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In Science, Engineering and Mathematics
QUARTERLY
SPRING 2000

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COVER: Broadcom Corporation provides this image of a microchip layout (see chip on fingertip, page 19) that has helped to catapult the company into one of the world's most successful broadband communications businesses. Broadcom, based in Irvine, makes 95% of the chips that go into U.S. digital cable set-top boxes and cable modems. The company was co-founded by Henry Samueli, the subject of our interview, beginning on page 18.

CAMP STATEWIDE

The University of California, Irvine serves as lead campus and administrative center for CAMP systemwide

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CAMP is dedicated to UC undergraduate achievement in science, mathematics, engineering, and technology.

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QUARTERLY

THE UNIVERSITY OF CALIFORNIA JOURNAL FOR THE CALIFORNIA ALLIANCE FOR MINORITY PARTICIPATION IN SCIENCE, ENGINEERING AND MATHEMATICS

SPRING 2000 • VOLUME 8 • NUMBER 3

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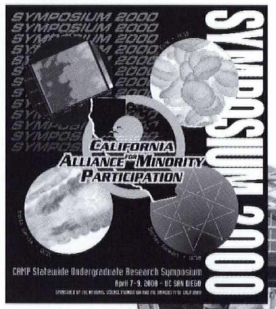

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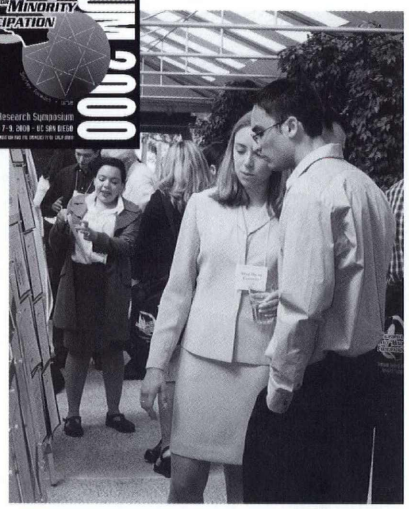

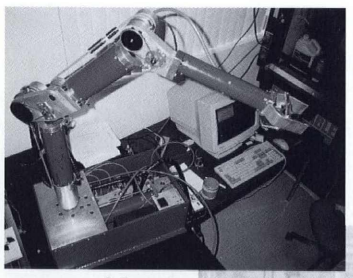

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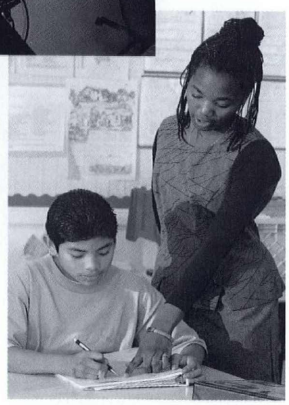

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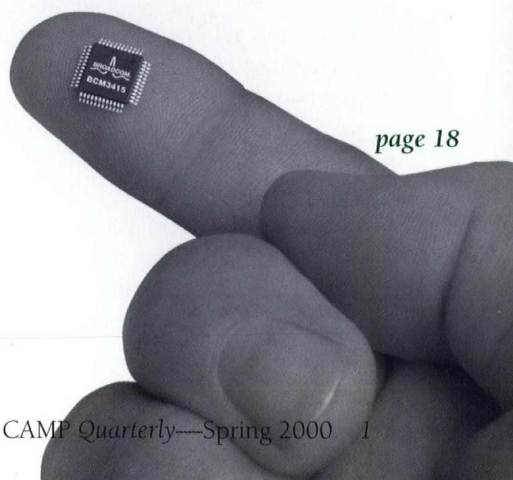
COLUMNS & DEPARTMENTS



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COMMENCEMENT 2000

Congratulations Graduates! The UC students named here have received CAMP support in significant ways—through peer tutoring, cooperative learning workshops, laboratory research, scientific symposia, teacher preparation or other meaningful activity. All students are Spring 2000 graduates unless indicated otherwise by the academic quarter in which the degree was completed. Please see "Forum," page 7, for faculty perspectives on what it means to be a graduate of the University of California.

UC RIVERSIDE

Maricela Covarrubias, biology; presented research, "The Genetic Relationship Between Wild and Domesticated Avocado (*Persea Americana*)" at AAAS Annual Meeting and SACNAS Annual Conference; making plans for graduate study.

LaKrecia Sanders, mathematics; will attend Claremont Graduate School for master's degree in education and teaching credential, Fall 2000; CAMP peer counselor three years; special recognition for research on wavelets, 1999 CAMP Statewide Undergraduate Research Symposium; president, Association of Para-Professional Counselors.

Magdalia Serna, mathematics, statistics minor; accepted to University of Chicago master's program in financial mathematics, Fall 2000; Chancellor's Honor List; CAMP peer counselor.

Daniel Smith, biology, statistics minor; Dean's List; award for oral presentation on research, "Functional Redundancy of Xenobiotic Degraders in Soil," at Louisiana AMP Conference 2000 and honors for poster presentation at the CAMP 2000 Undergraduate Research Symposium; Chancellor's Fellowship worth $40,000 to support his master's degree at UCR in microbiology. Plans to continue with the Ph.D. and become a university professor.

Monica Villarreal, chemistry, religious studies minor; Marquette University School of Dentistry, Fall 2000; presented research, "Atomic Force Microscopic Imaging of a Porphyrin Monolayer on a Gold Electrode," at the 1999 SACNAS Annual Conference.

Omar Zuniga, mathematics; admitted to Ph.D. programs at University of Arizona and UC San Diego; fellowship from Alliance for Graduate Education and the Professoriate (AGEP) at UCSD; two summer projects at University of Puerto Rico; completing senior thesis through the University Honors Program.

