junior, Bi: Xavier University of Louisiana

Genetic Mapping of an Immunological Defect in a Mouse Model of Diabetes

Mentors: Ellen Rothenberg, *Professor of Biology*, and Mary A. Yui, *Postdoctoral Scholar in Biology*

GUILLAUME R. OBOZINSKI

Senior, Ma: École Normale Supérieure

Unsupervised Learning for Signature Recognition

Mentor: Pietro Perona, *Professor of Electrical Engineering*

JASON S. OH

Victor Neher SURF Fellow
Freshman, Ph

Entanglement Purification and Quantum Key Distribution With Oscillator States

Mentor: John P. Preskill, *Professor of Theoretical Physics*

JONG C. OH

MetaProbe SURF Fellow
Sophomore, Bi

Characterization of FGF Family of Signaling Molecules in the Developing Chick Gut

Mentor: Helen McBride, *Postdoctoral Scholar in Biology*

CARENE A. OLIVERAS GARCÍA

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

SynGAP Plays an Important Role in Synaptic Formation and Plasticity

Mentors: Mary B. Kennedy, *Professor of Biology*, and Luis E. Vazquez, *Graduate Student in Biology*

ELAINE OU

Sophomore, EE

Network Considerations for a Dynamic Shared Haptic Environment

Mentor: Cagatay Basdogan, *Senior Member of the Technical Staff, JPL*

STEVE T. PAIK

Arthur A. Noyes SURF Fellow
Sophomore, Ph

Quantifying Conduction in Nanoelectronic Materials

Mentor: Richard P. Muller, *Director of Quantum Simulations, Materials and Process Simulation Center*

NICHOLAS M. PALKO

Freshman, APh

Computer Aided Focused Ion Beam MillingMentor: Axel Scherer, *Bernard Neches Professor of Electrical Engineering, Applied Physics, and Physics***VIJAY S. PARADKAR**

Freshman, Aerospace Eng; Princeton University

Mars Surface Mobility Study: Polar Rover Concept DesignMentor: Lloyd C. French, *Systems Architect, JPL***JULIE G. PARRA***The James Irvine Foundation MURF Fellow*
Junior, Ge; California State Polytechnic University, Pomona**Analysis of Marine Geophysical Data for the Southern Oceans**Mentor: Joann M. Stock, *Professor of Geology and Geophysics***TOD A. PASCAL***Howard Hughes Medical Institute MURF Fellow*
Sophomore, Ch; Lincoln University**Computer Simulation of DNA Molecules: PX 5:5, PX 6:5, PX 7:5, PX 8:5, and PX 9:5 Double Crossover Molecules**Mentors: William A. Goddard, *Charles and Mary Ferkel Professor of Chemistry, Materials Science, and Applied Physics*, and Nagarajan Vaidehi, *Director, Biomacromolecular Simulations, Materials Simulation Center***ROBERT E. PAYAWAL***The James Irvine Foundation MURF Fellow*
Sophomore, Ph; Sacramento City College**The Millimeter-Wave Properties of Superconducting Microstrip Lines**Mentors: Jonas Zmuidzinas, *Professor of Physics*, and Anastasios Vayonakis, *Graduate Student in Physics***SCOTT W. PAYNE***Caltech-NUS Exchange*
Senior, EAS**Micro Air Vehicle**Mentor: Gerard Leng, *Senior Lecturer of Mechanical Engineering, National University of Singapore***CURTIS W. PEHL**

Junior, Ge

Magnetostratigraphy of the Triassic Jurassic BoundaryMentor: Joseph L. Kirschvink, *Professor of Geobiology***KALOYAN M. PENEV**

Sophomore, Ph

Lagrangian Approach to Tidally Excited Stellar OscillationsMentor: Roger D. Blandford, *Richard Chace Tolman Professor of Theoretical Astrophysics***DANIEL E. PEREA***JPLUS SURF Fellow*
Junior, Ch; University of California, Riverside**Solar Cell Characterization and Analysis**Mentor: Lee K. Johnson, *Research Scientist, JPL***ERIC A. PETERS***Huntington Medical Research Institute SURF Fellow*
Freshman, Ch**Development of a Method to Analyze Small Peptides Within Cerebrospinal Fluid and Its Application Toward the Study of Headaches**Mentors: Michael Harrington, *Program Director, Molecular Neurology, Huntington Medical Research Institute*, and Robert H. Grubbs, *Victor and Elizabeth Atkins Professor of Chemistry***TIMOFEI PIATENKO**

