1991 ANNUAL REPORT

SURF

Summer Undergraduate Research Fellowships

CALIFORNIA INSTITUTE OF TECHNOLOGY

ACKNOWLEDGEMENT

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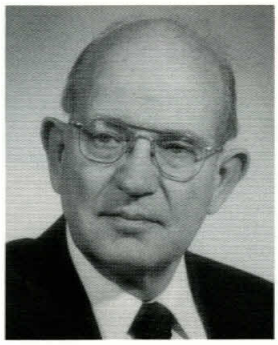
DEDICATION

The 1991 SURF program is dedicated to Dr. Lew Allen, former Director of the Jet Propulsion Laboratory. During his long and distinguished career which included service as Director of the National Security Agency, Chief of Staff of the U. S. Air Force, and Director of JPL, Dr. Allen has been an enthusiastic and dedicated supporter of undergraduate education and research. Of primary importance to SURF was his opening of JPL to SURFers in 1983. JPL now serves as the venue for about one quarter of all SURF research projects. Dr. Allen recently has been appointed as a member of the SURF Board, and we look forward to his guidance and support.



PRESIDENT'S MESSAGE

1991 was a dynamic year for undergraduate research at Caltech!

Because SURF so effectively integrates classroom experiences with a real-life opportunity to ask new questions and to seek answers no one else knows, the program continues to grow in popularity and prestige. SURF fosters collegiality between research sponsor and student. It brings together teams that produce new ideas, discover new knowledge, and provide superlative mutual stimulation. It is an important program at Caltech which carries on the tradition of undergraduate research begun long ago by Arthur Amos Noyes and Ernest Swift.

With more undergraduates participating than ever before, 192 this summer, the SURF ranks have been broadened to include 46 non-Caltech students from across the country, England, and Germany. The Institute owes a special tribute to the selfless dedication of so many SURF research sponsors and the program's many special friends, whose generous gifts make SURFing possible at Caltech.

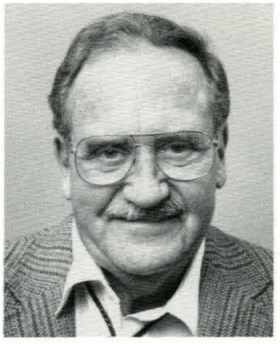
As part of our centennial celebration, Caltech hosted EUREKA, the fifth National Conference on Undergraduate Research. We are proud of our hundred years of dedication to education and research, and we were very pleased to have had the opportunity to encourage over 800 undergraduate students in their intellectual journey.

Thomas E. Everhart
President
California Institute of Technology

REPORT FROM THE SURF BOARD

Ray Owen

The SURF program achieved another banner summer. A record 192 students participated in SURF during the summer, enthusiastically working with their research sponsors to carry out their projects. In March Caltech hosted EUREKA, the fifth National Conference on Undergraduate Research. With our long tradition of involving undergraduate students in research, it was particularly fitting for us to celebrate our centennial in this way.



This was also a fine year for the SURF Board. We welcomed seven new members: Lew Allen, Robert Banning, Ralph Jones, Robert Perpall, Edith Roberts, Victor Veysey, and Robert Zurbach. Each brings a deep interest in and dedication to the value of research as part of the undergraduate experience, carried through to a good public presentation of results.

We formed three committees to focus and extend the work of the Board. Lew Allen serves as chairman of the Donor and Support Committee. Other members include Robert Banning, Hannah Bradley, Carl Larson, and Edith Roberts. The committee is responsible for assisting with the identification of potential contributors to the SURF program, for helping to develop new summer research opportunities in industry for the students, and for encouraging the establishment of new SURF endowments.

Joanna Muir is the chairman of the Student Relations Committee; members include Marcella Bonsall, Betty Nickerson, Robert Perpall, and Victor Veysey. In addition, Julia Kornfield, Assistant Professor of Chemical Engineering and a SURF student in 1982, and Ken Libbrecht, Associate Professor of Astrophysics and a 1979 SURFer, serve on this committee. The committee's responsibilities include coordinating interaction between the students and members of the Board and other donors. Joanna Muir, Marcella Bonsall, and Betty Nickerson hosted a "thank you note writing party" during July to encourage students to express their appreciation to their financial sponsors. On August 20, Amytis Barrett, Joanna Muir, Del and Robert Noland, Janet and Victor Veysey, and Betty Nickerson hosted their SURF students for dinner at the Athenaeum. This event provided the students and their financial sponsors an opportunity to discuss the progress of the research and to become better acquainted. Bob Perpall and Vic Veysey, as members of this committee, helped students rehearse their final oral presentations.

Fred Shair, founder of the SURF Program and life member of the SURF Board, serves as chairman of the Campus Liaison Committee. Ralph Jones, and Bob Zurbach join Fred on the committee as well as Bill Whitney, Division Technologist in the Observational Systems Division at JPL and a member of the SURF Administrative Committee. This summer the committee assisted in setting up roundtable discussions for small groups of students. The committee is charged with maintaining interactive communication between the SURF program and other student related activities and organizations both on and off compus.

The SURF Board is dedicated to the educational values of undergraduate research at Caltech. Our mission is to contribute to the vitality, continuity, and effectiveness of the SURF program. Through the participation of the Board in the work of these committees, we are pursuing our mission with vigor.

The SURF endowments are an important and valuable source of funds for our students. We thank the many donors who have contributed and continue to contribute to these funds. We salute Samuel and Frances Krown for establishing the first endowment in 1982. We thank particularly Hugh and Audy Lou Colvin for their generosity. This year the SURF student stipend was increased to $3600. In order to provide income at the increased stipend, the cost of a SURF endowment will be $75,000.

My year as Chairman of the SURF Board has been very rewarding for me. I have long had deep interest in the education and welfare of our young people, and this year has given me another opportunity participate in a successful and important activity in their interest. I have enjoyed my interactions with the Board and with the Administrative Committee, the chance to work with the excellent, hard working, and dedicated staff of the SURF and Development Offices, and the opportunity to be involved with students and their research projects.

The future for SURF looks bright. EXCELSIOR!

Report of the SURF Administrative Committee

Terry Cole

The Administrative Committee consists of faculty from each of Caltech's six academic divisions, members of the JPL technical staff, and members of the administrative staff. Our role is the strengthening of SURF and maintaining it as the nation's leading undergraduate research program.

The primary goal of SURF is to provide opportunities for Caltech and selected undergraduates from other institutions to carry out independent research under the direction of leading scientists and engineers. We endeavor to assure funding for every Caltech student who meets the criteria of the faculty and JPL sponsors.

The year past has seen the achievement of several milestones in the SURF program. These included the hosting of the EUREKA Conference, inauguration of the Minority Undergraduate Research Fellowship program, and participation of nine of JPL's Sacred Mountain Scholars as guest SURFers. These latter initiatives have served the committee's goal of increasing minority participation in SURF, and the Institute's efforts to attract talented minority students, faculty, and staff.

During the year the Committee took significant action in regard to stipends. In light of the fact that no cost of living increases in the SURF stipend had occurred for the last six years, our committee voted to increase stipends 17% to $3,600. We are working closely with the Development Office to ensure that adequate funds are raised to support this increase.

We welcome the appointment of our colleague Ray Owen as chair of the SURF Board and look forward to working closely with him as we develop undergraduate research at Caltech.

THE HERITAGE OF SURF

Even the founders of SURF had no idea what a phenomenal success the program was going to be. Founded in 1979 with 18 students and 17 faculty sponsors, the Summer Undergraduate Research Fellowships program has served over 1300 students and has been a model for similar programs at universities throughout the country.

The SURF program was designed in 1979 by Fred Shair, then a member of the faculty Scholarships and Financial Aid Committee, to fill several needs: The National Science Foundation was phasing out its undergraduate research program; the committee needed to distribute monies from the President's Prize Fund. A program to capitalize on the availability of faculty during the summer months, to encourage interaction with undergraduate students around a research problem of mutual interest, and to meet the need for summer employment was ideal. SURF formed around the grant process: each student would write and submit a proposal to be reviewed for funding. Those who were accepted would receive a stipend during ten weeks of the summer. At the end of that time, each was expected to describe his or her results at a scientific meeting. In some cases, it was expected that research would result in published papers.

