

1992 ANNUAL REPORT



CALIFORNIA INSTITUTE OF TECHNOLOGY

Acknowledgement

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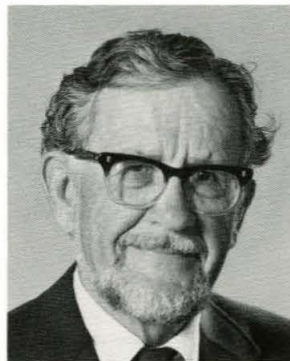
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SURF Annual Report

Dedication

The 1992 SURF program is dedicated to John D. Roberts, Institute Professor of Chemistry, Emeritus, in recognition of his long commitment to the education of undergraduate students and his excellence as a SURF research sponsor. Since 1986, Jack has been a mentor to thirteen SURF students, six of whom worked with him more than one summer—a total of 21 SURF positions.



President's Message

Congratulations to the SURF team on another outstanding year! This summer was rich with 198 talented students, their dedicated research sponsors, and committed donors, staff, volunteers, and other friends of the program. I want to express my personal gratitude to this cadre of over 450 people who, through their contributions of time, money, counsel, and leadership, make SURF the unique and dynamic program it is.

The essence of SURF is the mentoring relationship between research sponsor and student. It creates an environment in which students ask questions and seek solutions to unsolved problems at the frontiers of science and technology. The SURF experience provides an individual research-oriented counterpoint to the classroom learning experience most students encounter. Through a wealth of enrichment programs, students gain a broad overview of many other aspects of a research career. SURF is one of the activities that has helped Caltech to achieve its place of excellence in the academic world, and the Institute is indebted to those who made it happen in the summer of 1992.

Thomas E. Everhart

Thomas E. Everhart
President
California Institute of Technology



Report of the SURF Board

Lew Allen

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. We vigorously pursue our mission through our fund raising efforts and our interactions with the students and SURF staff.

At the February meeting of the SURF Board, we set a goal of helping to raise \$351,000 by March 1 each year from individuals, corporations, foundations, and the endowment to support 150 SURF students working on the campus. This figure represents 65% of the funds needed to pay student stipends at the level of \$3600. The remaining 35% will be raised from faculty research sponsors.

To achieve this goal, the Fundraising Committee, under the leadership of Hannah Bradley, has undertaken a campaign to identify and solicit potential new contributors to the SURF program. I am very pleased to report that since the beginning of the campaign in August, we have received pledges for two new stipends, the creation of a new endowment, and a number of smaller donations. We deeply appreciate the commitment demonstrated by these new friends of the program.

SURF endowments are an important and valuable source of funds for student stipends. We salute Samuel and Frances Krown for their leadership in establishing the first endowment in 1982. We thank the many donors who have contributed and continue to contribute to these funds. The long-term objective is to raise \$8 million in endowment to provide SURF stipends in perpetuity.

The Student Relations Committee, chaired by Joanna Muir, hosted a pizza lunch for the seventeen students representing Caltech at the National Conference on Undergraduate Research at the University of Minnesota in March. The purpose of the gathering was for the students to get acquainted with each other before the trip. Following the conference, the committee arranged a dinner at the Athenaeum for the students and members of the Board. It was another opportunity for students and Board members to interact and for the students to report on their experiences. In July the committee put on a very well-attended "thank you note writing party" to encourage students to express their appreciation to their financial sponsors.

Bill Whitney and Fred Shair co-chair the Campus Liaison Committee. They added four new members to the committee: Sally Asmundson, Director, Career Development Center; Lucy Guernsey, Executive Director of the Caltech Y; Bob O'Rourke, Assistant Vice President, Public Relations; and Carole Snow, Director, Admissions. The committee organized and facilitated four roundtable discussions and conducted the series *Can You Do Research for a Living?*

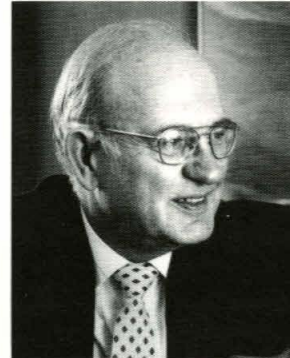
We were saddened to learn of the deaths of two good friends of SURF and members of the SURF Board.

Hugh Colvin was deeply interested in and committed to Caltech students, and he encouraged them to take advantage of unique opportunities. He and his wife, Audy Lou, demonstrated their belief in the importance of travel to broaden education and life experience by creating the Colvin International SURF fellowship. In addition, they established nine other SURF endowments. Hugh served on the SURF Board from 1984 until his death and as chairman from 1987 to 1989.

Arthur Adams was a long-time friend of Caltech and of SURF. He was committed to helping to create excellent experiences for our bright and talented students. His legacy to SURF is the four endowments he established. Art joined the SURF team in 1983 as a charter member of the SURF Board, serving as chairman from 1989 to 1990.

Ben Earl and Loyd Sigmon resigned this year after many years on the Board. We thank them for their service and their dedication to the values of SURF.