Junior, Ph/Ma; Cornell University

Characterization and Testing of LIGO's 40-Meter Lab PSL (Optics)Mentor: Alan J. Weinstein, *Professor of Physics***LILLIAN B. PIERCE**

Junior, Ma; Princeton University

Predicting the Properties of Chimeric Libraries Generated by Family ShufflingMentor: Frances H. Arnold, *Dick and Barbara Dickinson Professor of Chemical Engineering and Biochemistry***JESSE E. PINO**

Sophomore, Ph

QCD Background and the Two Photon Decay Mode of the Higgs Boson at the CMSMentor: Harvey B. Newman, *Professor of Physics***NICHOLAS A. PIRO**

Freshman, Ch

Conformational Studies of β -Diethylaminopropionic and γ -Dimethylaminobutyric Acids by NMR SpectroscopyMentor: John D. Roberts, *Institute Professor of Chemistry, Emeritus***ERIK V. POUNDERS***JPLUS SURF Fellow*
Sophomore, Eng; Pasadena City College**Tectonic Features on the Surface of Mars**Mentor: Robert C. Anderson, *Member of the Technical Staff, JPL***JONATHAN R. PRITCHARD***Caltech-Cambridge Exchange*
Junior, Ph; University of Cambridge**Spintessence and the Coincidence Problem**Mentor: Marc P. Kamionkowski, *Professor of Theoretical Physics and Astrophysics***EMMA S. RAINEY***NASA USRP*
Senior, Ge/Ph; University of Minnesota**Developing a Realistic Model of Plume-Lithosphere Dynamics for Coronae on Venus**Mentor: Suzanne Smrekar, *Research Scientist, JPL***BRENDA J. RAMIREZ***The James Irvine Foundation MURF Fellow*
Junior, ME; California State Polytechnic University, Pomona**Phase-Resolved NO Planar Laser Induced Fluorescence of an Acoustically Forced Jet Flame at Frequencies <60 Hz**Mentors: Fred E. Culick, *Richard L. and Dorothy M. Hayman Professor of Mechanical Engineering and Professor of Jet Propulsion*, and Albert Ratner, *Postdoctoral Scholar in Aeronautics***REY N. RAMIREZ***Huntington Medical Research Institute SURF Fellow*
Sophomore, Bi**Genetic Alterations in the APC Gene and Susceptibility to Colon Cancer**Mentors: Faye E. Eggerding, *Director, Cancer Genetics and Molecular Oncology Laboratory, Huntington Medical Research Institute*, and Marianne Bronner-Fraser, *Albert Billings Ruddock Professor of Biology***LAVANYA REDDY**

Junior, EAS

Change Detection and Identification: The Limitations of Visual Short-Term MemoryMentors: Christof Koch, *Lois and Victor Troendle Professor of Cognitive and Behavioral Biology and Professor of Computation and Neural Systems*, and Patrick Wilken, *Postdoctoral Scholar in Biology***JESSICA E. REYNOLDS***Toshi Kubota Aeronautics SURF Fellow*
Freshman, EAS (ME)**Alternate Water Propulsion Methods**Mentor: Morteza Gharib, *Professor of Aeronautics and Bioengineering***MATTHEW G. RICHARDS**

Freshman, Aeronautics/Political Science; Massachusetts Institute of Technology

Mars Surface Mobility Study: Polar Rover Concept DesignMentor: Lloyd C. French, *Systems Architect, JPL*

EUNICE V. RIVAS

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

DNA-Peptide Cross-Linking via the Flash Quench Technique: Dependence on Peptide Sequence

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

MICHAEL RIZK

Sophomore, ECE

Development of a Hybrid Sensor Array for the Electronic Nose

Mentor: Margie Homer, *Senior Member of the Engineering Staff, JPL*

RICHARD A. ROBISON

Richter Scholar
Junior, Bi

The Role of Specific RNA Sequences in the Replication and Packaging of Yellow Fever Virus

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

JAMAL T. RORIE

Samuel P. and Frances Krown SURF Fellow
Junior, Ph

Observed Dark Noise and Scintillation Rates at KamLAND

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

MARK S. RUDNER

Peter A. Lindstrom, Jr., SURF Fellow
Sophomore, Ch

Chemically Assembled Electronic Nanocomputers (CAENs): Structural Modeling, Optimization, and Characterization of Rotaxane-Like Molecules