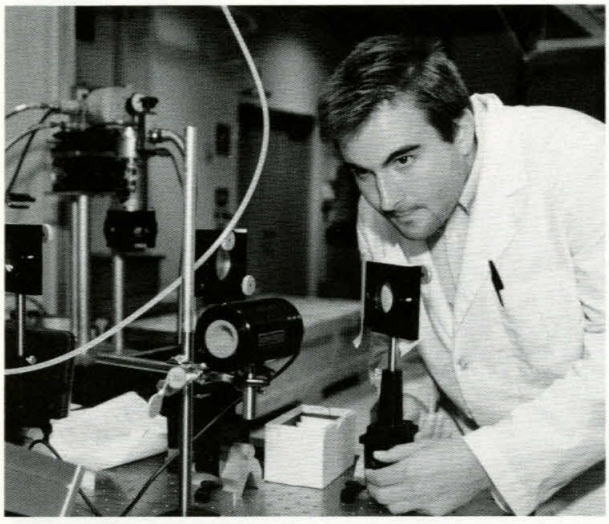
Students have discovered how exciting front-line research can be. They apply what they have learned in the classroom to real-life projects, seeking solutions to unanswered questions. They gain insight into what a professor's professional life is like, and about the kind of career they might like to pursue in the future. Equally important is the interaction between students and professors that the SURF program provides. Research sponsors are more than qualified teachers for undergraduates, they are mentors. The mentor-protégé relationship encompasses not only the research project but also the relationships within the research group, the economics of research, and research ethics. The student-sponsor relationship is one of the most important aspects of the SURF experience.

However, SURF not only benefits the students. Over 20% of SURF students become co-authors on articles in the open scientific literature and are, therefore, contributing substantially to the research of their sponsors. Through the Speakers Bureau, SURFers share their enthusiasm for science and help to further the public's scientific awareness.

The Institute benefits from the SURF program. Many entering freshmen say they chose Caltech because of

the chance to do research. The program helps to build bridges between students and faculty; between Caltech and JPL; between the Institute and alumni, donors, the community, and the local schools. Some departments have recruited graduate students through the SURF program.

SURF has grown beyond almost anyone's expectations. A total of 192 students including 46 from other campuses undertook projects this year, supervised, encouraged, and counseled by 134 faculty, JPL, and off-campus sponsors. In addition to growing numbers, the geographical locations of the research also expanded as several of the students worked in such diverse places as Taiwan, Switzerland, and Africa. One student SURFed at Rice University; one, at the University of Wisconsin.



Over the years, other changes have taken place in the program. Noontime seminars, leadership roundtables, and communications workshops have been added. The stipend has been increased, and funding for the program has become more diversified. Individuals, foundations, and corporations have enthusiastically supported SURF and the need for quality research training at the undergraduate level. In addition, many find that such support can result in reciprocal benefits to both the donor and the student.

None of this would have been realized without Fred Shair's original vision for an undergraduate research program at Caltech. Serving as director during SURF's first eleven years, Fred brought together a dedicated team, laying the groundwork for the phenomenal growth and success of the program. Under his leadership SURF flourished and matured.

Many devoted volunteers joined the SURF team including an administrative committee, the SURF Board, speakers, faculty, and JPL technical staff members, Caltech administrative staff, and, of course, the enthusiastic and hard working undergraduates who are the reason for the program's existence and the reward for the effort.

SURF provides a new dimension to the process of undergraduate education. Graduates of SURF, with their sophisticated and practical knowledge of how to conduct research, have a marked advantage as they embark on their career paths, apply to graduate schools, or look for jobs in industry.

Each year since 1985, the SURF program has been dedicated to someone who has made an extraordinary contribution to the enhancement of undergraduate life at Caltech. SURF has been dedicated to Lee DuBridge, Hans Liepmann, Ray Owen, Fred Shair, Robert Sharp, Ernest Swift, and this year, to Lew Allen.

The heritage of SURF is rich; SURF's benefits reach far and touch many. The program positively affects students as they prepare for their careers, it benefits the Institute, and it builds bridges among individuals, organizations, and institutions.

DIRECTOR'S REPORT

Carolyn Merkel

SURF enjoyed its largest program this summer with 192 students participating. To enrich the research experience, students heard technical seminars, participated in roundtable discussions, discussed career development issues, learned how to present a technical talk, and planned and attended social activities. It was a rich, active, stimulating summer of undergraduate research and a fine celebration of Caltech's centennial.

The Caltech SURF Team

The SURF team boasts over 450 members including students, research sponsors, administration, staff, alumni, and friends of the program. This team is dedicated to the intellectual formation of our students and committed to developing new opportunities for them. The SURF team spirit is an important ingredient to the dynamic success of the program. We value the unique contribution of each member.

SURF Support

This year the SURF Administrative Committee authorized an increase in the student stipend to $3,600 for the ten-week period. Because of the increased support from the faculty, JPL, the SURF Board and other friends, corporations, and foundations, the SURF Committee was able to reach its goal of funding all the top-ranked proposals.

The SURF endowments are a vital source of funding for the program. This summer, endowment interest funded more than 13 students. We thank the generous friends of SURF who have established endowments; they are listed on page 36.

We thank David Goodstein, Vice Provost, and the administration for the special recognition given SURF this year. In May, the SURF staff moved into spacious new offices in the Beckman Institute. In another demonstration of the value it places on the program, the administration increased its financial commitment to SURF.

Caltech Seminar Series

Each Wednesday during the summer, members of the Caltech faculty or JPL technical staff presented overviews of their areas of research. The seminars are open to the Caltech community. Speakers and their topics were:

Diana Barkan, Assistant Professor of History, *The Nobel Prize Then and Now*

Mark Davis, Professor of Chemical Engineering, *Molecular Sieves: Inorganic Solids that Can Organize and React with Å Level Specificity*

Dennis A. Dougherty, Professor of Chemistry, *Plastic Magnets?*

Melany L. Hunt, Assistant Professor of Mechanical Engineering, *Hot Topics in Thermal Engineering*

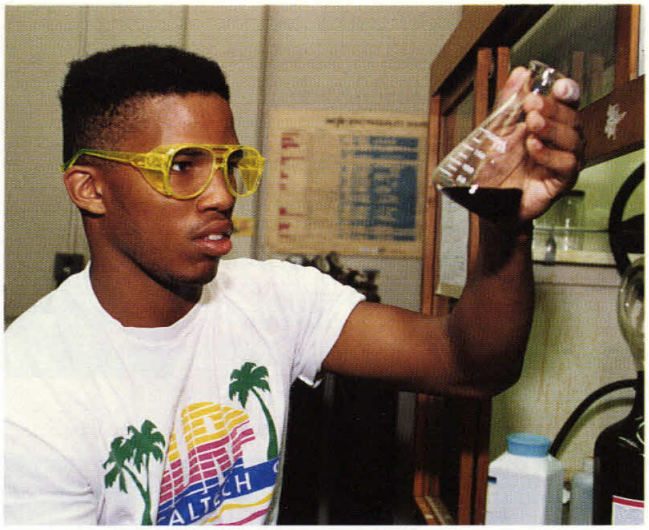
Joseph L. Kirschvink, Associate Professor of Geobiology, *Magnetism in the Human Brain*

Henry Lester, Professor of Biology, *Molecules of Thought*

Mary E. Lidstrom, Associate Professor of Applied Microbiology, *Detoxification of Hazardous Wastes by Bacteria*

Jeffrey Plaut, Research Associate, Magellan Science Team, JPL, *Magellan at Venus: Results from the First Mapping Cycle*

Paul Ray, Graduate Student in Physics, *Computational Astronomy with Parallel Supercomputers*



Yu-Chong Tai, Assistant Professor of Electrical Engineering, *Micromachines and Micromotors*

JPL Seminar Series

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

John Dick, Telecommunications Science and Engineering Division, *Whispering Gallery Modes in Cooled Sapphire Resonators for Ultra-High Q and Low Phase Noise* (this seminar was cancelled because of an earthquake)

Richard Doyle, Information Systems Division, *Space Applications of Artificial Intelligence*

Bill Gray, Systems Division, *Space Submillimeter Astronomy*

Harold Lang, Earth and Space Sciences Division, *Geological Remote Sensing*

Ed Marion, Systems Assurance Division, *Reliability Engineering*

Donald Rapp, Mechanical Systems Engineering and Research Division, *Infrared Astronomy in the Post-SIRTF Era*

Dick Stanton, Electronics and Control Division, *The ASTRO Experience*

Ben Toyoshima, Institutional Computing and Mission Operations Division, *Flight Operations: Present and Future*

Art Vaughan, Observational Systems Division, *Wavefront Aberration in the Hubble Telescope*

Special Programs

We offer many special programs to provide diversity, balance, and enrichment to the students' research experience. Many people have given much time and effort in the creation and development of these programs; they have taken initiative and given leadership to these activities. We thank them for their contributions.