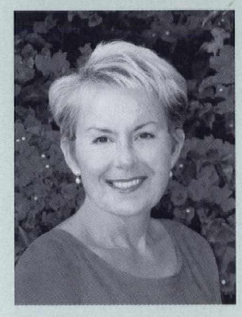
UCLA

Estela Ayala, physiological science; **Angela Boutte**, biochemistry (graduate school Fall 2000); **Linda Calvillo**, physiological science (Harvard MD program, Fall 2000); **Michael Cooper**, biology; **Vida de Arce**, biology; **Erwin de la Cruz**, chemical engineering; **Cesar Fernandez**, molecular, cell & developmental biology (Yale Ph.D. program, Fall 2000); **Candace Finn**, physiological science and English; **John Gonzales**, physiological science; **Juan Guzman**, physiological science (UCI Ph.D. program, Fall 2000); **Amie Jimenez**, biochemistry; **Luciana Kohatsu-Arce**, cell & molecular biology (UCLA ACCESS/Ph.D. Program, Fall 2000); **Teferi Mitiku**, molecular, cell, & developmental biology; **Luis Munoz**, microbiology & molecular genetics (Harvard MD Program, Fall 2000); **Sha-Shonda Revels**, molecular, cell, & develop-

COMMENCEMENT 2000 continues on page 28

FROM THE EDITOR

Class of 2000, best wishes for your every success. We hope to hear more of you in the future through CAMP affiliated programs that support



graduate study. In particular, AGEP, Alliance for Education and the Professoriate, an important new NSF iniatiative. UC's AGEP leadership recently hosted NSF director Roosevelt Johnson, who visited every UC campus the week of May 8.

Our features reflect student support from the University, government, and private sector.

UC San Diego hosted the CAMP 2000 Statewide Undergraduate Research Symposium. Chancellor Robert C. Dynes discusses the research experience in his editorial, insights which he shared in person at the symposium. Vice Chancellor Joseph Watson's participation throughout the event is another indication of the campus' commitment to student development. Highlights from the symposium begin on page 9. Proceedings will be available from the Statewide Office in July.

U.S. Congresswoman Loretta Sanchez conveys her support for CAMP in a precedent-setting letter to the director of the National Science Foundation. We are pleased to share this with you.

Capturing headlines this year is the gift by Henry Samueli, Chief Technical Officer of Broadcom Corporation to the schools of engineering at UCLA and UCI. Dr. Samueli's thoughts on education and technology—and his verve—come through in the interview beginning on page 18. If you gaze too long at our cover, courtesy of Broadcom, you may begin to experience the dizzying matrix inside a microchip.

Marjorie DeMartini

GUEST EDITORIAL

Engaging Underrepresented Students In Research: The Role of Peer Influence

BY ROBERT C. DYNES
CHANCELLOR
PROFESSOR OF PHYSICS
University of California, San Diego

We scientists are a motley group. Some of us scrutinize molecules; others gaze at galaxies. Our pursuit of knowledge may lead us to the laboratory bench or to the ocean's depths or to workstations at supercomputer centers.

But we do have a few things in common. We are all driven by a passion for discovery. We are all indebted to the personal mentors who stoked that passion when we were young. And we all get a chance to pay back the debt by serving as mentors to younger scientists.

I was one of the few high school students from my community in London, Ontario to attend college. In my junior year at the University of Western Ontario, when my department chair urged me to go to graduate school, I didn't even know what graduate school was. But I knew he believed in me, and so, buoyed by his confidence, I entered the graduate physics program at McMaster University, where I went on to earn my master's and doctorate degrees.

My thesis adviser at McMaster was a theoretical physicist named Jules Pierre Cabot. Jules had an insatiable curiosity, and he was addicted to the thrill of revelation. Working alongside him was exhilarating. I remember finishing up one experiment at 4 a.m. and realizing on my way home that I knew something that no one else in the world knew. It felt like heaven.

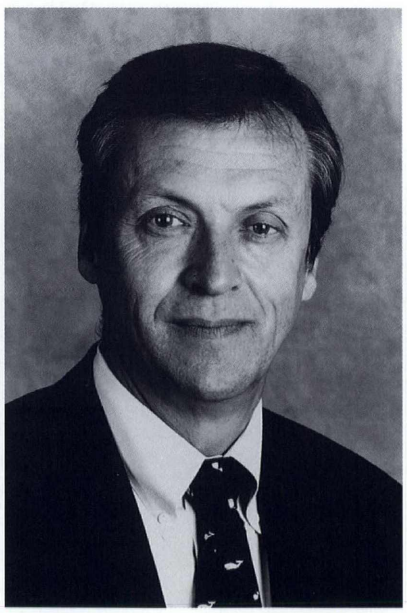
Today, in my physics lab at UC San Diego, I work alongside talented students like Taryl Kirk, the son of immigrants from Trinidad, who was interviewed in the Winter 1999 CAMP *Quarterly*. Taryl is an extraordinary young man. Watching him grow as a gifted researcher with a bright future is enormously rewarding.

Here at the University of California, scientists strive each day to answer the unanswered, and when we succeed, we take pride in contributing to the betterment of society. But that is only part of our mission. We must strive just as hard, and take just as much pride, in nurturing the women and men who will pick up where we leave off.

Does such mentoring produce tangible benefits? Empirical data (an investigator's touchstone) indicate that it does. Undergraduate students who team up with faculty for serious research experiences enter Ph.D. programs with greater frequency than other students do. Programs like CAMP that directly orchestrate student-faculty research collaborations play a significant role in making these experiences more widely available.