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

COLIN W. RUNDEL

Sophomore, Bi

Genetic Analysis of Oxidative Stress and Aging in *Drosophila melanogaster*

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

ROBB B. RUTLEDGE

Junior, Bi

An fMRI Search for a Cross-Modal Brain Area Responsive to Both Human Faces and Voices

Mentors: Nancy Kanwisher, *Professor, Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology*, and Pietro Perona, *Professor of Electrical Engineering*

MICHAEL C. RYCZKO

Senior, Behavioral Neuroscience; Laurentian University

Towards a Rodent Model of Awareness

Mentor: Christof Koch, *Lois and Victor Troendle Professor of Cognitive and Behavioral Biology and Professor of Computation and Neural Systems*

DANA L. SADAVA

Sophomore, EAS (Ae)/Lit

Mars Surface Mobility Study: Polar Rover Concept Design

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

JULIA A. SALZMAN

Junior, Ma; Princeton University

A Linear Algebraic Approach to Error Bounds in Decoding of Quantum Messages

Mentor: Leonard J. Schulman, *Associate Professor of Computer Science*

ERIC C. SAMULON

Freshman; University of California, Berkeley

Wind Velocity in Dust Devils

Mentor: Michael Hecht, *Project Manager, JPL*

TODD E. SCHUMAN

Mr. and Mrs. Robert L. Noland SURF Fellow
Junior, Ae/Ec

Application of PowerSail to a Titan Lander Mission

Mentor: Joel C. Sercel, *Lecturer in Aeronautics*

ISAAC SEE

Marcella Bonsall SURF Fellow
Sophomore, Ma

Negative Regulators of MAPK in T Cells

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

ANNEMARIE SELAYA

Howard Hughes Medical Institute MURF Fellow
Junior, Ecology, Behavior, and Evolution; University of California, Los Angeles

Characterization of an Age-Dependent Muscle Mutant, *Jumpy*, in *Drosophila melanogaster*

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

MILAN N. SHAH

Caltech-Cambridge Exchange
Senior, EAS; University of Cambridge

Design and Production of an Injection Ludwig Tube

Mentor: Hans G. Hornung, *C.L. "Kelly" Johnson Professor of Aeronautics*

DEREK M. SHANNON

Barbara, Lind, and John Gee SURF Fellow
Junior, Geobi/Ae

Is a Newly Discovered Inorganic Process Responsible for the Magnetite Crystals of ALH84001?

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

MONA A. SHEIKH

Rita A. and Øistein Skjellum SURF Fellow
Sophomore, EE

Audio Signal Processing-Simulation and Analysis

Mentor: P.P. Vaidyanathan, *Professor of Electrical Engineering*

SAKEN SHERKHANOV

Richter Scholar
Junior, Bi

Characterization of TRF5 Protein in DNA Replication and Sister Chromatid Cohesion in *Saccharomyces cerevisiae*

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

ERIK G. SHIPTON

NASA USRP
Sophomore, Ph/AM; University of California, Berkeley

Rapid Bacterial Spore Detection

Mentor: Adrian Ponce, *Visiting Associate and Senior Member of the Technical Staff, JPL*

ANATOLY SHOLOMYANSKY

Junior; Management of Information and Communication Systems; Fordham University

Mars Surface Mobility Study: Polar Rover Concept Design

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

MARIE-CLAIRE E. SIDDALL

JPLUS SURF Fellow
Junior, Ch; University of California, Irvine

The Los Angeles River: A Case Study in the Changing Fortunes of Urban Conservation

Mentor: Benjamin H. Johnson, *Instructor in History*

DEBORAH E. SINCLAIR

Junior, Ec/Ma; University of Redlands

Could Florida Happen in Los Angeles County?