I look forward to 1993 with optimism. The Board faces challenges as it pursues its goals to help bring the SURF program into a more robust financial position. SURF is a unique and important educational activity, and it deserves the support of the Board and of its many friends.



Report of the SURF Administrative Committee

Terry Cole

The SURF Administrative Committee consists of faculty from each of Caltech's six academic divisions; members of the JPL senior technical staff; the president of ASCIT, representing the student researchers; and members of Caltech's administrative staff. Our role is the strengthening of SURF, maintaining its research excellence, and keeping it as the nation's premier undergraduate research program.

The primary goal of SURF is to provide opportunities for Caltech and selected undergraduates from other universities to carry out independent research under the direction of leading scientists and engineers. The goal of SURF is to assure funding for every Caltech student who meets the criteria of the faculty and JPL sponsors. A testament to the research excellence of SURF is the statistic that over 20% of SURF students coauthor papers in the professional technical literature.

An important responsibility of the SURF Administrative Committee is to review the student's proposals which numbered more than 270 this year. Overall the proposals were outstanding, reflecting the collaboration between the research sponsors and students, and competition for available funds was strong.

During the summer of 1992, 198 undergraduates, including 48 from other universities, completed SURF projects. In March, Caltech sent a strong delegation of seventeen undergraduate researchers to the Sixth National Conference on Undergraduate Research. The Minority Undergraduate Research Fellowship (MURF) program has continued with nine students from seven institutions participating.

We welcome the appointment of Dr. Lew Allen, former Director of the Jet Propulsion Laboratory and 1991 SURF dedicatee, as the new chairman of the SURF Board and look forward to working closely with him as we develop undergraduate research at Caltech.



The Mission of SURF

Caltech's Summer Undergraduate Research Fellowships program introduces undergraduate students to research under the guidance of seasoned research sponsors. Students experience the process of research as a creative intellectual activity, and gain a more realistic view of the opportunities and demands of a professional research career.

How SURF Carries out its Mission

Through SURF, which is modelled on the grant process, students enter the environment of scientists. In collaboration with their research sponsors, they write project proposals which are reviewed by a faculty committee. Awards are made on the basis of recommendations of the reviewers and available funding. Work is carried out during ten weeks in the summer; at the conclusion of the summer, students submit a technical report and give an oral presentation on SURF Seminar Day, a symposium patterned after a professional technical meeting. As with any grant award, students receive a stipend; in 1992 the stipend was \$3600.

The SURF program offers a wealth of enrichment activities to enable students to broaden their knowledge of a variety of fields, to consider many aspects of a research career, and to balance their research experience with cultural and social activities. The Director's Report describes these activities.

The SURF Advantage

The mentor-protégé association is the most important aspect of the SURF experience. This alliance encompasses not only the student's summer project but also professional relationships within the research group and the broader research community, the economics and politics of research, and ethics.

Students discover how exciting front-line research can be. They also struggle with the frustrations. They gain insight into what a professor's professional life is like. Many students solidify their desire to pursue research careers; some revise their career plans.

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.

The Institute benefits from the SURF program. Many entering freshman report that they chose Caltech because of the chance to do research. Some departments have recruited graduate students through the SURF program. The program helps to strengthen the links between students and faculty; between Caltech and JPL; between the Institute and alumni, donors, the community, and other colleges and universities.

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

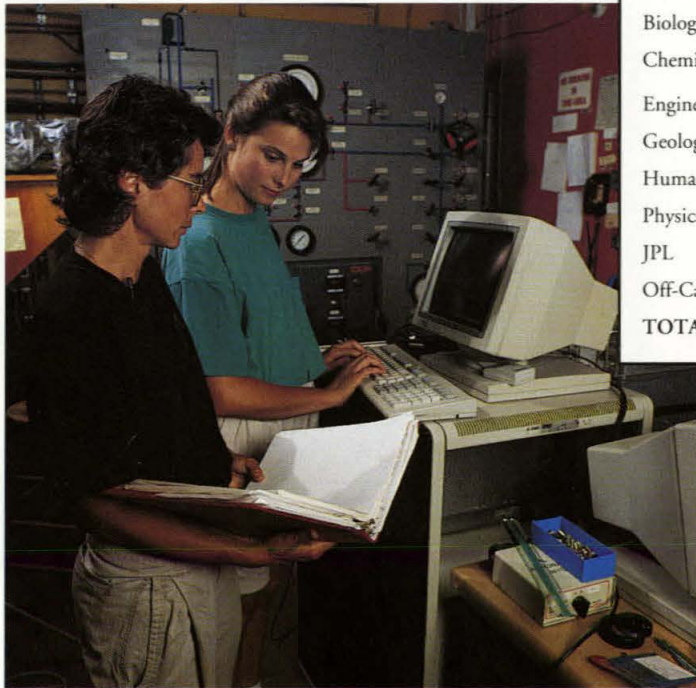
The 1992 SURF Class

SURF '92 was dynamic and rich with a record number of SURF students, expanded activities, enthusiastic participation by students, faculty, volunteers, and welcome support from the SURF Board and SURF Administrative Committee.