Communication Program

For many students, the presentation on SURF Seminar Day is their first experience in public speaking. To help them prepare for their talks, Mary Ann Smith designed a program to integrate communication skills into the research experience. The program consisted of three phases: an orientation session attended by students and their research sponsors; a series of three small-group workshops; and a panel discussion by faculty recognized as outstanding speakers.

In the orientation session, Mary Ann outlined expectations for the communications workshops and prescribed standards of presentation. Students then met three times in small groups with her to present specific assignments. The assignments were designed (1) to convince the students of the necessity of connecting the audience to the topic, (2) to help the student think about how to to accomplish the con-

nection through careful explanation and analogy, and (3) to teach a specific speech skill.

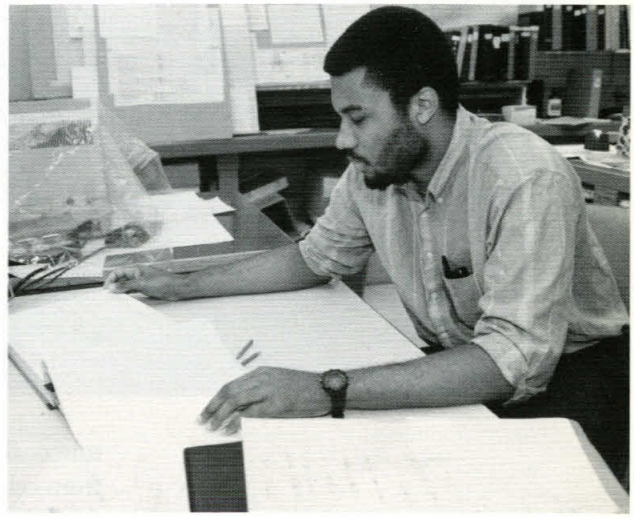
Students within the small groups represented a variety of research areas. The diversity of interest and background in the group helped the students recognize the necessity for clear explanations even with a technically educated audience. They enjoyed sharing information and ideas across and within their disciplines. The students served as their own best critics and supporters. The workshops offered a relaxed but challenging arena to try out ideas and new skills.

Doctors David Goodstein, Mary Kennedy, and Paul Robinson participated in a panel moderated by Mary Ann Smith. They discussed how they prepared to speak to different types of audiences, what they considered to be professional standards for speakers in their disciplines, and the importance of being able to communicate technical information to a lay audience.

Students were motivated to participate in the workshops to prepare for the final oral presentation; however, the communication program provided other benefits to the students, the faculty, and to the pedagogical aspects of the research. Students began to understand the importance of clearly communicating their research, knowledge, and ideas to other scientists or to the public for funding purposes as well as for general education. In the group sessions many recognized the necessity of gaining a more thorough understanding of their research to be able to communicate it clearly; they learned to ask more interpretive questions of their research sponsors. Through the integration of research and presentation skills, SURF committed to ensuring that researchers of the future can communicate new ideas and knowledge.

Speakers Bureau

Eugene Lit, a senior in chemistry and three-time SURFer, coordinated the SURF Speakers Bureau this year. Ten students worked in teams of two to give talks, demonstrations, and experiments at Washington Middle School in Pasadena. Topics included: Air Pressures, Engineering, Human Nervous System, Geology, and Chemistry: Phase Change. Students repeated their presentations to all classes in two grade levels. In his report, Eugene said, "Their feeling is that they made a very large impact on a number of students. At the beginning of the year some of our students were heckled about their talks with comments like 'why are you bothering to teach this to us?' By the end of the year, one of the students who had asked this question was was inquiring when the next group would be coming."



Can You Do Research for a Living?

Four informal sessions led by Bill Whitney, JPL, and member of the SURF Administrative Committee, were held on topics of interest to people contemplating careers in research:

1. Getting a Head Start on Graduate School
2. Funding for Research
3. More about Graduate Schools
4. Scientific Fraud

The two sessions on graduate schools emphasized the value of setting career goals and basing decisions and plans on these goals. Other participants were Julia Kornfield, Assistant Professor of Chemical Engineering and a 1982 SURFer, Sally Asmundson, Director of Career Development, and Paul Robinson, JPL. Recent graduates Eugene Lit,

Mark Dinan, and Charles Budney gave accounts of their experiences in planning for and applying to graduate programs.

Earl Friese, Director of Sponsored Research, presented the session on research funding. He discussed the various sources of money, and the essential role of the investigator in seeking out and understanding the needs of potential sponsors. He emphasized the importance of good communication skills in explaining to non-specialists the objectives, significance, and technical content of proposed work.

David Goodstein discussed a wide range of issues connected with scientific fraud and misconduct, using examples drawn from celebrated cases of the past and from recent newspaper accounts. The subtlety of some of these issues and the role of good scientific judgment in avoiding problems were illustrated with entries from the notebooks of Robert A. Millikan.

SURF Press Conference

Paul Robinson, Assistant to the Chief Technologist, JPL, is coordinating the first SURF press conference to be held in the fall. Journalism students from California State University, Northridge, will interview selected SURF students about their research. The journalism students are from Dr. Larry Schneider's class on science writing and reporting. The purpose of the press conference is threefold: (1) to broaden the SURF experience, (2) to involve journalism students in science writing early in their reporting and writing experience, and (3) to establish a non-combative and non-adversarial relationship among scientists, press, and public.

Paul chaired a steering committee to plan the press conference. Other committee members are George Alexander, Manager of Public Affairs, JPL; Carolyn Merkel, Robert O'Rourke, Assistant Vice President for Public Relations, Caltech; and Larry Schneider.

Y Program

The Y program got off to a rousing start this year with a well attended barbeque to celebrate the first day of SURF. The executive committee met weekly under the guidance of Joan Spears, SURF assistant, and Caltech Y director, Lucy Guernsey, and her assistant, Chris Sundberg. The Y offered Wednesday night movies. Tickets were available at discount for the Hollywood Bowl, Pasadena Playhouse, Raging Waters, Disneyland, Magic Mountain. There were two horseback riding day trips and hikes in the mountains. Some students attended free public concerts ranging from pop to classical. Many took advantage of the unique opportunity to learn ballroom dancing; the classes concluded with a waltz party in the Athenaeum. A few students participated in a 5-K run to benefit the Hollenbeck Police Department's Summer Youth Programs.

Twelve students travelled to Tijuana to work at the YMCA to help construct a community center room and to interact with the orphans. Several of the SURFers made return trips. As one student reported: "We received much more than we gave. It's one of those things you have to experience to

understand. The difference in standard of living does not reflect a difference in personal happiness."

Roundtables

The SURF Board Campus Liaison Committee, under the chairmanship of Fred Shair, coordinated the roundtable series this summer. Other members of the committee are Ralph Jones, Bill Whitney, and Bob Zurbach.

Dr. George Smith, Senior Vice President of Hughes Aircraft Company and Director of the Hughes Research Laboratories, and Distinguished Caltech Alumnus, met with a small group of students at lunch in the Athenaeum. He described the goals of the research at Hughes. Conversation touched on such topics as the preparation needed for an industrial research career; advantages and disadvantages of working before going to graduate school; how and why research people move into management positions; and the knowledge and aptitudes required of a successful research manager.