Mentor: R. M. Alvarez, *Associate Professor of Political Science*

PAUL E. SNAPE

Junior, Ch; Pomona College

Modification of an Existing Chemical Ionization Mass Spectrometer (CIMS) for Ground Based Measurements of Atmospheric Nitric Acid

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

ANGELA K. SNOW

William H. and Helen Lang SURF Fellow
Junior, EAS

Arsenic Reduction in *Shewanella* "ana"

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

THOMAS M. SNYDER

Thomas C. Hays SURF Fellow
Junior, Ch

Characterization of the Binding of N Peptide to λ BoxB by *in vitro* RNA Selection

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

DANIELLE M. SOLANO

Sophomore, Bi

Detection Methods of Bacteria in Icy Environments

Mentor: Arthur Lane, *Research Scientist, JPL*

BENJAMIN SOLISH

Freshman, Aeronautics and Astronautics; Massachusetts Institute of Technology

A Study of the Affects of Changing From X-Band to Ka-Band for the Mars Reconnaissance Orbiter Mission

Mentor: Ross Jones, *MUSES CN Project Manager, JPL*

NEHA G. SONI

Richter Scholar
Sophomore, CS

Computer-Based Modeling of Unusual Nucleic Acid Structures

Mentor: Erik Winfree, *Assistant Professor of Computer Science and Computation and Neural Systems*

LAKSHMINARAYAN "RAM" SRINIVASAN

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

How the Locust Brain Smells

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

JAMIE B. ST. JULIEN

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

Development of Caged Anisomycin for Studying Protein Synthesis in Hippocampal Neurons

Mentors: Erin M. Schuman, *Associate Professor of Biology; Assistant Investigator, Howard Hughes Medical Institute, and Changan Jiang, Postdoctoral Scholar in Biology*

ELIZABETH L. STAMESHKIN

Sophomore, Bi

Characterization of a Novel Gene Implicated in Neural Crest Development

Mentor: Marianne Bronner-Fraser, *Albert Billings Ruddock Professor of Biology*

ERICA M. STANLEY

The James Irvine Foundation MURF Fellow
Junior, CS; Clark Atlanta University

Segmentation and Animation of Volumetric Datasets

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

RICHARD S.L. STEIN

Junior, Ch

Simulation of Diffusion Gradients Across Cellular Tissue

Mentor: Arthur D. Lander, *Professor and Chair, Department of Developmental and Cell Biology, University of California, Irvine*

ROBIN S. STEIN

Howard Hughes Medical Institute SURF Fellow
Junior, Ch; Michigan State University

Conformational Preference of 3-Aminovaleric Acid in Solution

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

ROSALIA STELLACCI

Senior, Ph Methodologies; University of Pisa

Measurement of Metal Creep in Gravitational Wave Detectors

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

LAWRENCE S. STEWART

Class of '36 SURF Fellow
Freshman, EE

Treatment of Low Level Chromium (VI) Contamination by Redox Assisted Coagulation

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

DANIEL L. STICK

The Associates SURF Fellow
Junior, Ph

Building a DNA Oscillator

Mentor: Erik Winfree, *Assistant Professor of Computer Science and Computation and Neural Systems*

NICHOLAS G. STOLTZ

Junior, Ph; Washington and Jefferson College

Properties of Thermoelectric Thin Films

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

MELISSA J. STRAUSBERG

Samuel P. and Frances Krown SURF Fellow
Freshman, PISC

Investigation of the Chemistry and Processes of the Newport Estuary

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

MICHAEL B. STRUMPF

Junior, ECE; University of Rochester

Spacecraft Data Handling Systems

Mentor: Joel C. Sercel, *Lecturer in Aeronautics*

VICTORIA C.S. STURGEON

Honeywell SURF Fellow
Junior, EAS (ME)/Ec

A Model of Fluid Behavior Using Wave Splitting Techniques

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

CHRISTOPHER T. SUNG

Bristol-Myers SURF Fellow
Freshman, Bi/Ch

Time Course of Expression of $\alpha 4\beta 2$ Nicotinic Acetylcholine Receptors in Midbrain Neurons

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

ANONGPAT SUTTANGKAKUL

Junior, Bi

Natural Variation of *Tb1* in Maize and Teosinte and the Epistatic Interaction Between QTL-2s and QTL-4s

Mentors: John Doebley, *Professor, Department of Genetics, University of Wisconsin-Madison, and Elliot M. Meyerowitz, Professor of Biology*

MOLLY E. SWANSON

Flintridge Foundation SURF Fellow
Junior, Ph

Observing Ultra High Energy Cosmic Rays: Simulation and Data Analysis for CHICOS

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

ROBERT P. SWINNEY

Mr. Robert M. Abbey SURF Fellow
Junior, Ay

Radioassay Techniques in Neutron Activation Analysis of the KamLAND Liquid Scintillator

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

SEAN S. SZEJA

Richter Scholar
Sophomore, Ph

Transport Between Troposphere and Stratosphere: Analysis of CO₂ Spectra for Precision of Remote Sensing