One hundred ninety-eight students received SURF awards out of an applicant pool of more than 270 students. Included in this number are 48 non-Caltech students, nine of whom were part of the MURF (Minority Undergraduate Research Fellowships) program, and eleven international students.



Carolyn Merkel



Summary of the 1992 SURF Class

<i>Division</i>	<i>Number of Sponsors</i>	<i>Number of Caltechs Students</i>	<i>Number of Non-Caltech Students</i>
Athletics	1	1	0
Biology	22	20	10
Chemistry and Chemical Engineering	15	26	12
Engineering and Applied Science	23	32	3
Geological and Planetary Sciences	9	9	2
Humanities and Social Sciences	5	5	0
Physics, Math, and Astronomy	17	21	0
JPL	29	31	21
Off-Campus	5	5	0
TOTALS	126	150	48

SURF Application Procedure

The SURF application process is as follows: Students identify potential research sponsors from announcements of opportunity posted in the SURF Office. In collaboration with their research sponsors, the students write detailed proposals which are submitted to the SURF Office in early March together with three letters of recommendation. Non-Caltech students also send transcripts. The SURF Administrative Committee

members review the proposals in their respective divisions, evaluate the application packages, rank the students, and make recommendations for funding. The Director makes awards on the basis of committee recommendations and available funding.

Because of the collaboration between students and research sponsors prior to submission of the proposals, more than 93% of the applications were judged by the reviewers to be very strong and were recommended for SURF funding.

SURF Funding

Each student receives a stipend of \$3600 for the ten-week period. Stipend costs for this year's program were \$712,800. This money is raised from a variety of sources. The Institute provides money and office space for the administration of the program. Funds for student stipends are raised from individuals, corporations, and foundations. Caltech faculty generally pay from research grants a portion of their students' stipends, and JPL research sponsors pay the full stipend. An endowment has been created to ensure the continuation of the program.

Since the Institute pays all expenses for the administration of the program, and research sponsors pay research costs, all funds raised from outside sources are used for student stipends or special research-related opportunities. Contributions from private or corporate sources are used exclusively for Caltech students unless otherwise stipulated by the donor. Non-Caltech SURF students are fully funded from the research grants of their sponsors or from public funds when available.

Endowment and Memorial Funds

We are delighted to report three new endowments were established this year.

An endowment was created in memory of Dr. Edward W. Hughes, Senior Research Associate in Chemistry, Emeritus. Dr. Hughes, who came to Caltech in 1938 as a research fellow, was an important member of the community for 49 years. He taught a section of Physical Chemistry for non-chemistry majors, forging warm interactions with the students.

The family and friends of Mr. Arthur E. Lamel contributed a SURF endowment to support a student annually in electrical engineering. Mr. Lamel, a Caltech alumnus (BS'33 EE), spent his career as an electrical engineer.

The Petersen SURF endowment was a gift from Sidney R. Petersen and his wife, Nancy. Mr. Petersen, retired Chairman of Getty Oil Co., has been a Caltech Trustee since 1980.

The Aerojet colleagues of Chandler C. Ross, under the leadership of Dr. Werner Kirchner, set up a memorial fund to honor Dr. Ross for his unique technical contributions in the field of turbo machinery and rocket propulsion technology. The fund supported the stipend of SURFer Eric Wemhoff, a junior in mechanical engineering, to work with Professor Melany Hunt. The SURF award and a plaque were presented to Eric by Sharon Ross Ormsbee, Dr. Ross' daughter, at a luncheon of the Aerojet Alumni at the Athenaeum.





SURF Seminar Day

The 1992 SURF program culminated on SURF Seminar Day, Saturday, October 17, when students presented their final oral reports in 18 parallel sessions. The symposium is modelled on a professional technical meeting and is attended by faculty, students, staff, JPL technical staff, alumni, parents, donors, other members of the Caltech community and friends of SURF.

New this year was a poster session. Twenty students informally presented their results to those interested during the hour-long session. Proceedings of SURF Seminar Day including abstracts of student projects may be requested from the SURF Office.

SURF Seminar Day commences with a luncheon in the Beckman Institute Courtyard followed by the student talks. The meeting concludes with a reception to honor the students hosted by President and Mrs. Everhart.

The non-Caltech students who returned to their home institutions at the end of summer gave their final presentations at Summer Seminar Day in August.