Al Schaff, retired Special Assistant to the President of Ametek, led another roundtable discussion. The objective of the discussion was to acquaint the students with interrelationships between the technical and operational aspects that make for better individual and management performance in an industrial organization.

Thomas Tombrello, Professor of Physics at Caltech; William Bridges, Carl F Braun Professor Engineering at Caltech; and Jeffrey Richardson, Division Leader, Chemistry Division, Lawrence Livermore National Laboratory, led a discussion with twenty students contrasting and comparing research opportunities and careers in academia, industry, and in national laboratories.

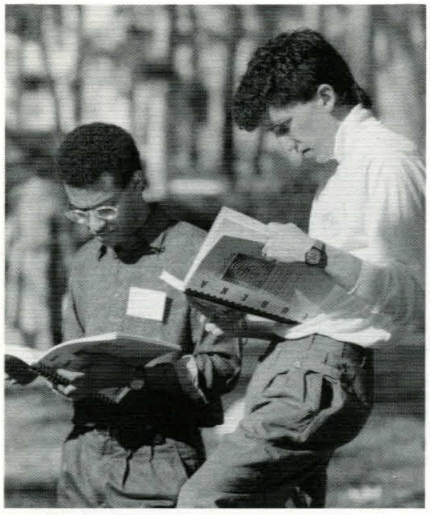
Minority Undergraduate Research Fellowship (MURF)

Professor David Van Essen reports: "1991 was the first summer for the new Minority Undergraduate Research Fellowship (MURF) program in Biology and Chemistry. By a variety of measures, the MURF program was highly successful: more than 100 applications were received, 14 excellent students were admitted, and nine students accepted our offer. These nine MURF students spent 8-10 weeks working under the supervision of a faculty sponsor and a post-doctoral or graduate student advisor.

"As participants in SURF, the MURF students took part in various SURF programs and activities.

"We held a series of weekly lunch meetings to discuss technical topics or to evaluate the program. The students had an opportunity to meet with minority graduate students at Caltech and with minority leaders Drs. Jewell Cobb, a member of Caltech's Board of Trustees, and Yvonne Freeman, Manager, Minority Science and Engineering Initiatives Office at JPL.

"Students found their summer experience to be both enjoyable and useful in helping to evaluate their career options. Most of MURF students plan to apply to a doctoral program; many of them indicated that they are likely to apply to Caltech as a result of their successful summer experience. We are optimistic that the MURF program will succeed in our long-term objective of



increasing the representation of minority groups in the fields of science and engineering."

EUREKA

More than 1100 students and faculty attended EUREKA, the fifth National Conference on Undergraduate Research, at Caltech last March. The enthusiastic participation in the conference of such a large delegation of students and faculty signals the importance of research in the undergraduate curriculum. The conference provides a forum for students to exchange information and ideas, to showcase their achievements, to discover firsthand the methods and presentation styles in the various disciplines.

The keynote addresses by Drs. Leroy Hood, Evelyn Fox Keller, Louis Sullivan, and Mr. Ray Bradbury, were interesting, instructive, and stimulating. The panel on global warming, moderated by Mr. Robert Cowen, discussed the controversy in the scientific community surrounding this important topic. Other panelists included Drs. Moustafa Chahine, James Huffman, Richard Lindzen, V. Ramanathan, and Richard Stroup.

In addition to giving seminars or posters and hearing keynote addresses, students visited a major film studio in Hollywood where they were treated to a tour of the studios including several movie sets, a staged earthquake and avalanche. This event provided a startling contrast between the arts and sciences as reported by the students at the conference with the glitz and glamour of science fiction as portrayed by the movie industry. In stark comparison with the art and science fiction of Hollywood, the Jet Propulsion Laboratory offered tours of several facilities including the Space Flight Operations Facility, the Microdevices Laboratory, and the Spacecraft Assembly Facility. Conferees had the chance to see full scale mockups of spacecraft, learn about communication in space, and view computer visualization movies from the Voyager encounters with the outer planets.

SUMMARY OF THE 1991 SURF CLASS

Divisions and Options	*Number of Sponsors*	*Number of Students*	*Number of Non-Caltech Students*
Biology	20	29	9
Chemistry and Chemical Engineering			
Chemistry	17	34	9
Chemical Eng.	4	5	1
Engineering and Applied Science			
Aeronautics	1	2	
Applied Mathematics	3	3	
Applied Microbiology	1	2	1
Applied Physics	4	5	
Computer Science	1	1	
Electrical Engineering	3	6	
Engineering	4	4	1
Mechanical Eng.	3	5	
Geological and Planetary Sciences			
Geology	3	5	
Planetary Science	3	3	1
Humanities and Social Sciences			
Humanities	4	5	1
Social Sciences	4	4	
Physics, Mathematics, and Astronomy			
Astronomy	9	13	1
Mathematics	2	2	
Physics	16	22	2
JPL	30	40	20
OFF-CAMPUS	2	2	
TOTAL	134	192	46

SURF PUBLICATIONS

1. "Crustal Structure Near the Eastern Transverse Ranges," *EOS*, 60, p. 876 (Abstract), N.W. Clayton* J.B. Minster**.
2. "Coulomb Distortion of Pion Spectra from Heavy-Ion Collisions," *Physical Review Letters,* Vol. 43, No. 1, p. 1581-1584 (1979), K.G. Libbrecht*, S.E. Koonin**.
3. "Flux Pinning by Magnetic Impurities in an Amorphous Superconducting Alloy," Report to the Department of Energy, (1980), D.L. Whiting*, (worked with W. Johnson**).
4. "IUE and Visual Spectrophotometry of Markarian 9, Markarian 10, and 3C 390.3," *Astrophysical Journal* Vol. 243, p. 445 (1981), R.W. Goodrich*, J.B. Oke**.
5. "Structure and Transcription of Normal and Abnormal Globin Genes," *Journal of Supermolecular Structure of Cellular Biochemistry,* Supp. 5, p. 381 (1981), N. Proudfoot, M. Shander, S. VandeWoude*, T. Maniatis**.
6. "Repetitive Sequences of the Sea Urchin Genome II. Subfamily Structure and Evolutionary Conservation," *Journal of Molecular Biology,* 149, p. 15-39 (1981), R.H. Scheller, D.M. Anderson, J.W. Posakony, L.B. McAllister*, R.J. Britten, E.H. Davidson**.
7. "Repetitive Sequences of the Sea Urchin Genome: Distribution of Members of Specific Repetitive Families," *Journal of Molecular Biology,* 145, p. 5-28 (1981), D.M. Anderson, R.H. Scheller, J.W. Posakony, L.B. McAllister*, S.G. Trabert, C. Beall, R.J. Britten, E.H. Davidson**.
8. "Molecular Basis of Genetic Defects in Human Globin Genes," *Journal of Supermolecular Structure of Cellular Biochemistry,* Supp. 5, 229 (1981), M. Shander, S. VandeWoude*, N. Proudfoot, T. Maniatis**.
9. "Organization and Expression of Multiple Actin Genes in the Sea Urchin," *Molecular and Cellular Biology,* Vol. 1, No. 7, p. 609-628 (July 1981), R.H. Scheller, L.B. McAllister*, W.R. Crain, Jr., D.S. Durica, J.W. Posakony, T.L. Thomas, R.J. Britten, E.H. Davidson**.
10. "Infrared Photometric Observation of BL Lac Object BL Lacertae (2200-42)," *Annual Report of the Mount Wilson and Las Companas Observatories,* 1981-1982, R. Pogge* (worked with G. Neugebauer**).
11. "Absolute Spectrophotometry of Very Large Redshift Quasars," *Astrophysical Journal,* Vol. 255, p.11 (1982), D. Korycansky*, J.B. Oke**.
12. "Experimental Study of Autorotation with Flow Visualization," Received Third Place Certificate of Merit at American Institute of Aeronautics and Astronautics Minta Martin Student Competition for presentation of a technical paper, University of California, Irvine, April, 1982, I. Sugioka* (worked with F.E.C. Culick**).
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Jing-Tying Chao *Junior, EAS*	Transmission of Solitary Waves in Branching Open Channel	Theodore Y. Wu *Professor of Engineering Science*
Tara L. Chapman *Junior, Bi/Ch* *Arizona State University*	cDNA Clone of the 30 kDa Subunit of the Human Respiratory Chain NADH Dehydrogenase	Anne Chomyn *Senior Research Associate in Biology*
A. Raghava Chari *Senior, Ma*	Nonleptonic Weak Decay of Λ_b to Charmed Baryons	Mark B. Wise *Professor of Theoretical Physics*
Julian C. Chen *Junior, Bi/Ch* *Richter SURF*	Crystallization and Elucidation of the Three-Dimensional Structure of Triple Helical DNA	Douglas C. Rees *Professor of Chemistry*
Wayne W. Chen *Sophomore, Bi* *Lacy SURF*	Engineering Subtilisin E Activity in Nonaqueous Organic Solvents by Means of Random Mutagenesis Coupled With an Effective Screening System	Frances H. Arnold *Assistant Professor of Chemical Engineering*
Mark J. Cheng *Sophomore*	Regional Variation and Sex Differences in Mortality During Taiwan's Epidemiological Transition in the Early Twentieth Century	John R. Shepherd *Ahmanson Postdoctoral Instructor in East Asian Studies*
Richard Chiu *Junior, EE*	A Band Pass Computer Compensated Silicon Cell Radiometer	Gilbert Yanow *Technical Group Leader, JPL*
Tom T. Chiu *Junior, Ch* *Yale University*	Synthesis and Characterization of Unique 21-Residue Peptide for Biomineralization Studies	Sunney I. Chan *Professor of Chemical Physics and Biophysical Chemistry*
Henry O. Choi *Sophomore, ME* *General Motors SURF*	The Effect of Upstream Bend on Flow Characteristics and Forces in the Inducer	Christopher E. Brennen *Professor of Mechanical Engineering*
Chek P. Chuan *Senior, EE*	Controlling The Real World, Macintosh Style	Rodney M. F. Goodman *Associate Professor of Electrical Engineering*
Lori L. Clampitt *Senior, Ay* *Smith College*	Stellar Populations in M32	Wendy Freedman *Astronomy Faculty, Carnegie Obvservatories*
Richard W. Clark *Sophomore, Lit* *St. John's College* *NSF SURF*	Japanese Language Software Programs	Kayoko Hirata *Lecturer in Japanese*
Samuel J. Clark *Senior, Bi/ME* *Colvin International SURF*	Census Update and Evaluation of the Potential for an AIDS Testing Program in the Gwembe Tonga of the Middle Zambezi Valley, Zambia	Thayer Scudder *Professor of Anthropology*
Michael A. Clemens *Sophomore, Bi*	Characterization of a cDNA Clone Encoding a Suspected DNA Regulatory Protein	Carl S. Parker *Associate Professor of Chemistry*
Douglas I. Clowe *Sophomore, Ay* *Richter SURF*	Shell Creation in Colliding Galaxies	Thomas A. Prince *Associate Professor of Physics*
Kathleen T. Coughlin *Sophomore, Ph* *Richter SURF*	Scale-model Measurements of Antennas Used in Submillimeter Detectors	Jonas Zmuidzinas *Assistant Professor of Physics*