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

JENNIFER C. TAGGART

Junior, Ph

Imaging Scatters From Seismic Array Data

Mentor: Robert W. Clayton, *Professor of Geophysics*

KAISA E. TAIPALE

Mr. and Mrs. Donald M. Alstadt SURF Fellow
Sophomore, Ma

Community Service at Caltech: Comparisons and Preliminary Findings

Mentor: William F. Deverell, *Associate Professor of History*

SI HUI TAN

Freshman, Ph

Non-Adiabatic Spin Transportation of Ultracold Neutrons

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

JAPECK TANG

Caltech-NUS Exchange
Sophomore, ECE

Compression of 3D Animation Data

Mentor: Kuntal Sengupta, *Associate Professor, Department of Electrical and Computer Engineering, National University of Singapore*

HAREEM TARIQ

Junior, Ph; Florida Institute of Technology

Tool Development for External Trigger Driven Burst Detection

Mentor: Szabolcs Marka, *Postdoctoral Scholar in Physics*

MARTIN K. TCHERNOOKOV

Sophomore, Ph

Stability Analysis of the Geodesic Laplacian Model

Mentor: Nikolai Makarov, *Professor of Mathematics*

SARAH L. TEEGARDEN

Sophomore, Bi

Using Monoclonal Antibodies Against Huntingtin to Block Its Toxicity

Mentor: Paul H. Patterson, *Professor of Biology*

CHRISTINA L. TELLES

Sophomore, Bi

Plasticity of the Medial Striatum Due to Habit Learning in Rats

Mentors: Ann M. Graybiel, *Walter A. Rosenblith Professor of Neuroscience, Massachusetts Institute of Technology*, and Erin M. Schuman, *Associate Professor of Biology; Assistant Investigator, Howard Hughes Medical Institute*

CRISTINA A. THOMAS

Freshman, PISc

Planetary Data in Education

Mentor: Leslie Lowes, *Co-Director, Solar System Exploration Education and Public Outreach Forum, JPL*

ELIZABETH G. THOMAS

Richter Scholar
Junior, Ma

Majorizing Estimators and Efficiency of a Statistical Technique in Randomized Algorithms

Mentor: Leonard J. Schulman, *Associate Professor of Computer Science*

JAMAR E. THOMAS

The James Irvine Foundation MURF Fellow
Sophomore, CS; Clark Atlanta University

The Benefits of the Benes Network in Spatial Computing

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

ANDREW R. THOMPSON

Sophomore, Ph/CS; Drake University

Volume Visualization of Scientific Data Using 3D Texture Mapping

Mentor: Lee Elson, *Research Scientist, JPL*

SAMUEL E. THOMPSON

Junior, EAS (CNS)

Localization of Cross-Modal Integration Using Electrophysiology

Mentors: Shinsuke Shimojo, *Professor of Biology*, and Ladan Shams, *Postdoctoral Scholar in Biology*

JIAN YUAN THUM

Richter Scholar
Freshman, Bi

Analysis of Mating Behavior in *C. elegans*

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

BRYAN E. TIEDEMANN

Richter Scholar
Junior, ChE

Spectroscopy and Electrochemistry of M(CN)₆⁻ Complexes (M = Mo, W) in Protic and Aprotic Solvents

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

SONIA C. TIMBERLAKE

Huntington Medical Research Institute SURF Fellow
Sophomore, Bi

Molecular Correlates of Conscious Level in Cerebrospinal Fluid

Mentor: Michael Harrington, *Program Director, Molecular Neurology, Huntington Medical Research Institute*

OANA TOCOIAN

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

Quantum Entanglement: An Interactive Multimedia Presentation

Mentor: Hideo Mabuchi, *Associate Professor of Physics*

JAMES T. TONG

Richter Scholar
Sophomore, EE

High Stability Low Noise Piezo Driver

Mentors: Stephen R. Quake, *Associate Professor of Applied Physics*, and Charles F. Spence, *Graduate Student in Applied Physics*

DIANA TORRES

The James Irvine Foundation MURF Fellow
Sophomore, CE; University of Puerto Rico, Mayagüez

Dynamic Characteristics of Woodframe Buildings

Mentors: James L. Beck, *Professor of Applied Mechanics and Civil Engineering*, and Vanessa Camelo, *Graduate Student in Civil Engineering*