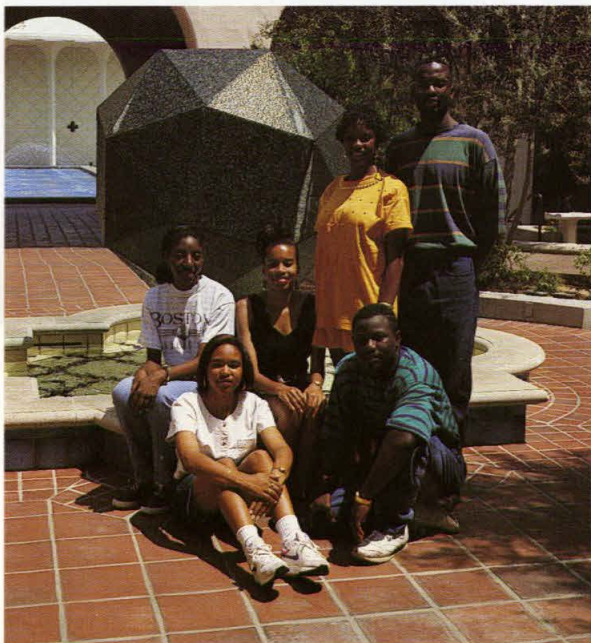
Minority Undergraduate Research Fellowships (MURF)

This summer was the second year for the MURF program in biology and chemistry coordinated by Kai Zinn, Assistant Professor of Biology. Nine students participated out of an applicant pool of 140. Twenty-one offers were made, eleven students accepted the offers. Subsequently, two student withdrew for medical reasons.

To apply for the MURF program, students submit an application with a statement of purpose, two recommendations, and a transcript of grades. The application packages are reviewed and ranked, candidates for admission are matched with research sponsors according to their stated research interests, and finally offers are made.

MURF students participate fully in the SURF program. In addition, they meet weekly as a group to discuss technical topics or to evaluate the program. Each week one student summarizes a technical article for the others in the MURF journal club. Final oral presentations are given in a special session attended by members of the various research groups.

Students found their summer experience to be both enjoyable and useful in helping to evaluate their career options. At the conclusion of the summer, several MURF students expressed their intention to apply for graduate schools; at least one student will apply to Caltech. We continue to be optimistic that the MURF program will help us achieve our long-term objective of increasing the representation of minority groups in the fields of science and engineering.



SURF Student Advisory Council

An eleven-member SURF Student Advisory Council was created this year to provide feedback on ongoing programs, assist with planning for the future, and establish liaison with the student body. Students represent each division, JPL, the non-Caltech students, the MURF program, and ASCIT. Their insights and comments have been useful as we commence evaluation of the 1992 program and look forward to 1993.

Special Programs

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

Communications Program

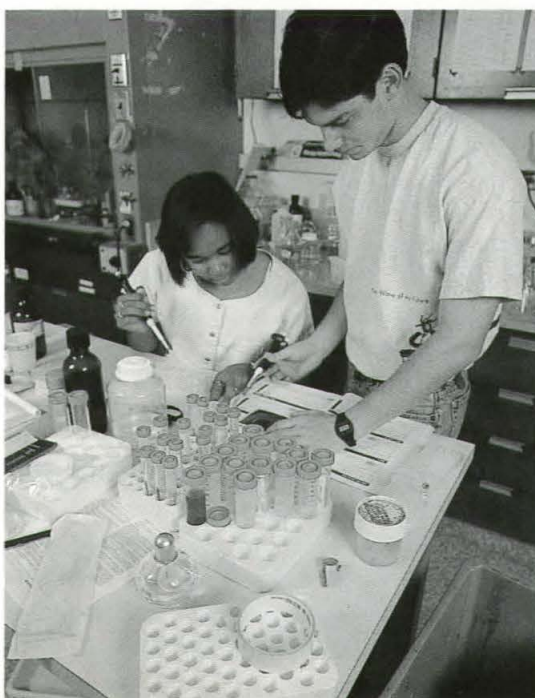
Summer Workshops

For many SURF students, the presentation on SURF Seminar Day is their first experience in public speaking. To help them prepare for this talk, Mary Ann Smith, the SURF communications consultant, expanded our communication program to integrate communication skills with the research experience, utilize students trained as peer coaches to facilitate workshops, and provide intensive rehearsals for the final oral report.

Mary Ann trained fifteen student peer coaches to facilitate small-group communications workshops. The peer coaches convened their groups for 90 minutes three times during the summer, advocated a standard of excellent speeches, encouraged their group members to support each other in their public speaking, and led the groups through the assignments. Workshop assignments were to create an analogy to relate a piece of technical information to something commonly understood by a general audience, to prepare a visual aid, and to organize the outline for the final speech.

Three scientists, Terry Cole, David Goodstein, and Joann Stock, all recognized as excellent speakers, participated in a panel discussion, *Scientists as Speakers*. They discussed how they prepare a talk for various audiences, shared their experiences as speakers, and provided observations and advice.

In the final week before SURF Seminar Day, peer coaches met with students who desired to rehearse their presentations. The Industrial Relations Center offered the use of their facilities including video cameras, VCR's, and monitors to aid the students in critiquing their talks.





Speakers Bureau

Jean Cass coordinated the SURF Speakers Bureau during the '91 - '92 academic year. Students worked in teams of two to give hour-long science talks, demonstrations, and experiments at five local elementary, junior high and high schools. Another group of SURF students conducted *Fun With Science* days at local elementary schools giving several science demonstrations. The purpose of the speakers bureau is to encourage interest in science in pre-college students with a long-term view to recruiting some students to careers in science and engineering. All students and teachers involved with these projects reported having great interest in and gaining personal benefits from their participation in this program.