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Graham I. Cummins *Sophomore, Ch* *Richter SURF*	Third Order Optical Effects and Optical Limiting in Phthalocyanines	Seth R. Marder *Member of the Beckman Institute*
David M. Cutrer *Senior, APh/EE* *Abbey SURF*	Stabilization of Nanocrystalline Alloy Solutions	William L. Johnson *Ruben and Donna Mettler Professor of Engineering and Applied Science*
Bang P. Dang *Sophomore, EE/CS*	Fertility of the Qing Imperial Clan	James Z. Lee *Associate Professor of History*
John F. Davis *Senior, EE* *Arizona State University*	SURFSAT Ka-Band Transponder Development	Robert C. Clauss *Systems Development Program Manager, TDA Office, JPL*
Deborah Dixon *Senior, Ph* *Colorado College*	Production of the 1987 Atlas of Surface Oceanographic Parameters, and the Use of the Atlas in the Study of Interannual Oceanographic Variations	David Halpern *Senior Research Scientist, JPL*
Jennifer A. Dooley *Junior, APh* *Ford SURF*	Microstructure and Grain Growth in NiFe Thin Films	Harry A. Atwater, Jr. *Assistant Professor of Applied Physics*
Roanna N. Doty *Junior, EAS/CS*	Project SEED: Zoom-In	James M. Bower *Associate Professor of Biology*
Doruk Engin *Senior, Ph* *Clark SURF*	Solitons in Photorefractive Crystals	Amnon Yariv *Thomas G. Myers Professor of Electrical Engineering and Professor of Applied Physics*
Edward V. Etzkorn *Junior, Ph*	Contact Resistivity of GaAs/In/Ta-Si-N/Au Metallization Systems	Elzbieta Kolawa *Senior Research Fellow in Applied Physics*
Anissa Evans *Senior, Bi* *University of Arkansas at Pine Bluff* *MURF*	The Cholinergic Neuronal Differentiation Factor in Two Divergent Species	Paul H. Patterson *Professor of Biology*
Matthew R. Fetterman *Senior, Ph* *NSF SURF*	Turbulence in Interstellar Molecular Clouds	Thomas G. Phillips *Professor of Physics*
Diana K. Fort *Sophomore, Bi* *University of Toronto*	Conformational Analysis of Aspartic Acid	John D. Roberts *Institute Professor of Chemistry, Emeritus*
Steven K. Fought *Sophomore, Ph* *NSF SURF*	Adding Interaction to Video	Nathan S. Lewis *Professor of Chemistry*
Jeffrey A. Foust *Junior, Ge/Ph*	Preliminary Determination of the Velocity Structure of Southern California through the use of TERRAscope	Hiroo Kanamori *John E. and Hazel S. Smits Professor of Geophysics*
George L. Fox *Junior, Bi/Ch*	The Isolation and Characterization of Suppressor and Enhancer mutants of the *APETALA 3* gene in *Arabidopsis thaliana*	Elliot M. Meyerowitz *Professor of Biology*
Ann Marie O. Francisco *Sophomore, Bi* *University of California Berkeley*	Study of the Innervation Dependent Development of the Lamina in *Drosophila melanogaster*	Seymour Benzer *James G. Boswell Professor of Neuroscience*
Dan Y. Frumin *Junior, EAS*	An Investigation of Unsupervised Learning Algorithms with Applications to Real Time Antenna Fault Diagnosis	Padhraic Smyth *Member of the Technical Staff, JPL*