FERNANDO A. TORRES

The James Irvine Foundation MURF Fellow
Junior, Ph; University of California, Davis

Statistical Properties of Galaxy Voids in Cold Dark Matter Universes

Mentors: Marc P. Kamionkowski, *Professor of Theoretical Physics and Astrophysics*, and Andrew Benson, *Postdoctoral Scholar in Astronomy*

CUONG C. TRIEU

Richter Scholar
Freshman, ChE

Advanced Oxidation of Phenol in Aqueous Solution Employing Ultrasound and Ozone

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

VICTOR C. TSAI

Freshman, Ph

LIGO Physics Environmental Monitoring

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

KEVIN Y. TSE

Mr. and Mrs. Charles J. Pankow SURF Fellow
Sophomore, Bi

The Role of PU.1 and GATA-3 in Early T-Cell Differentiation

Mentor: Ellen Rothenberg, *Professor of Biology*

NORA N. TU

Howard Hughes Medical Institute SURF Fellow
Sophomore, Bi

Developing a Mouse Model for Schizophrenia Following Prenatal Exposure to the Influenza Virus

Mentor: Paul H. Patterson, *Professor of Biology*

JENNIFER P. TUNG

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

Isotopic Fractionation of Biologically Produced Nitrous Oxide

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

AHMET TURA

Richter Scholar
Sophomore, EE

Programming the DSP Microprocessor to Communicate With the Computer and Process Data for the Study of the Movement of RNA Polymerase on a DNA Strand

Mentors: Stephen R. Quake, *Associate Professor of Applied Physics*, and Charles F. Spence, *Graduate Student in Applied Physics*

JAMES R. TURNBULL

Senior, Ph/CS; California State Polytechnic University, Pomona

Miniaturized Detectors for In-Space Propulsion Diagnostics

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

LISA J. TURNER

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

Nicotinic Acetylcholine Receptor: Studies on Ion Channel Gating

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

PAUL G. UPDIKE

The Associates SURF Fellow
Junior, EE

Object Recognition for the Automotive Industry

Mentor: Pietro Perona, *Professor of Electrical Engineering*

TRISTAN S. URSELL

NASA USRP
Junior, Ph; Rensselaer Polytechnic Institute

Sublimation Inhibitory Methods for Skutterudite Thermoelectric Materials

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

YELIZ UTKU

Sophomore, Ch; Koc University

Artificial Extracellular Matrix Proteins

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

DAVID A. VAN VALEN

Howard Hughes Medical Institute MURF Fellow
Sophomore, Ma; Massachusetts Institute of Technology

Dynamics of DNA Condensation

Mentors: Zhen-Gang Wang, *Associate Professor of Chemical Engineering*, and Andrew J. Spakowitz, *Graduate Student in Chemical Engineering*

ANDREA M. VANACORE

Sophomore, Political Science/Communications; Pasadena City College

The Influence of National Space Policy Over NASA Strategic Plans

Mentor: Suzanne Y. Frederick, *Staff Specialist for Strategic Planning, JPL*

JOSEPH T. VANDERSLICE

Freshman

Improving Collaboration in the Stick Pulling Experiment Using Vision

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

VIRGINIA P. VASSILEVSKA

Marcella Bonsall SURF Fellow
Sophomore, Ma

Coding and Graceful Labeling of Trees

Mentor: Richard M. Wilson, *Professor of Mathematics*

PHILIP A. VENTURELLI

Junior, Ph

Force Control Development for a Spaceborne Assembly Robot

Mentors: William L. Whittaker, *Fredkin Professor and Director, Field Robotics Center, Carnegie Mellon University*, and Nicholas Z. Scoville, *Francis L. Moseley Professor of Astronomy*

ANAEL VERDUGO

Richard and Dena Krown SURF Fellow
Sophomore, Ma

A Study on Localization of Finite Groups

Mentor: David B. Wales, *Professor of Mathematics*

VALERIE A. VILLAREAL

NSF Center for the Science and Engineering of Materials MURF Fellow
Junior, Ch; California State University, Los Angeles

Study of Self-Assembling Hydrogels as the Sieving Matrix for Capillary Electrophoresis

Mentors: Julia A. Kornfield, *Professor of Chemical Engineering*, and Frank Gomez, *Professor, Department of Chemistry and Biochemistry, California State University, Los Angeles*