SURF students also gave presentations at the SURF Kickoff Dinner, Alumni Seminar Day, Pasadena Rotary, and at regional and national conferences.

Can You Do Research for a Living?

Bill Whitney, Division Technologist, Observational Systems Division, JPL, and Julia

Kornfield, Assistant Professor of Chemical Engineering, Caltech, coordinated four informal sessions for students contemplating professional research careers. Topics included: setting career goals; are you suited for research; what are the alternatives; getting into graduate school; research funding; research documentation; scientific fraud; and other related subjects. The purpose of the sessions was not to provide answers to all questions raised, but to encourage the participants to think about possible career paths, set goals, and make decisions and plans based on those goals. Two of the four sessions were devoted to a discussion of graduate schools, and included material on how students can take advantage of the SURF experience to strengthen their graduate school applications.

Sally Asmundson, Director, Career Development Center; Paul Robinson, Assistant to Chief Technologist, JPL; and Carole Snow,

Director of Admissions participated in planning and conducting the discussions, joined by students Jean Andino, Eugene Lit, and Lan Smith. David Goodstein, Caltech Vice Provost, presented the session on research documentation and scientific fraud.



Myers-Briggs Type Indicator

Kathy Harris, Supervisor, Professional Development, JPL, presented a three-session series on the Myers-Briggs Type Indicator. She administered the MBTI instrument, described the theory of temperament preferences, the development of the research, and its implications in career choices and work styles.

Tour of the Mt. Wilson Telescopes

Dr. Robert Jastrow talked to a group of SURF students at Mt. Wilson about the history of astronomy in general, astronomy at Mt. Wilson in particular, and the interesting science in progress there. Donald Nicholson, a docent of the MWI, led a tour with excellent commentary on history and anecdotes of the observatories. Students and staff enjoyed a picnic supper at twilight overlooking the valleys.

SURF Press Conference

How do you tell the world of the excitement and benefit of your research? Call a press conference! And that is what SURF did. The first press conference, coordinated by Paul Robinson, Assistant to the Chief Technologist, JPL, featured the work of Stephanie Buck, Varoujan Gorgian, Michael Mulqueen, and Antonio Rangel. Bob Finn from Caltech's public relations department assisted the students in writing press releases and coached them for their first encounters with the media. Members of the press corps included Larry Wilson, reporter for the Pasadena *Star News*, Bill Scott from *Aviation Week and Space Technology*, and Heidi Aspaturian, Bob Finn, Doug Smith, and Betsy Woodford from the PR department. The reporters asked probing questions and provided advice on dealing with the press. The July 20, 1992, issue of *Aviation Week and Space Technology* reported on Antonio Rangel's work on the Casini economic model for maximizing science return for fixed program cost.

This pilot program was interesting and successful. Future press conferences will involve a wider cross section of the SURF community.

Caltech Y Summer Program

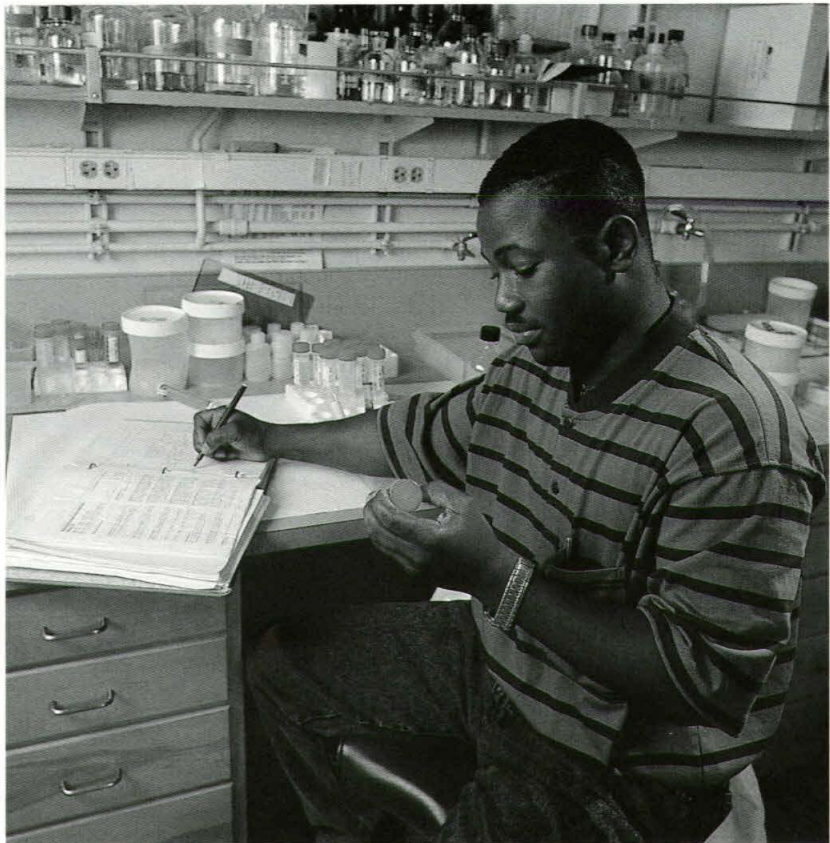
For the student community, the Caltech Y coordinates social and cultural activities, community outreach programs, and provides discount tickets for theme parks, theaters, and sporting events. Through these events, students have the chance to meet other members of the Caltech summer community. The Y programs provide important diversity and balance to SURF students' research focus. Students may join the Summer ExComm (Executive Committee) to help organize and plan activities. All campus residents are welcome to participate.