Such collaborative relationships are especially important in diversifying the ethnic composition of the scientific community. A homogeneous research establishment can

"We scientists are a motley group. Some of us scrutinize molecules; others gaze at galaxies. Our pursuit of knowledge may lead us to the laboratory bench or to the ocean's depths or to workstations at supercomputer centers. But we do have a few things in common. We are all driven by a passion for discovery."
—Robert C. Dynes, Chancellor, UC San Diego



CURRICULUM VITAE

Robert C. Dynes

Chancellor
University of California, San Diego

EDUCATION

- 1964 B.Sc. Mathematics and Physics, University of Western Ontario
- 1965/68 M.Sc. and Ph.D. Physics, McMaster University, Hamilton, Ontario

PROFESSIONAL EXPERIENCE

UC San Diego

- 1996-Present Chancellor
- 1991-Present Professor of Physics
- 1995-96 Senior Vice Chancellor-Academic Affairs
- 1995-96 Chair, Department of Physics

AT&T Bell Laboratories

- 1968-70 Postdoctoral Fellow
- 1970-75 Member of Technical Staff
- 1975-82 Department Head, Semiconductors and Chemical Physics Research
- 1982-83 Department Head, Materials Physics Research
- 1983-90 Director, Chemical Physics Research

HONORS

- Fellow, American Physical Society; Fellow, Canadian Institute of Advanced Research; Member, National Academy of Sciences; Fritz London Award in Low Temperature Physics; Fellow, American Academy of Arts and Sciences; Honorary D.Sc. Degree, McMaster University

COMMITTEES AND BOARDS

- California Science and Technology Fellow
- National Research Council: Board of Physics & Astronomy (Chair)
- San Diego Economic Development Corporation Board

PERSONAL

- Born in London, Ontario, Canada; U.S. Citizenship, 1984

Please see Chancellor Dynes' welcome remarks for Symposium 2000, page 10. Added afternoon attraction (page 12): wielding a hockey stick given by AVC Loren Thompson, the Chancellor gave a spontaneous passing lesson in ice hockey to interested students. Applied Physics!

never have the breadth of vision to see the big picture. The most fruitful research enterprises are integrated ventures in which assorted investigators bring different perspectives and skills to work on common problems.

Underrepresented students need to hear at an early age that careers in research are attainable and are worth attaining. The number of new slots filled by future biologists, engineers, computer scientists, chemists, and physicists from underrepresented populations will depend largely upon the number of current underrepresented students who can increase their levels of preparation in mathematics and science. To that end, the University of California is dramatically expanding its partnerships with the state's public schools to ensure that more creative young minds fulfill their educational potential.

I know each of you applauds that effort. But do you realize how important you are to its success? The nurturing of young minds happens at the individual level through personal interaction. I am a physicist today because, when I was a student, accomplished physicists with busy schedules took time out to encourage and guide me. To borrow Isaac Newton's phrase, I can see far because I have stood on the shoulders of giants.

I am proud that Taryl Kirk and my other student proteges have brilliant careers ahead of them. And I am pleased to think that they will someday serve as mentors to the next generation of research investigators.

When the eminent African-American educator W.E.B. Du Bois celebrated his 90th birthday, he wrote to his newborn great-grandson, "The return from your work must be the satisfaction which that work brings you and the world's need of that work. With this, life is heaven, or as near heaven as life can get."

We scientists are fortunate that our work brings us satisfaction as it addresses the needs of the world. We can enjoy the thrill of revelation, and we can share with one another our ideas and our fervor for ideas. And, looking to the future, we can ensure that our work continues by preparing our successors to carry it on.

Today, all across California, thousands of elementary, middle and high school students hope as we once hoped and struggle as we once struggled. They need to know that, while a career in science is hard work, the rewards are potentially far greater than in almost any other area of human endeavor. They need to hear that all those hours of concentration will be a worthwhile investment. They need to see that less-traveled paths lead to wonderful worlds.

And, most important, they need mentors to ignite their passion for discovery—older mentors with years of experience and younger mentors who only recently sat where they now sit.

The University of California's programs for early outreach and for immediate outreach and recruiting need your help. Please join us in reaching talented students of color across our communities. This is shaping up to be our most meaningful collaboration yet, and it promises a great yield for many years to come.

Letters

WINTER 2000 ISSUE

Thank you for your letter enclosing the very fine Year 2000 issue of the CAMP Quarterly. I am delighted to join my perspective with other mentoring colleagues in this attractive edition. CAMP is a beacon for the future of science, engineering and mathematics education.

Rita R. Colwell
Director, National Science Foundation

What a great story! And the cover is spectacular. Thanks so much for taking the time to present the [UC Merced] campus and all its complexities.

Carol Tomlinson-Keasey
Chancellor, UC Merced

I appreciate the recognition of my role in founding CAMP. There is one additional bit of history. The CAMP program and NSF proposal grew out of a program supported by the Hughes Foundation. Eloy [Rodriguez] and I submitted a grant which was funded and actually used to bring the first students into the format eventually used for CAMP—biology students, as I recall. Luis Villarreal and Francisco Ayala were also involved in those early efforts.

L. Dennis Smith
President, University of Nebraska

It is exciting to see how far CAMP has come, and inspiring to think of how much more our UC campuses can accomplish by working together to mentor underrepresented students, encourage undergraduate research, and provide positive role models in the science, mathematics, and engineering fields. I particularly enjoyed reading the "Millennium Moments" section. I send my best wishes for CAMP's continuing success under your able leadership.

Henry T. Yang
Chancellor, UC Santa Barbara

Thank you for sending me the CAMP *Quarterly* for Winter 2000. Without a doubt, this issue is of the highest caliber and contains the most interesting articles. When I reviewed the students' comments, their quotes jumped out at me as testimony to the quality of CAMP activities. I plan to circulate this issue among the staff here at Puente.

Felix Galaviz
Executive Co-Director, Puente

COMMUNITY COLLEGE INSTITUTE

I am a member of the first Community College Summer Institute held at UC Irvine. I transferred and graduated from UCI in 1995. Since then I have completed a master's degree at Stanford in mechanical engineering. I've been working for Boeing as an aerospace engineer. Keep me in mind for any upcoming CAMP events in which you would like to have CAMP alumni participate.