STUDENT	TOPIC	SPONSOR
Tracy C. Fu *Senior, APh*	Reflection High Energy Electron Diffraction	Thomas C. McGill *Fletcher Jones Professor of Applied Physics*
Andrew K. Fung *Senior, EAS/Ae* *Kubota SURF*	Low Speed Visualization of the Flow Around a Flying Disk	Fred E. C. Culick *Professor of Mechanical Engineering and Jet Propulsion*
Swathi Ganaraj *Junior, Bi*	A Study of Temperature-Sensitive Mutations in the *Sindbis* Virus	James H. Strauss *Professor of Biology*
Timothy J. Gerk *Junior, Ec/EAS* *Shair SURF*	Increasing the Fractal Dimension of Aggregate Particles of a Titanium Dioxide Aerosol	Richard C. Flagan *Professor of Chemical Engineering*
David L. Gershon *Senior, Ph* *University of California San Diego*	Measurements of Atmospherics Trace Gases from Table Mountain Observatory	Michael R. Gunson *Member of the Technical Staff, JPL*
Balasubramanian Girish *Junior, Ph/Ma*	The Parallel Auxiliary Field Monte Carlo Shell Model Program	Steven E. Koonin *Professor of Theoretical Physics*
William C. Glenn *Sophomore, MS* *Noyes SURF*	The Study of Halogenated Tetra-phenylporphyrin	Harry B. Gray *Arnold O. Beckman Professor of Chemistry*
Keow Lin (Lindee) Goh *Junior, Bi* *Nickerson SURF*	Isolation of Suppressors and Enhancers of the Weak *leafy-S1251* Allele of *Arabidopsis thaliana*	Elliot M. Meyerowitz *Professor of Biology*
Jeremy N. Gollub *Senior, Ph* *Noland SURF*	Low Energy ^{12}C-^{12}C Elastic Scattering, and its Effect on Measurements of 16N Beta-Alpha Decay	Charles A. Barnes *Professor of Physics*
Francisco G. Gomez *Junior, Ge* *Northern California Associates SURF*	Structural Deformation in Wyman Canyon, White Mountains, California	Bruce C. Murray *Professor of Planetary Science*
Varoujan Gorjian *Senior, Ay* *Richter SURF*	Minimal Manifold of Elliptical Galaxies	S. George Djorgovski *Associate Professor of Astronomy*
Michael G. Greenblatt *Senior, Ma* *Richter SURF*	Mean Iterations and Their Extensions	W.A.J. Luxemburg *Professor of Mathematics*
Robert B. Grubbs *Junior, Ch* *Pomona College*	The Aqueous Photoreduction of α-FeOOH in the Presence of Electron-Donating Ligands	Michael R. Hoffmann *Professor of Environmental Chemistry*
Korhan Gurkan *Junior, EE/AMa*	Design of an Optical Transmitter for SURFSAT	Hamid Hemmati *Technical Group Leader, JPL*
Cynthia J. Hammond *Junior, Ch* *Principia College*	Force Modeling for the Global Positioning System (GPS) Satellites	Stephen M. Lichten *Technical Group Supervisor, JPL*
Linda J. Hanely *Sophomore, Ch*	Synthesis of Tetrakis (Pentafluoro Phenyl) Porphine	Harry B. Gray *Arnold O. Beckman Professor of Chemistry*
Joshua G. Harris *Junior, EE/Ma* *Occidental College*	Spacecraft Dynamics Visualization	J. Balaram *Member of the Technical Staff, JPL*

STUDENT	TOPIC	SPONSOR
Shameen Hashmi *Senior, EE*	Design and Test of Power Regulation and Distribution and Supply from Solar Cells for SURFSAT	Robert C. Clauss *Systems Development Program Manager, TDA Office, JPL*
Kimberly Hatch *Sophomore, Bi*	The Dependence of Protein Deposition on Surface Roughness was Investigated Using an Atomic Force Microscope (AFM)	Mark S. Anderson *Member of the Technical Staff, JPL*
Stephen C. Heise *Junior, APh/EAS*	Photographing FISHed Chromosomes	Melvin I. Simon *Ann P. and Benjamin F. Biaggini Professor of Biological Sciences*
Francisco Herrero *Sophomore, EE*	Ka-Band Link Experiment	S. A. Butman *Member of the Technical Staff, JPL*
Albert K. Ho *Senior, Bi* *Morgan SURF*	Sequence Requirements for Localization of Transmembrane Proteins to the Yeast ER	Scott D. Emr *Associate Professor of Biology*
Karla R. Holley *Senior, Ch* *Hampton University* *MURF*	Preparation of Cytochrome c Oxidase Vesicles to Study the Proton Pumping of the Native and Modified Enzyme	Sunney I. Chan *Professor of Chemical Physics and Biophysical Chemistry*
Eric M. Hollmann *Senior, Ph* *University of California Berkeley*	SURFSAT Signal Characteristics	Robert C. Clauss *Systems Development Program Manager, TDA Office, JPL*
Anthea H. Howell *Junior, EAS* *General Motors SURF*	Two Dimensional Flow Around an Oscillating Hydrofoil	Allan J. Acosta *Richard L. and Dorothy M. Hayman Professor of Mechanical Engineering*
Mark L. Huber *Sophomore, Ma* *Harvey Mudd College* *NSF SURF*	Visualization of Single-Electron Orbitals	Nathan S. Lewis *Professor of Chemistry*
Polly E. Jacobs *Senior, Ph* *Stanford University*	Designing An Optical Transmitter for SURFSAT	James Lesh *Supervisor, Optical Communications, JPL*
Celeste Jamison *Senior, Ch* *Hampton University* *MURF*	Expression Systems for Blue Copper Proteins	John H. Richards *Professor of Organic Chemistry*
Joseph B. Jensen *Senior, Ay* *Sigmon SURF*	Total Eclipse Observations of Solar Emission at 0.85mm	Harold Zirin *Professor of Astrophysics*
Karin M. Johnson *Senior, Bi*	Determining Recognition Sites for Lysyl-tRNA Synthetase	John N. Abelson *Professor and Chairman of Biology*
Kimberly Johnson *Senior, Bi* *Dillard University* *MURF*	Bacterial Attachment in Porous Media	Mary E. Lidstrom *Associate Professor of Applied Microbiology*
Tadashi Kanamori *Sophomore, Ae*	Infrared Analysis of Jupiter	Glenn S. Orton *Member of the Technical Staff, JPL*
Miikka M. Kangas *Sophomore, EE/Ph*	Controlling the Real World, Macintosh Style	Rodney M. F. Goodman, *Associate Professor of Electrical Engineering*
Tarun M. Kapoor *Junior, Ch/Bi*	De Novo Design and Structural Analysis of Metal Binding Peptides	Barbara Imperiali *Assistant Professor of Chemistry*

STUDENT	TOPIC	SPONSOR
Amir Khosrowshahi *Senior, Ph/Ma* *Harvard University*	Analysis of Chaos in a Two Layer Shallow Water Climate Model	Steven E. Koonin *Professor of Theoretical Physics*
Bryan H. Kim *Senior, EAS*	Supersonic Pilot Tube Improvements	Melany L. Hunt *Assistant Professor of Mechanical Engineering*
Alicia K. Kloesel *Junior, Ph* *Bryn Mawr College*	Polymeric Liquid Flow Dynamics: Measurement of the First and Third Normal Stress Differences	Julia A. Kornfield *Assistant Professor of Chemical Engineering*
Jeff M. Koshi *Junior, Ph*	The Reversal of the Sun's Polar Magnetic Field	Harold Zirin *Professor of Astrophysics*
Mark T. Lakata *Senior, Ph*	Characterization of Thin Film Ceramic Ferroelectric Memory Cells	Sarita Thakoor *Member of the Technical Staff, JPL*
David Lande *Junior, Ph/EAS*	Polarization of ^{3}HE Nuclei	Robert D. McKeown *Associate Professor of Physics*
Walter Landry *Junior, Ph/CS*	Gravitational Lenses and the Multiply Imaged Quasar 2016+112	Roger D. Blandford *Richard Chace Tolman Professor of Theoretical Astrophysics*
James R. Langston *Sophomore, Bi/Ay*	Identification of New Genes Involved in *C. elegans* Vulval Induction	Paul W. Sternberg *Assistant Professor of Biology and Assistant Investigator, Howard Hughes Medical Institute*
Wa-To Lau *Junior, Ch* *NSF SURF*	Studies of Electron-Molecule Collisions at Low Energies Using Massively Parallel Computers	B. Vincent McKoy *Professor of Theoretical Chemistry*
Albert S. Lee *Sophomore, EE/Ec*	Excess Female Mortality and Taiwan's Epidemiological Transition in the Early Twentieth Century	John R. Shepherd *Ahmanson Postdoctoral Instructor in East Asian Studies*
Garland A. Lee *Senior, EAS* *Colman SURF*	An Experimental Method for Velocity Measurements of Particles in a Gravity-Fed Vertical Channel	Melany L. Hunt *Assistant Professor of Mechanical Engineering*
Jong Won Lee *Junior, APh*	The Preparation of the Cryogenic Target System	Robert D. McKeown *Associate Professor of Physics*
Robert B. Lee *Senior, APh* *Lang SURF*	Study of Transport and Optical Properties in Strained Semiconductor Quantum Wells by Cathodoluminescence	Kerry J. Vahala *Associate Professor of Applied Physics*
Roy K. Lee *Junior, Ph*	Computer Models of Alluvial Fans	Thomas G. Farr *Group Supervisor, JPL*
Victor S. Lee *Junior, EE*	A Band Pass Computer Compensated Silicon Cell Radiometer	Gilbert Yanow *Technical Group Leader, JPL*
Dori S. Levanoni *Sophomore, Ph* *Noland SURF*	Visualization of Molecular Orbitals Using Semi-Empirical Methods	Nathan S. Lewis *Professor of Chemistry*
David J. Levitt *Senior*	Development and Testing of a Micro-Coring Drill	Kim Aaron *Task Manager, Sample Acquisition, Analysis and Preservation, JPL*
Marcia J. Li *Junior, Bi*	A Study of the DNA Regulatory Region and Its Proteins	R. Andrew Cameron *Senior Research Associate*
Melissa Y. Li *Junior, EE*	Power Devices Characterization Study	Dan Karmon *Technical Group Leader, JPL*