DANA J. VUKAJLOVICH

Junior, Geoch

Spatial Variations of Trace Elements in Surface Waters of Kaneohe Bay

Mentors: Eric H. De Carlo, *Associate Research Professor, University of Hawaii*, and John M. Eiler, *Assistant Professor of Geochemistry*

WILLIAM R. WAJERT

Olstein and Rita A. Skjellum SURF Fellow
Junior, EAS (CS)

The Quantification of Bisection Replication Tradeoffs in Network Graphs

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

CHENYANG WANG

Richter Scholar
Junior, Ph/EAS

Statistical Physics of Quantum Error Recovery

Mentor: John P. Preskill, *Professor of Theoretical Physics*

EMILY WANG

Richter Scholar
Junior, Bi

Neurodegeneration and Lifespan Extension Genes in *Drosophila*

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

JIALAN WANG

The Associates SURF Fellow
Freshman, Ma/Ph

Clonal Interference

Mentors: Christoph C. Adami, *Faculty Associate in Computation and Neural Systems*, and Claus Wilke, *Postdoctoral Scholar in Computation and Neural Systems*

LIZHOU WANG

Freshman, Ph/EE

Using Galaxies to Test Cosmological Models

Mentors: Vahé Petrosian, *Professor of Physics and Applied Physics, Stanford University*, and Harvey B. Newman, *Professor of Physics*

SIDNEY WANGHoward Hughes Medical Institute SURF Fellow
Junior, Ch**Expression and Biochemical Characterization of a Double Cysteine Mutant Mechanosensitive Channel**

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

XIAOBO C. WANG

Junior, Ch

Synthesis of N-Acetylgalactosamine Monomers for a Chondroitin Sulfate Oligosaccharide Library

Mentor: Linda C. Hsieh-Wilson, *Assistant Professor of Chemistry*

YINGBING WANGMr. and Mrs. Robert E. Anderson SURF Fellow
Sophomore, ChE**Preventing Apoptosis in Muscle Tissue Extends Life Span in *Drosophila***

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

SARAH E. WARREN

Sophomore, Ge

Measurements of Ecosystem Carbon Fluxes and Net Primary Production in Interior Alaska

Mentor: James T. Randerson, *Assistant Professor of Global Environmental Science*

ANIKA N. WATSONHoward Hughes Medical Institute MURF Fellow
Sophomore, Polymer Science/Ch; University of Southern Mississippi**Controlled Drug Delivery System**

Mentors: Julia A. Kornfield, *Professor of Chemical Engineering*, and Rob G. Lammertink, *Postdoctoral Scholar in Chemical Engineering*

MISTY M. WATSON

Junior, Ph; Xavier University of Louisiana

PSL Acoustic Noise Attenuation Project

Mentor: Szabolcs Marka, *Postdoctoral Scholar in Physics*

JACOB J. WEEL

Sophomore, Ph; University College Utrecht

Energy Dissipation in Fused Silica Suspension Violin Modes

Mentor: Phil Willems, *Staff Member in Physics*

BENJAMIN A. WELANDERHowell N. Tyson, Sr., SURF Fellow
Junior, EAS**Development of Methods to Evaluate Polymers for Potential Actuator Applications**

Mentor: Morteza Gharib, *Professor of Aeronautics and Bioengineering*

KIRSTEN F. WELGEHuntington Medical Research Institute SURF Fellow
Freshman, Bi/H**Molecular Pathways of Migraine**

Mentors: Michael Harrington, *Program Director, Molecular Neurology, Huntington Medical Research Institute*, and Douglas C. Rees, *Professor of Chemistry; Investigator, Howard Hughes Medical Institute*

JASON C. WEN

Sophomore, Bi; Stanford University

Use of a Ferromagnetic Column to Separate Magnetosomes From *Magnetospirillum magnetotacticum*

Mentor: L. E. Bertani, *Member of the Professional Staff in Biology*

SIMON D. WEST

Sophomore, Ma/Ph; University College London

Quantum Entanglement Through Interactive Multimedia

Mentor: Hideo Mabuchi, *Associate Professor of Physics*

JUSTIN S. WHITE

Freshman

Fabrication and Analysis of Adiabatically Tapered Si Waveguides

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

RANDALL M. WHITE

Freshman

Fabrication and Applications of Flexible Metal Electrodes for Elastomer-Based Devices