Leonel Serrano

The first time I heard about science programs opening doors for underrepresented students was at the CAMP Community College Summer Institute at Irvine. I was a student then at Grossmont College. Now I've made four research presentations and I'm graduating from UC San Diego. My plans definitely include graduate school.

Alejandro Diaz-Lamas

GRADUATE SCHOOL BOUND

Princeton has accepted me for admission in Fall 2000, and is giving me full funding for five years. I visited the East coast during spring break to see how I would like the campus.

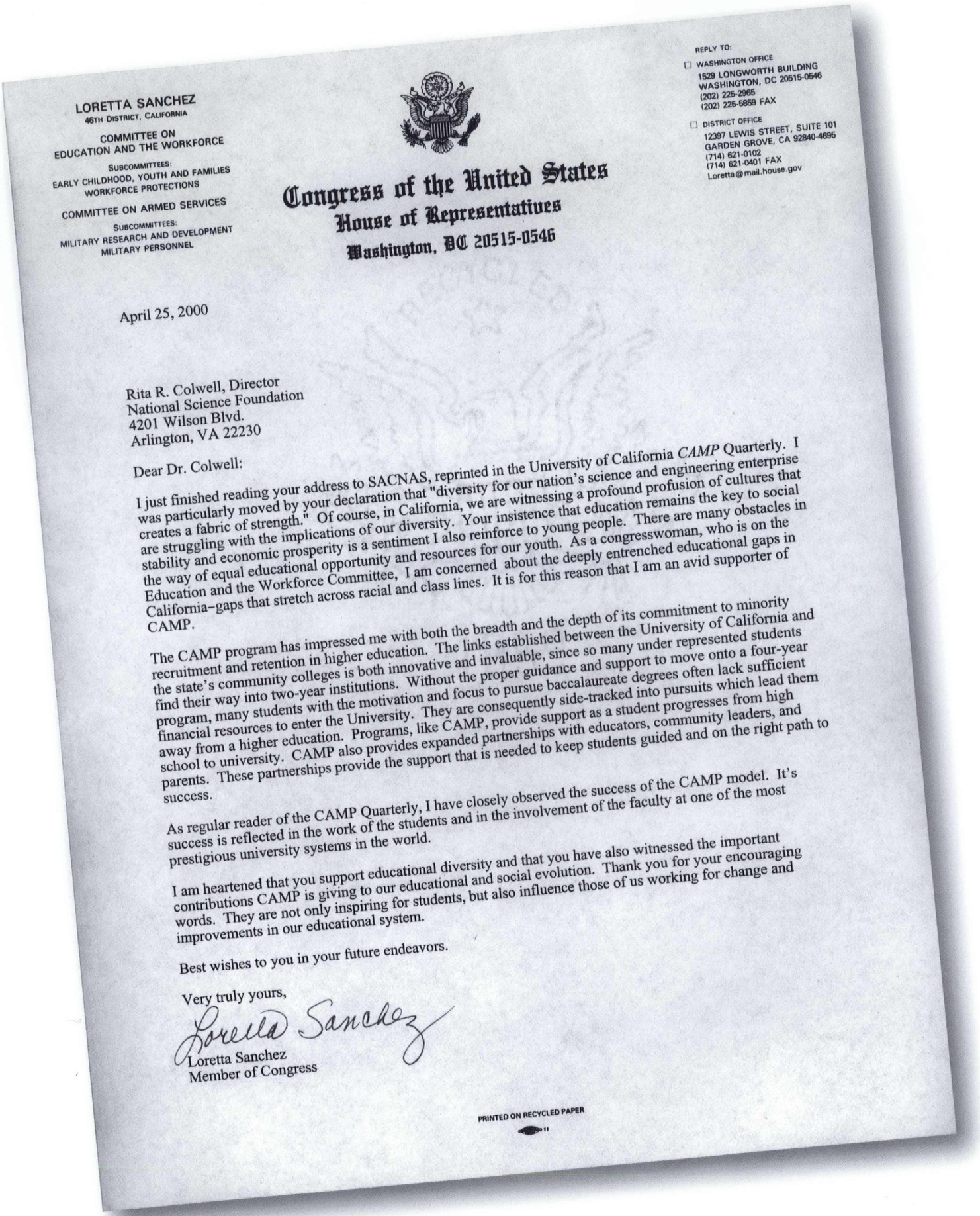
Juan Bravo
UCI Class of 2000 (CAMP-Toshiba Scholar)

Thanks to CAMP, I made friends, learned about resources and prepared for graduate school. Without CAMP, I would have transferred out or struggled through my major with little enthusiasm. Now I've been admitted to UCLA for graduate study.

Jennifer Rodriguez
UCSB Class of 1999

I am pleased to inform you that I have been accepted to Cornell Medical School. I have also been granted interviews at numerous schools such as UC San Francisco, UC Davis, Johns Hopkins, University of Pennsylvania, Yale, and UCLA. I could not have done it without CAMP. Thank you so much!

Gbemi Adeseun
UCI Class of 2000



LORETTA SANCHEZ
46TH DISTRICT, CALIFORNIA

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April 25, 2000

Rita R. Colwell, Director
National Science Foundation
4201 Wilson Blvd.
Arlington, VA 22230

Dear Dr. Colwell:

I just finished reading your address to SACNAS, reprinted in the University of California *CAMP* Quarterly. I was particularly moved by your declaration that "diversity for our nation's science and engineering enterprise creates a fabric of strength." Of course, in California, we are witnessing a profound profusion of cultures that are struggling with the implications of our diversity. Your insistence that education remains the key to social stability and economic prosperity is a sentiment I also reinforce to young people. There are many obstacles in the way of equal educational opportunity and resources for our youth. As a congresswoman, who is on the Education and the Workforce Committee, I am concerned about the deeply entrenched educational gaps in California–gaps that stretch across racial and class lines. It is for this reason that I am an avid supporter of CAMP.