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Xinling Liang *Sophomore, Ph/EE*	Radiation Damage of CsI(Tl) and CsI(Na) Crystals	David G. Hitlin *Professor of Physics*
Sheldon K. Lim *Senior, APh*	Increasing Charge Transfer Efficiency in CCD's Using Novel Doping Techniques	Eric R. Fossum *Assistant Section Manager, JPL*
Martin W. Lin *Junior, EE*	Applications of High Tc Superconductors in Magnetic Bearings	Dr. Wei-Kan Chu *Deputy Director, Texas Center for Superconductivity at the University of Houston*
Hsiu-Hsien Ling *Junior, Bi*	Analysis of Di-I Diffusion in Fixed Primate Visual Cortex	David C. Van Essen *Professor of Biology*
James Alan Low *Junior, EAS* *Lindstrom SURF*	Visualization of Single-Electron Orbitals	Nathan S. Lewis *Professor of Chemistry*
Yvonne Lung *Senior, ChE* *NSF SURF*	Computer Modeling of Chemical Engineering Systems for Control Studies	Manfred Morari *Ross McCollum-William H. Corcoran Professor of Chemical Engineering*
Whye-Kei Lye *Junior/Ph*	The Stability and Behavior of Strange Attractors in Cumatic Simulations	Steven E. Koonin *Professor of Theoretical Physics*
Cynthia M. Machacek *Sophomore, Ge* *Richter SURF*	Global Positioning Satellite (GPS) Surveying	Kenneth W. Hudnut *Research Fellow in Geology*
Jason D. MacLeod *Junior, Bi/Ch* *Adams SURF*	Synthesis and Characterization of a Ruthenium Modified Peptide	Sunney I. Chan *Professor of Chemical Physics and Biophysical Chemistry*
Linda N. Maepa *Junior, Ge*	Oxygen in the Early Earth: Evolution of the Superoxide Dismutase Enzymes	Joseph L. Kirschvink *Associate Professor of Geobiology*
Rohan Mahadevan *Junior, Ph* *Richter SURF*	Pulsar Wind Nebulae and the Warm Ionized Medium	Shrinivas R. Kulkarni *Associate Professor of Astronomy*
Marc H. Malek *Senior, EAS/Ec*	Resource Allocation Under Uncertainty	Stephen M. Robinson *Professor of Industrial Engineering and Computer Sciences, University of Wisconsin*
Gabriela Mallen-Ornelas *Junior, Ay/Ma*	Color and Population Gradients in Globular Clusters	S. George Djorgovski *Associate Professor of Astronomy*
David P. Max *Senior, EAS* *Colvin SURF*	Phase Functions of Jupiter's Atmosphere	Kevin H. Baines *Member of the Technical Staff, JPL*
Michael G. Maxwell *Senior, Ma* *Class of '36 SURF*	Stochastic Dominance for Unbounded Lotteries	Kim C. Border *Associate Professor of Economics*
McKeithen L. McCormick *Senior, APh* *Richter SURF*	Construction of an Electrospray Cluster Ion Source	Thomas A. Tombrello, Jr. *Professor of Physics*
Michael D. McDaniel *Senior, Ph* *Dartmouth College*	Encyclopedia of Global Change: The Daily Planet	James E. Knighton *Member of the Technical Staff, JPL*
Todd R. McLaughlin *Junior, Bi* *Richter SURF*	Neocortex and Longevity	John M. Allman *Hixon Professor of Psychobiology and Professor of Biology*

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Audra H. Meng *Junior, EE*	Vertical Bloch Line Memory	Romney R. Katti *Technical Group Leader, JPL*
Kyle C. Miller *Senior, Ph* *Principia College*	Process Control with Fuzzy Logic	Hugh Henry *Supervisor, Simulation Software Group, JPL*
Jason P. Modisette *Senior, Ph* *Richter SURF*	High Time-Resolution Optical Photometry of Millisecond Pulsars	Shrinivas R. Kulkarni *Associate Professor of Astronomy*
Areez M. Mody *Junior, Ph/Ma* *Richter SURF*	Imaging with the STM	John D. Baldeschwieler *Professor of Chemistry*
Erika Moilanen *Junior, Bi* *Krown SURF*	Chemostat Studies of Mutation in *E. coli*	Mary E. Lidstrom *Associate Professor of Applied Microbiology*
Thomas W. Momary *Senior, Ph* *University of California San Diego*	Stratospheric Aerosols in the Jovian Atmosphere: A Reduction of Near-Infrared IRTF Imagery	Kevin H. Baines *Member of the Technical Staff, JPL*
Alfredo M. Morales *Senior, Ch* *Adams SURF*	Single Component Organoscandium Complexes as Models for Ziegler-Natta Polimerization Catalysts	John E. Bercaw *Professor of Chemistry*
Sabrina Morgan *Senior, Bi* *Tuskegee University* *MURF*	Genetic Analysis of the Regulatory Region of the Herculin Gene	Barbara J. Wold *Associate Professor of Biology*
Michael P. Mulqueen *Sophomore, ChE*	Global Sea Level Change	Richard S. Gross *Member of the Technical Staff, JPL*
James Murdoch *Sophomore, Ch* *Swift SURF*	Synthesis and Characterization of Nonlinear Optical Materials	Seth R. Marder *Member of the Beckman Institute*
Hiok-Tiaq Ng *Senior, EE* *Richter SURF*	An Experimental Method to Obtain and Study Ultra-Cold Atoms	Kenneth G. Libbrecht *Associate Professor of Astrophysics*
Trinh D. Nguyen *Senior, ChE* *UCLA*	Numerical Studies of Wet Tropospheric Correction from Integrated Water Vapor	Victor Zlotnicki *Research Scientist, JPL*
Tuan D. Nguyen *Senior, EE*	DHT Interface Design, Ka-Band Link Experiment (KABLE)	S. A. Butman *Member of the Technical Staff, JPL*
Seth B. Noble *Junior, CS* *NSF SURF*	Management Support Applications of the New World of Computing System	Frederick B. Thompson *Professor of Applied Philosophy and Computer Science*
Jay P. Obernolte *Senior, EAS*	Computer Interface for a Cultured Neuron Probe	Jerome Pine *Professor of Physics*
Matthew C. Paduano *Senior, Ph* *Krown SURF*	High Pressure Multi-wire Proportional Counter for High Energy γ Radiation	John M. Grunsfeld *Senior Research Fellow*
Shan-ng Pak *Senior, EAS* *NSF SURF*	Automatic Grid Generation	Thomas A. Prince *Associate Professor of Physics*
Jonathan N. Pakianathan *Senior, Ph/Ma* *Noland SURF*	Contribution of Galactic Synchrotron Radiation and Infrared Dust Radiation to Cosmic Microwave Background Anisotropy Measurements	Anthony C. S. Readhead *Professor of Astronomy*