National Conference on Undergraduate Research

Seventeen 1991 SURF students represented Caltech at the Sixth National Conference on Undergraduate Research at the University of Minnesota in March. The students derived benefit from the experience of attending NCUR, reporting on their research, and having the chance to interact with students from other universities. We thank the Caltech Chapter of Sigma Xi, donors, and faculty who paid travel costs for students to attend the conference.

Students from all disciplines, including science, engineering, humanities, social sciences, fine and performing arts, participate in the conference. 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.

Caltech hosted the Fifth NCUR in 1991 as part of the Institute's centennial celebration.





Caltech Seminar Series

Each Wednesday, members of the Caltech faculty, JPL technical staff, and a representative from the food industry presented overviews of their areas of research. Speakers and topics were:

Jacqueline K. Barton, Professor of Chemistry, *Travels Along the DNA Helix*

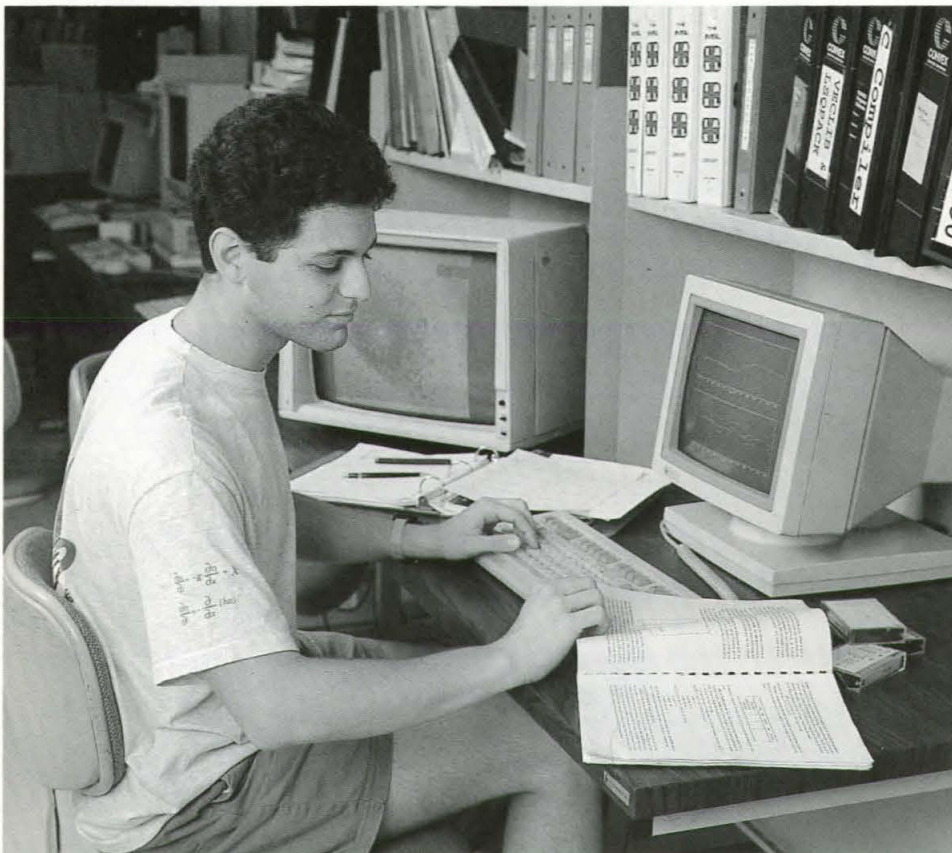
James M. Bower, Associate Professor of Biology, *Parallel Brains and Parallel Computers*

Charles Elachi, Lecturer in Electrical Engineering and Planetary Science, Caltech; Office of Space Science and Instruments, Assistant Laboratory Director, JPL, *Transarabia Expedition: Space Technology and the Discovery of the Lost City of Ubar*

Scott E. Fraser, Anna L. Rosen Professor of Biology, *Imaging as a Tool for the Study of Biological Patterning*

Elizabeth R. Gerber, Assistant Professor of Political Science, *Learning about Ballot Propositions from Political Campaigns*

Hiroo Kanamori, John E. and Hazel S. Smits Professor of Geophysics; Director, Seismological Laboratory, *Seismic Excitation by Space Shuttles*



Julia A. Kornfield, Assistant Professor of Chemical Engineering, *A Short Talk about Long Molecules*

Pietro Perona, Assistant Professor of Electrical Engineering, *Detecting Boundaries in Images: Computations and Biological Perspective*