The CAMP program has impressed me with both the breadth and the depth of its commitment to minority recruitment and retention in higher education. The links established between the University of California and the state's community colleges is both innovative and invaluable, since so many under represented students find their way into two-year institutions. Without the proper guidance and support to move onto a four-year program, many students with the motivation and focus to pursue baccalaureate degrees often lack sufficient financial resources to enter the University. They are consequently side-tracked into pursuits which lead them away from a higher education. Programs, like CAMP, provide support as a student progresses from high school to university. CAMP also provides expanded partnerships with educators, community leaders, and parents. These partnerships provide the support that is needed to keep students guided and on the right path to success.

As regular reader of the CAMP Quarterly, I have closely observed the success of the CAMP model. It's success is reflected in the work of the students and in the involvement of the faculty at one of the most prestigious university systems in the world.

I am heartened that you support educational diversity and that you have also witnessed the important contributions CAMP is giving to our educational and social evolution. Thank you for your encouraging words. They are not only inspiring for students, but also influence those of us working for change and improvements in our educational system.

Best wishes to you in your future endeavors.

Very truly yours,

Loretta Sanchez

Loretta Sanchez
Member of Congress

PRINTED ON RECYCLED PAPER

FORUM

What is a UC graduate?

Commencement, June 2000 provides a fresh opportunity to reflect upon what it means to be a UC graduate. We asked the CAMP regional directors for their perspectives on what it means to earn a degree from the University of California. What are the salient qualities of a UC graduate? What set of skills to ensure success in life should graduates take with them when they leave the university? CAMP faculty and staff at each of the participating UC campuses serve as mentors, role models, academic counselors and colleagues. Several directors have guided undergraduates in their coursework and pursuit of the B.S. degree for more than 30 years.

"First, the UC graduate should recognize and appreciate that he or she has earned a degree from one of the greatest universities in the world. Second, the graduate should evidence the results of that education by routinely incorporating higher level thinking and creativity in his/her daily lives."

—A. Russell Flegal, Professor of Environmental Toxicology, UC Santa Cruz

"Being educated in a research university means that UC graduates are grounded in fundamental understanding and driven by inquiry. The combination of fundamentals and inquiry prepare our graduates for pursuit of knowledge as a way of life."

—Derek Dunn-Rankin, Professor of Mechanical & Aerospace Engineering, The Henry Samueli School of Engineering, UC Irvine

"UC graduates have a high degree of professionalism; they must be prepared to adjust rapidly to the work environment; and they should always seek ways to develop personally and professionally."

—Kenneth C. Millett, Professor of Mathematics, UC Santa Barbara

"Completing a UC degree provides alumni with the opportunity to secure the best positions worldwide. Having earned a degree from one of the foremost university systems in the nation obligates graduates to become leaders in their communities, to inspire youth who follow, and to implement change in our society to the benefit of all. Alumni have the responsibility to assist the University of California to fulfill its mission of excellence in teaching, research and public service."

—Carlton R. Bovell, Professor of Biology, Emeritus, UC Riverside

"For our engineering students as with all UC graduates, we endeavor to provide a firm intellectual foundation enhanced by the environment of discovery. We challenge our graduates to collaborate and communicate effectively, while maintaining an awareness of the importance of ethics, diversity, economics, and the environment." —*James F. Shackelford, Associate Dean and Professor of Chemical Engineering and Materials Science, College of Engineering, UC Davis*

"Our graduating seniors find themselves with a diverse set of options, resulting from an in-depth immersion in the sciences as undergraduates. Lorraine Sadler, UC Berkeley Class of 2000, says it all: 'Being a UC graduate means being in the difficult position of having too many great graduate programs to choose from.'"

—P. Buford Price, Dean, College of Letters & Science, UC Berkeley

"To be a UC graduate is not only to be a leader on a local and state level, but also to have the talent and potential to aspire to national and even global leadership. UC graduates know no boundaries to what they can achieve."

—Miguel Garcia-Garibay, Associate Professor, Chemistry & Biochemistry, UCLA

"Our graduates are known nationally for having completed a rigorous curriculum with high standards in science and technology. As UC graduates, these students have transformed themselves into scientists, researchers, and engineers who will continue to seek intellectual challenge, confident in having done so once before with success."

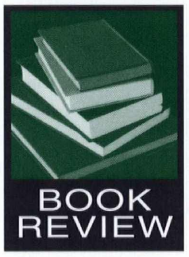
—Sarah Richards, CAMP Coordinator, UC San Diego

The Closed World: Computers and the Politics of Discourse in Cold War America

BY PAUL EDWARDS, MIT PRESS, 1996

Minds In Motion: An Open Ended Discussion

BY MANUEL N. GÓMEZ



At times I think the most definitive thing we can say about the human mind is that it seems to thrive on ambivalence. My approach to this review, even my first sentence, is homage to this supposition in as much as I feel the need to try to clarify some issues that stubbornly resist clarity in a curious mind. I am thinking in particular of those issues related to what is commonly called our "high-tech explosion," a description that both exalts and demonizes the omnipresence of technology in our daily lives. With all of the recent attention on Internet security, I recalled Paul Edwards ambitious book, *The Closed World: Computers and the Politics of Discourse in Cold War America*, and wondered what he would have to say about the latest hacking incidents. For it was his book that piqued my own interest in both the origins and the potential of technology in an increasingly open world of global commerce.