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Jon D. Pelletier *Junior, Ph/AMa* *Richter SURF*	The Fourteenth Amendment and Original Intent	J. Morgan Kousser *Professor of History and Social Science*
Phillip M. Pippenger *Senior, EE* *Lees SURF*	Computer Aided Flight Control	Fred E. C. Culick *Professor of Mechanical Engineering and Jet Propulsion*
Jed W. Pitera *Sophomore, Bi*	A Study of Alphavirus Capsid-Glycoprotein Interactions	James H. Strauss *Professor of Biology*
Antonio Rangel *Junior, Ec* *Veysey SURF*	CCRE: A Computerized Barter Exchange	John O. Ledyard *Professor of Economics and Social Sciences*
Christopher S. Raymond *Senior, AMa*	The Meandering Rivulet	Kirk Brattkus *von Karman Instructor of Applied Mathematics*
Eugene Reyzer *Senior, Ph/AMa* *Richter SURF*	Numerical Solution of Equations in 2-D liquid	Daniel I. Meiron *Associate Professor of Applied Mathematics*
Mark I. Richardson *Ph* *Imperial College* *University of London*	Martian Dust Opacity Mapping	Terry Z. Martin *Member of the Technical Staff, JPL*
Nathan C. Rockwell *Senior, Bi*	M Phase Modification of cdc25 in *Xenopus* Egg Extracts	William G. Dunphy *Assistant Professor of Biology*
Christopher D. Rosin *Senior, EAS* *Richter SURF*	Modeling Networks of Phase Oscillators with a Connection Machine	Ernst Niebur *Research Fellow in Biology*
Karen E. Ross *Junior, Bi/Hist* *Richter SURF*	Immunohistochemistry of Rat Brain Post-Synaptic Proteins	Mary B. Kennedy *Associate Professor of Biology*
Isabel P. Russ *Phys. Ge* *University of Munich*	The Diurnal and Environmental Change of the Dielectric Constant of Alaskan Trees: Cause and Effect on the Radar Backscatter Coefficient	Jo Bea Way *Member of the Technical Staff, JPL*
Christine A. Sadlowski *Junior, Bi* *Harvard University*	Presence of the Cystic Fibrosis Gene Believed to Be Found in the Rat Choroid Plexus by PCR Screening of a cDNA Library	Henry A. Lester *Professor of Biology*
Steven Sandberg *Sophomore, Ph*	Two Laser Photodissociation Spectroscopy of CH4+	Mitchio Okumura *Assistant Professor of Chemical Physics*
Daniel A. Sandoval *Junior, EE* *Muir SURF*	Project SEED: Expanding Project SEED	James M. Bower *Associate Professor of Biology*
Karl M. Schneider *Senior, EAS/CS*	Implementation of Spacecraft Command Verification Software on a Hypercube	Joan C. Horvath *Manager, Instant Sequencing Task, JPL*
Mimi Sengupta *Junior, EAS/CS*	Project SEED: Small Things	James M. Bower *Associate Professor of Biology*
Juan Sepulveda *Senior, Ch* *University of Puerto Rico* *MURF*	Enantioselective Synthesis of an Advance Imtermediate in Studies Towards the Total Synthesis of Dynemicin A	Andrew G. Myers *Associate Professor of Chemistry*
Shuyan Sheu *Junior, Bi* *Richter SURF*	Structural and Functional Analysis of ZebI—a Novel Steroid Hormone Receptor Analog from *Drosophila melanogaster*	Carl S. Parker *Associate Professor of Chemistry*

STUDENT	TOPIC	SPONSOR
Douglas G. Shiels *Junior, EAS*	Mechanical Design and Analysis of SURFSAT	Robert C. Clauss *Systems Development Program Manager, TDA Office, JPL*
Shiyin Siou *Sophomore, CS/EE*	Multi-Channel A/D, D/A Converter	Rodney M. F. Goodman *Associate Professor of Electrical Engineering*
Aimee Smith *Junior/ APh* *Krown SURF*	Low Temperature Cleaning of (100) Si Surfaces Using RHEED/REELS	Harry A. Atwater, Jr. *Assistant Professor of Applied Physics*
S. Lan Smith *Senior, ChE* *Barrett SURF*	A Study of the Effects of Solvent-Solute Interactions on the T1 Relaxation of the Formate Proton	John D. Roberts *Institute Professor of Chemistry, Emeritus*
Stanford Smith *Senior, Bi* *Clark Atlanta University* *MURF*	Isolation and Characterization of Putative Olfactory Receptor Clones	Kai Zinn *Assistant Professor of Biology*
Mark M. Son *Junior, Ph/Ma*	Visualization of the Effect of Gravitational Lensing on Radiation from a Neutron Star	Thomas A. Prince *Associate Professor of Physics*
John D. Stamm *Junior, Ph*	Radio Astronomy of Solar Active Regions During a Partial Eclipse	Dale E. Gary *Senior Research Associate in Astrophysics*
Daron M. Standley *Junior, Ph/Ch* *Harvey Mudd College*	Similar Redox Couples In Liquid-Semiconductor Solar Cells	Nathan S. Lewis *Professor of Chemistry*
Andrew J. Stevens *Senior, Ch*	Reaction Mechanism for the Catalytic Generation of H2 from Tetrakis (m-pyrophosphito)diplatinate(II) and Aromatic Alcohols	Harry B. Gray *Arnold O. Beckman Professor of Chemistry*
Jason D. Stiffler *Junior, Ph* *New Mexico Institute of Mining and Technology*	Reduction of Asteroid Brightness Data and Multiple Target Observations Using a CCD Camera	Alan Harris *Supervisor, Earth and Planetary Physics Group, JPL*
Anne L. Su *Senior, Bi* *Harvard University*	Characterization of Brain Degeneration in the *Drosophila drop-dead* Mutant	Seymour Benzer *James G. Boswell Professor of Neuroscience*
Anna M. Sullivan *Junior, Ma* *Bryn Mawr College*	Ozone - From Patterns to Processes	Yuk L. Yung *Professor of Planetary Science*
Shio-Hsien Tai *Senior, EE*	An Experimental Method to Obtain and Study Ultra-Cold Atoms	Kenneth G. Libbrecht *Associate Professor of Astrophysics*
Erik D. Taylor *Junior, APh*	Velocity Measurements in a Multi-Phase Flow	Melany L. Hunt *Assistant Professor of Mechanical Engineering*
Thomas F. Thaller *Senior, Ge/Anthropology* *California State Polytechnic University, Pomona*	Data Comparison of the Jovian Atmosphere in the Visible to Thermal Infrared Spectral Bands (up to 22 microns)	Glenn S. Orton *Member of the Technical Staff, JPL*
Joseph H. Thywissen *Sophomore* *Harvey Mudd College*	Visualizing the Face Centered Cubic Crystal Lattice	Nathan S. Lewis *Professor of Chemistry*
Andrea Torres-Perez *Senior, Bi* *California State University Fresno* *MURF*	Two Mutations Which Disrupt *Caenorhabditis elegans* Male Spicule Development	Paul W. Sternberg *Assistant Professor of Biology and Assistant Investigator, Howard Hughes Medical Institute*

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Helen Y. Tsai *Junior, Ch/Bi* *Krown SURF*	NMR Conformational Study of the Diastereomers Ephedrine and Pseudoephedrine	John D. Roberts *Institute Professor of Chemistry, Emeritus*
Christopher G. Tully *Senior, Ph*	Spin-spin Correlations in Tau Production on the Z Peak	Harvey B. Newman *Professor of Physics*
Yuan T. Tung *Junior, EE*	A Band Pass Computer Compensated Silicon Cell Radiometer	Gilbert Yanow *Technical Group Leader, JPL*
Bonnie J. Wallace *Senior, Lit* *Krown SURF*	Objects and Impact - The Works of T.S. Eliot	Ronald L. Bush *Professor of Literature*
Deron A. Walters *Senior, Ph*	Characterization of Whispering Gallery Microresonators for Quantum-Nondemolition Measurements	H. Jeff Kimble *Professor of Physics*
John S. Ward *Senior, Ph* *Principia College*	Infrared Imaging of 3CR Galaxies	Peter R. Eisenhardt *Member of the Technical Staff, JPL*
Jia-Perng Jennifer Wei *Sophomore, Ch* *Bristol-Myers SURF*	Synthesis of a Macrocyclic Ligand to be Employed in Electron-Transfer Investigations	Harry B. Gray *Arnold O. Beckman Professor of Chemistry*
James H. Werner *Senior, APh* *IBM SURF*	Growth and Characterization of New Photorefractive Crystals	Amnon Yariv *Thomas G. Myers Professor of Electrical Engineering and Professor of Applied Physics*
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