Anneila I. Sargent, Senior Research Associate in Astronomy, *The Birth and Evolution of Other Planetary Systems*

Joann M. Stock, Associate Professor of Geology and Geophysics, *Current Topics in Plate Tectonics*

Steven A. Witherly, Director of Research, Nutralite Corporation, *The Physiologic Gourmet: What Makes Food Taste Good?*

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:

Perry Bankston, Electronics and Control Division, *Electric Power Technology for Planetary Exploration*

Ed Baroth, Institutional Computing and Mission Operations Division, *Technical Programming with Pictures (Icons)*

Ron Blom, Earth and Space Sciences Division, *The Trans-Arabia Expedition: Space Technology and the Discovery of the Lost City of Ubar*

John Dick, Telecommunications Science and Engineering Division, *Whispering Gallery Modes in Cooled Sapphire Resonators for Ultra-high Q and Low Phase Noise*

Patricia George, Observational Systems Division, *Dirty Mirrors in Space: The Chemistry and Physics of Optical Contamination*

Bruce Hancock, Hardware Assurance Division, *Murphy and Argus: The Many Aspects of Reliability Engineering*

John Peterson, Information Systems Division, *Biological Information Signal Processor: A Computational Revolution*

Ron Ross, Mechanical Systems Engineering and Research Division, *Long-Life Cryogenic Refrigerators for Space Application*

Lincoln Wood, Systems Division, *An Overview of Deep-Space Navigation*



Roundtable Discussions

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

John Bryson, Chairman of the Board and Chief Executive Officer, Southern California Edison, *A Retrospective on a Career as an Environmentalist*

Margaret Frerking, Microwave Systems Section, JPL, *Balancing Career and Family*

Eleanor Helin, Member of the Technical Staff, JPL, *Benefits and Challenges of the SURF Experience*

Colonel David Jackson, Director, Army Space Technology and Research Office, *Technology and Research in the Military*

Robert Jastrow, President, Mt. Wilson Institute, *Interesting Science at Mt. Wilson*

William Lyte, Director of Marketing, ASL Consulting Engineers, *Environmental Technology*

Robert L. Shafer, Retired Management Consultant, *Characteristics of Leadership: The Pioneers to Present*

Fredrick H. Shair, Founder of the SURF Program, Dean, College of Natural Sciences, Cal State Long Beach, *Questions to Consider in Developing a Vocation and Avocation*


Thomas A. Tombrello, Professor of Physics, and **Jean de Pruneda**, Deputy Division Leader, Chemical Sciences Division, Lawrence Livermore National Laboratory, *Comparison of Research in Academia, Industry, and the National Laboratories*



Publications List:


BIOLOGY

1. "Experimental and Theoretical Studies of Monoclonal Anti-BSA-BSA Immune Complexes," D.M. Yarmush, J. Dunn*, C.K. Colton**, M.L. Yarmush.
2. "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**.
3. "Molecular Basis of Genetic Defects in Human Globin Genes," *Journal of Supermolecular Structure of Cellular Biochemistry*, Supp. 5, p. 229 (1981), M. Shander, S. VandeWoude*, N. Proudfoot, T. Maniatis**.
4. "Repetitive Sequences of the Sea Urchin Genome II. Subfamily Structure and Evolutionary Conservation," *Journal of Molecular Biology*, 149, pp. 15-39 (1981), R.H. Scheller, D.M. Anderson, J.W. Posakony, L.B. McAllister*, R.J. Britten, E.H. Davidson**.
5. "Repetitive Sequences of the Sea Urchin Genome: Distribution of Members of Specific Repetitive Families," *Journal of Molecular Biology*, 145, pp. 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**.
6. "Organization and Expression of Multiple Actin Genes in the Sea Urchin," *Molecular and Cellular Biology*, Vol. 1, No. 7, pp. 609-628 (July 1981), R.H. Scheller, L.B. McAllister*, W.R. Crain, Jr. D.S. Durica, J.W. Posakony, T.L. Thomas, R.U. Britten, E.H. Davidson**.
7. "Isolation of New Yeast DNA Replication Mutants Using Permeabilized Cells," *Proceedings of the National Academy of Science USA*, 80, p.p 6465-6469 (1983), C. Kuo, N-H. Huang*, J.L. Campbell**.
8. "Suppressors of a Temperature-Sensitive Copy-Number Mutation in Plasmid NTP1," *Molecular and General Genetics*, 192, p.p 95-100 (1983), D.R. Moser, C.D. Moser, E. Sinn*, J.L. Campbell**.
9. "Hemispheric Differences in Split-Brain Monkeys Viewing and Responding to Videotape Recordings," *Behavioral and Neural Biology*, 41, pp. 231-235 (1984), C.K. Ifune*, B.A. Vermeire, C.R. Hamilton**.
10. "Association of Gap Junctions with Endoplasmic Reticulum in Rat Parotid Glands," *Cell Tissue Research*, 238, pp. 589-594 (1984), J. Dunn* and J-P. Revel**.
11. "The Complete Pattern of Ocular Dominance Stripes in the Striate Cortex and Visual Field of the Macaque Monkey," *Journal of Neuroscience*, Vol. 5, No. 2, pp. 486-501, February 1985, S. LeVay, M. Connolly, J. Houde*, D.C. Van Essen**.
12. "Proliferation of Thymic Stem Cells With and Without Receptors for Interleukin 2: Implications for Intrathymic Antigen Recognition," *Journal of Experimental Medicine*, Vol. 161, pp. 1048-1062 (May 1985), J.P. Lugo, S.N. Krishnan*, R.D. Sailor, P. Koen, T. Malek, E.V. Rothenberg**.
13. "Nucleotide Sequence of Yellow Fever Virus: Implications for Flavivirus Gene Expression and Evolution," *SCIENCE*, Vol. 229, pp. 726-733, August 23, 1985, C.M. Rice, E.M. Lenches, S.R. Eddy, S.J. Shin*, R.L. Sheets, J.H. Strauss**.
14. "Sequences Required for In Vitro Transcriptional Activation of a Drosophila *hsp 70* Gene," *Cell*, Vol. 42, pp. 527-537, September 1985, J. Topol, D.M. Ruden*, C.S. Parker**.
15. "Novel Bioreactor-Cell Precipitator Combination for High-Cell Density, High-Flow Fermentations," *Biotechnology Progress*, Vol. 1, No. 4, pp. 250-259, December, 1985, G. Stephanopoulos**, K.-Y. San, B.H. Davison, M. Phoniadakis*.
16. "Software for Electrophysiological Experiments with a Personal Computer," *Journal of Neuroscience Methods*, Vol. 12, pp. 317-330, 1985, D.R. Kegel*, B.D. Wolf, R.E. Sheridan, H.A. Lester**.
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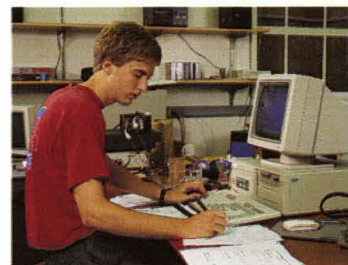
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A Study of RHEED Dynamics During Thin Film Growth