Edwards' book traces the evolution of the computer and those areas of research which have facilitated popular access to computers, as well as much of their sophistication and usefulness in civilian life. Although many people don't realize it, the Internet began as a military research network, the MILNET, which itself evolved out of the 1970's Department of Defense network ARPANET. In fact, Edwards demonstrates with great skill and thoroughness that the frontiers of technology we find ourselves at today have their origins in what he calls the closed world discourse of the Cold War. As Edwards argues, the political culture of the Cold War era ... saw communism both as an external enemy to be contained or destroyed by overt economic manipulation, covert political intervention, and military force, and as an internal danger to be contained by government and civil surveillance, infiltration, public denunciations, and blacklisting. (p. 9)

The most powerful means to maintain control over the threat of communism, and thereby maintain the integrity of a closed world discourse, was through electronic control of one's perceived enemy, whether it be through the development of sophisticated weaponry, decoding devices, or complex computerized systems capable of initiating or responding to a nuclear attack. Organizations such as Rand got their start as military research entities, collecting some of the finest minds in the cause of protecting American political and economic interests.

The notion of the closed world originated, according to Edwards, during the second world war to reflect the goal of communist containment. The strongest rationale for this closed world ideology was the threat of nuclear apocalypse, which more sophisticated technology was supposed to prevent. "During World War II, virtually all computer research (like most scientific research and development) was funded directly by the War Department as part of the war effort" (p. 44), according to Edwards, in service of centralized military control and containment. Digital computers capable of running multiple programs, mimicking human thought processes, communicating with humans, and even replacing humans in some functions existed only in theory, but in theory they did exist decades before they existed in fact. What Edwards wants to demonstrate in his book is that the military origins of computers, and in particular the development of artificial intelligence, was imbibed from the beginning with a political ideology of national control which must not be ignored or underestimated. For Edwards, what is at stake is the political subjectivity of humans living in a world where technological sophistication is inexorably tied to political and economic domination and control.

In the wake of recent computer attacks, it is difficult to hold fast to the notion of centralized control and containment. Instead, it is easier to see an increasingly open world, a decentralized, anonymous realm of cyberspace where the conspicuous lack of boundaries — or in the case of hacking, their permeability — is potentially more disturbing than the claustrophobic closed world of the Cold War.

In January, the computer system of the National Security Agency, once the nation's technology leader, was

Book Review continues on page 36

University of California, San Diego Hosts

CAMP 2000 Statewide Undergraduate Research Symposium

"Welcome to UC San Diego. We are extremely happy to have you here. These events take a lot of time, not just the staff putting it together but the faculty and many hours you students have invested in your research. The presentation experience will really inform you in terms of moving forward in academia."

—Loren C. Thompson, Ph.D., Assistant Vice Chancellor, UCSD

The University of California, San Diego, which celebrates its 40th anniversary in 2000-2001, hosted the Year 2000 CAMP Statewide Undergraduate Research Symposium, providing a forum for UC students to show their mettle. The purpose, the people, and the fellowship ensured a memorable event. Sarah Richards, CAMP Coordinator, attended to every detail.

The opening reception at the San Diego Supercomputer Center brought greetings from Associate Director Ann Redelfs who described the Center as her "house," and announced that eight CAMP students will begin internships in the coming academic year. Tours were led by senior staff. Vice Chancellor Manuel N. Gómez was taken with the 3-D imaging exhibits: "The hum of the technology and the capacity of this center is awesome!"

UCSD senior Alejandro Diaz-Lamas provided the student welcome. He told his peers, "Don't leave here without introducing yourselves to everyone. Be assertive."

We learned about teraflops (floating point operations per second) and terabites (a thousand billion megabytes of storage space), and how these help manage all the data that's being saved in the nation—for example, at the National Archives.

The Stephen Birch Aquarium of the Scripps Institution of Oceanography was the site of a special dinner that featured gourmet cuisine and spectacular ocean views. From the warm welcome by Loren C. Thompson to the dinner keynote by Dr. Willie C. Brown, students had the opportunity to get acquainted with faculty and students from across the state.

Fifty-seven undergraduates presented their research in oral and poster sessions. They attended a graduate school workshop with speakers from the national laboratories and faculty representing graduate programs.

Newly admitted freshmen to UCSD from the Early Academic Outreach Program were invited. These students, potential science, engineering or mathematics majors, attended the luncheon, which featured an address by Chancellor Robert C. Dynes. (*Please refer to page 3 for Dynes' related editorial.*)

Facilitated by Vice Chancellor Joseph Watson, physics student Taryl Kirk introduced the Chancellor, his mentor, "virtually" — via videotape. Kirk was studying for the GRE subject exam in physics. He said, "My relationship with Bob as a mentor has brought me closer to other professors and to the physics community."

Dynes then shared his background and how he came to be chancellor, beginning with his upbringing in Ontario, Canada.

Symposium 2000 Schedule of Events

FRIDAY, APRIL 7, 2000, *San Diego Supercomputer Center*

3:00-6:00 Afternoon Registration & Campus Tours

6:00-9:00 Welcome Reception

SATURDAY, APRIL 8, 2000, *Faculty Club*

Session I

9:00-10:20 Research Presentations:
Microbiology & Immunology
Developmental Biology & Public Health
Topics in Chemistry

10:40-2:00 Research Presentations:
Advances in Neuroscience
Poster Session I: Math, Et

Session II

2:00-3:20 Research Presentations:
Directions in Mathemat
Topics in Biochemistry
Poster Session II: Expl

3:40-5:00 Research Presentation
Directions in Engine
Ecology & Physiolo

5:30-8:30 Dinner, *Stephen Bir*
of Oceanography

SUNDAY, APRIL 9, 2000, *Faculty C*

9:00-11:00 CAMP Regional
9:00-10:00 Graduate School
10:00-10:45 Undergraduate
11:00-12:00 Graduate Scho
12:00-1:00 Success & Sur
1:00-3:00 Awards Lunch

GREETINGS FROM CHANCELLOR DYNES

"Welcome all of you to the second annual CAMP Statewide Undergraduate Research Symposium: students who are presenting your research findings, faculty mentors who have worked to help your students be here today, panelists and CAMP staff. It's an honor to have so many outstanding and dedicated individuals here representing all of the University's campuses and so many areas of research. I'd also like to welcome some very special, soon-to-be graduating high school seniors from San Diego and Imperial Valley schools. These students have demonstrated a strong interest in pursuing degrees in science, engineering and mathematics in UC and are here to observe this impressive symposium. As you may know, in addition to being chancellor, I'm also a professor of physics, and I never get too far from my research and physics lab."