Mentor: Stephen R. Quake, *Associate Professor of Applied Physics*

MARCUS R. WILLIAMSMr. and Mrs. Douglas B. Nickerson SURF Fellow
Sophomore, EAS (Env)**The Impacts of Metropolitan Los Angeles on Early Twentieth Century Conservation in the San Gabriel Mountains**

Mentor: Benjamin H. Johnson, *Instructor in History*

KEELY WILLIS

Junior, Ph; New College of the University of South Florida

Core Optics Auto-Alignment Sequencer

Mentor: Michael Landry, *Postdoctoral Scholar in Physics*

CRYSTAL R. WILSONHoward Hughes Medical Institute MURF Fellow
Sophomore, Molecular Bi; Hampton University**Passive Displacement of Latex Particles During Avian Neural Crest Migration**

Mentors: Marianne Bronner-Fraser, *Albert Billings Ruddock Professor of Biology*, and Seth Ruffins, *Postdoctoral Scholar in Biology*

HOMER F. WOLFE

Sophomore, Ph/Ma; New College of the University of South Florida

Characterization of Optical Materials for LIGO Upgrades

Mentor: Joseph M. Kovalik, *Staff Member in Physics*

MERRETT T. WONGWarren and Katharine Schlinger SURF Fellow
Junior, ChE**Surface Breakdown in Sub-Micron Spaces**

Mentor: Konstantinos P. Giapis, *Associate Professor of Chemical Engineering*

JAMES B. WORCESTER

Sophomore, EAS

Implementation and Evaluation of a Biologically Realistic Model for Attention and Object Detection

Mentor: Christof Koch, *Lois and Victor Troendle Professor of Cognitive and Behavioral Biology and Professor of Computation and Neural Systems*

NATHAN N. WOZNYRichter Scholar
Sophomore, Ph**Error Tolerance in Quantum Storage of Information**

Mentor: John P. Preskill, *Professor of Theoretical Physics*

TIAGO S. WRIGHTRichter Scholar
Junior, ECE**Animation of Algorithm and Data Interaction**

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

GILEAD WURMAN

Junior, Geoph

A GPS and InSAR Investigation of Land Subsidence Along the Dead Sea Shoreline

Mentors: Gidon Baer, *Research Geologist, Geological Survey of Israel*, and Joann M. Stock, *Professor of Geology and Geophysics*

SINA YEGANEH

Freshman, Ch

Electron Transfer Dynamics and Photoelectrochemistry of Ruthenium Trisbipyridyl SensitizersMentor: **Harry B. Gray**, *Arnold O. Beckman Professor of Chemistry***MUHAMMED A. YILDIRIM**Richter Scholar
Junior, EE**Data Compression and Information Rate for Correlated Quantum Sources**Mentor: **Hideo Mabuchi**, *Associate Professor of Physics***KISHA R. YOUNG**Howard Hughes Medical Institute MURF Fellow
Junior, Bi/Premed; Florida A&M University**The Role of *SpGATAc* on Secondary Mesenchymal Cells During Sea Urchin Development**Mentors: **Eric H. Davidson**, *Norman Chandler Professor of Cell Biology*, and **Paola Oliveri**, *Postdoctoral Scholar in Biology***PEARL YU**

Freshman, ME; Brown University

Studies of Internal Gravity Waves Using Ocean Color SensorMentor: **Roman Glazman**, *Research Scientist, JPL***YIFAN F. YU**

Sophomore, APh

Confidence Level Analysis Code for Experimental MeasurementsMentor: **Martin Barmatz**, *Principal Member of the Technical Staff, JPL***DAVID Y. ZHANG**Richter Scholar
Freshman, Bi/ECE**Self-Assembly of DNA: Using Wang Tiles to Build a DNA Computer**Mentor: **Erik Winfree**, *Assistant Professor of Computer Science and Computation and Neural Systems***QI ZHOU**Arthur E. Lamel Memorial SURF Fellow
Freshman, EE**Solar Photovoltaic Monolithic Microarray**Mentor: **Harry A. Atwater**, *Professor of Applied Physics and Materials Science***IRENA ZIVKOVIC**

Junior, Electronics Eng; University of Nis

Analysis of Burst Signals in LIGO DataMentor: **Alan J. Weinstein**, *Professor of Physics***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
H	History
ISP	Independent Studies Program
Lit	Literature
Ma	Mathematics
ME	Mechanical Engineering
Ph	Physics
PISc	Planetary Science
SES	Science, Ethics, & Society
SS	Social Science

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