SURFSAT — X- and Ka-band Beacon Subsystems Final Design and Prototyping

The Statistical Variability of the Water Potential and Moisture Content on Alaskan Forests and the Effects of Sample Size on Those Parameters

Computer Simulation of the Optical Properties of Scintillating Crystals

Plastocyanin Protein Production for Electron Transfer Study

Subcloning and Restriction Mapping of the Promoter Region of the SpCoel I Gene of *S. Purpuratus*

Expression of the Mouse MHC Class I L^d Heavy Chain

Calculating The N₂ Rotational Raman Spectrum

Oligocene - Recent Plate Reconstructions of the South-East Indian Ridge

Fluid Flow Past Double Airfoils

Pyrotechnic Shock Simulation: A Shaker Adapter

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Stereoselective Olefination of Ketones

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Data Analysis for Improved Software Reliability

Group IV Ternary Alloy Film Crystallization

Multiple Orbit Gamma-Ray Observations of GX 301-2

Dynamical Study of the Validity of Homopolymer
Flow Models

Immobilized Metal Affinity Gel Electrophoresis
(IMAGE)

Steady States in the Two-Dimensional Symmetric
Model of Dendritic Growth

Selective Recognition of DNA by [(lys)₂Rh(phi)]³⁺

Computational Study of the Initial Flow Around a
Circular Cylinder Impulsively Started in Linear and
Rotational Motion

Purification of Oligosaccharyltransferase

Catecholamines in the Zebra Finch Song System

An Approach to Flexible Spacecraft Specification

Optical Illusion: Simulation of the Nonclassical
Receptive Field in Primary Visual Cortex

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Study of Spheromak Injection with the Caltech Spheromak Accelerator

SURFSAT Expected Environments and Implications

Ruthenium Modification of cellobiohydrolase I

Fast and Parallel Implementation of Melting Algorithm for Clustering

Watching Granular Flows

Isolation of Mutants that Interact with *Leafy* Mutants During Floral Development in *Arabidopsis thaliana*

New Links in the Observable Features of Solar Filaments

Simple Model of Atmospheric HOx Chemistry and its Applications

Nuclear Magnetic Resonance Investigation of the Effect of Charge on 1,2-Disubstituted Ethanes and 1,3-Disubstituted Propanes

Controlling a Tendon Driven Robotic Finger with R/C Servo Motors

An Investigation of post-AGB Evolution in Warm Supergiants

Machine Learning with ITRule

Chemistry Visualization

Determination of Phosphoamino Acids in CDC7p

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Infrared Imaging of High Redshift Radio Galaxies

SURFSAT Functional Integration

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David Q. Zhu <i>Junior, EE</i>	Signal Processing System for Novel Fringe Detection in a Michelson Stellar Interferometer	Brad Hines <i>Member of the Technical Staff, JPL</i>

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