"I rated the oral presentations as excellent because it was nice to hear about other subjects and the types of questions being asked."

—Yidnek Mitiku, UC Santa Cruz

CAMP 2000 STATEWIDE UNDERGRADUATE RESEARCH SYMPOSIUM

"I was raised in a fairly tough area of the city—a blue collar area, and both my parents worked," he said. "Hockey was my first passion, and I planned to be a professional hockey player." Dynes told how that had changed when he met Bobby Orr and Bobby Hull on the ice—with arms like telephone poles. Dynes decided to "keep his face" and go to college. He lived at home as an undergraduate, studying general science, then became interested in physics. He talked about the moment when his research led to an epiphany: "That moment, when your fire is lit, is breath-taking. It

AWARDS, GUESTS, PRESENTERS

PHYSICAL SCIENCES & ENGINEERING AWARDEES

POSTER

Honorable Mention:
Helen R. Rueda, Chemistry, UCI
High Achievement:
Noel F. Ruiz, Computer Science, UCI
Outstanding Achievement:
Veronica Reyes, Chemistry, UCSB

ORAL

Honorable Mention:
Fabian C. Martinez, Mechanical & Electrical Engineering, UCB
High Achievement:
Briz B. Garcia, Mechanical Engineering, UCI
Outstanding Achievement:
Elizabeth N. Wilcut, Physics, UCB

BIOLOGICAL SCIENCES AWARDEES

POSTER

Honorable Mention:
Daniel A. Smith, Biology, UCR
High Achievement:
Vida De Arce, Biology, UCLA
Outstanding Achievement:
Christopher McCoy, Biochemistry, UCR

ORAL

Honorable Mention:
Carmen Carillo, Animal Physiology & Neuroscience, UCSD
High Achievement: A Tie!
Boaz Cotton, Biology, UCR; Ngozi D. Iroezi, Biochemistry, UCLA; AnneMarie Selaya, Physiology, UCLA
Outstanding Achievement:
Carolina Reyes, Microbiology & Molecular Genetics, UCLA

SPECIAL GUESTS

KEYNOTE SPEAKERS:

Chancellor Robert C. Dynes, Professor of Physics, UC San Diego
Dr. Willie C. Brown, Professor Emeritus of Biology, UC San Diego
Dr. Melvin Ramey, Professor of Engineering, UC Davis

WORKSHOP PRESENTERS:

Dr. Larry Berman, UC/DC, Washington Center
Dr. Donald Correll, Director, Science and Technology Education Program, Lawrence Livermore National Laboratories (*see related story, page 32*)
Dr. Michael Kalichman, Professor of Pathology, School of Medicine, UC San Diego
Dr. Carlos Robles, Director, CEA-CREST, California State University, Los Angeles
Susan Swarts, Office of Graduate Studies and Research, UC San Diego
Dr. Art Yayanos, Scripps Institution of Oceanography, UC San Diego

CAMP 2000 Statewide Undergraduate Research Symposium Presentations

BIOLOGICAL SCIENCES

IRANIA ALARCON
Microbiology & Molecular Genetics, Los Angeles
Mentor: Debi P. Nayak, Ph.D.
"Preparation of a Virus Stock"

CARMEN A. CARRILLO
Animal Physiology & Neuroscience, San Diego
Mentor: Eric P. Zorrilla, Ph.D
"The Effects of Naltrexone, a Non-Selective Opiate Antagonist, on Water, Sucrose, and Saccharin Consumption"

ANNA MARISA CERVANTES
Molecular Biology, San Diego
Mentor: Palmer W. Taylor, Ph.D.
"The Influence of Delta Subunit Mutations on α-Neurotoxin Binding to the Nicotinic Acetylcholine Receptor"

SARAH D. CORDOVA
Molecular Biology, Santa Cruz
Mentor: Zhiwu Zhu, Ph.D.
"The Role of MAC1 in Yeast Differentiation of Physiological and Toxic Levels of Copper"

GERMAN A. CORTEZ
Chemistry & Biology, Irvine
Mentor: Thomas M. Schultheiss, Ph.D.
"Role of the Transcription Factor Mesenchymal Forkhead 1(MFH-1) During Heart Development of Chick Embryos"

BOAZ COTTON
Biology, Riverside
Mentor: Walter Metzner, Ph.D.
"Three Dimensional Reconstruction of the Horseshoe Bat Brain Identification of the Neural Substrate Underlying Audio-Vocal Behavior"

Symposium Presentations continue on page 13

makes all the drudgery, all the things that go wrong, all the failed experiments worth it."

Dynes impressed upon students the importance of discovery.

"It is my conviction," he said, "that when we create new knowledge, that new knowledge will be used by well meaning people to improve our lives."

He added, "When the fire lights, don't put it out. If you have it, nurture it. It will stay with you the rest of your lives. When you create a concept—something new to the world—is the most wonderful moment you can imagine."

Dynes so captivated the audience that for a time it seemed that no one breathed.

Saturday evening, two accomplished UCSD students introduced another keynote speaker, a long time faculty member. Veronica Vargas (animal physiology and neuroscience)

WILLIE C. BROWN KEYNOTE HIGHLIGHTS

"I want to suggest a pattern of behavior that will prepare you for whatever career you choose. I suggest you pursue three things: *be a role model, be an optimist, be human.*

Be a role model! Set an example for excellence by performance, to the best of your ability. This includes being financially responsible.

Be optimistic! Optimists can identify their area of control, they can make constructive choices and focus on solutions. Optimists spread enthusiasm and reveal their passion.

Be human! Connect with other people. Many kinds of success will be closed to you unless you make connections. Work together on larger issues that we can do something about."

"I've been listening to the introductions and they all begin "Dr." "Doctor, Doctor, Doctor." Some day you students will be introduced with that title. You'll be the ones up here giving the faculty welcome."

—Ann Redelfs
Associate Director,
San Diego Supercomputer Center

PRESIDENT ATKINSON CONGRATULATIONS

Dear Dean Alexopoulos
and Vice Chancellor Gómez,

Thank you for sending me the program from the recent CAMP Statewide Undergraduate Research Symposium. I am pleased to have the program and to know of the symposium's success. It gives me great pleasure to see the great strides CAMP is making and the success it is enjoying. All those associated with CAMP are doing a wonderful job, and I hope you will convey my congratulations and appreciation to the faculty, students and staff.

Richard C. Atkinson
President
University of California

"Every day, you are taking steps forward that have gotten you here to this moment of success. The relationships that CAMP has created represent the very best that the university has to offer. Enjoy! Explore! Take advantage of everything here at this symposium."

—Manuel N. Gómez, CAMP Statewide Director

CAMP 2000 STATEWIDE UNDERGRADUATE RESEARCH SYMPOSIUM

and Gerald Tolbert (biochemistry and cell biology) praised Professor Willie C. Brown. Both are June 2000 graduating seniors. They particularly appreciated the guidance Dr. Brown had showed them when they most needed it.

"It's rare for a professor to take such personal interest in a student," they said.

Professor Brown delivered an exuberant and well received didactic address for the special dinner served at the Stephen Birch Aquarium of the Scripps Institution of Oceanography.

"I'm an admirer of the leaders of CAMP," Brown told the gathering. "I know that their efforts will ensure that you and those who follow you will participate in the science and technology revolution," he said.

Students enjoyed going through the aquarium and viewing the giant

VIDA DE ARCE
Biology, Los Angeles
Mentor: Susan Kinder Haake, Ph.D.
"Studies of a Putative Immunosuppressive Protein of *Fusobacterium nucleatum*"

ALEJANDRO DIAZ-LAMAS
Neuroscience, San Diego
Mentor: Sandra R. Chaplan, Ph.D.
"Competitive RT-PCR Quantification of Rat Dorsal Root Ganglion Preprotachykinin MRNA in Experimental Nerve Injury Models"

ERICK M. FERRAN
Molecular Biology & Immunology, Irvine
Mentor: Lisa Denzin, Ph.D.
"Immunoisolation and Analysis of PALA Cell MHC Class II-Enriched Compartments"

ESAYAS W. FIKRE
Aquatic Biology, Santa Barbara
Mentor: Nicole Phillips, Ph.D.
"A Large-Scale Spatial Survey of the Reproductive Output of Mussels and Barnacles, Two Kinds of Marine Intertidal Filter-Feeders"

KAREN L. FLEMING
Biology, Irvine
Mentor: Anthony A. James, Ph.D.
"Producing Genetically-Engineered Mosquitoes to Control Malaria Transmission"

DAVID M. GARCIA
Biology, Santa Cruz
Mentor: Steven K. Beckendorf, Ph.D.
"Characterization of Salivary Gland Gene Expression in *Drosophila melanogaster*"

FRANK F. GARCIA
Biochemistry, Los Angeles
Mentor: John Edmond, Ph.D.
"Carbon Monoxide and the Brain Growth Spurt"

NUVIA C. GUERRA
Biochemistry & Cell Biology, San Diego
Mentor: Tama Hasson, Ph.D.
"Localization of Unconventional Myosins in Developing Chick Cochlea"

ESMERALDA INIGUEZ
Animal Physiology & Neuroscience, San Diego
Mentor: Lawrence A. Palinkas, Ph.D.
"Health Care Utilization Patterns of the Latino Population in San Diego"

NGOZI D. IROEZI
Biochemistry, Los Angeles
Mentor: David R. Scott, Ph.D.
"Expression of *H. Pylori* Urease in *E. Coli*"

AWILDA JIMENEZ
Biology, Riverside
Mentor: Robert Spencer, Ph.D.
"Radioimmunohistochemistry Analysis of Corticotropin-Releasing Hormone in the Paraventricular Nucleus of the Hypothalamus and the Central Nucleus of the Amygdala"

LAURA MACIAS
Biochemistry & Molecular Biology, Santa Cruz
Mentor: Robert A. Ludwig, Ph.D.
"Isolation & Characterization of a Symbiotic RNA Gene from *Azorhizobium caulinodans*"

CARLOS A. MARTINEZ
Microbiology, Santa Barbara
Mentor: Duane W. Sears
"Creation of a Receptorkine Fusion Protein for Autoimmune Therapy"

CHRISTOPHER E. MCCOY
Biochemistry, Riverside
Mentor: Sheri J. Lillard, Ph.D.
"Quantitative Analysis of DNA Strand Breaks in Single Nuclei by Capillary Electrophoresis"

CARMELLE T. NORICE
Neuroscience, Los Angeles
Mentor: Nancy L. Wayne, Ph.D.
"The Role of Calcium/Calmodulin-Dependent Protein Kinase II in Regulating *Aplysia* Bag Cell Membrane Excitability and Egg-Laying Hormone Secretion"

CHRISTOPHER O. ORTIZ
Physiological Science, Los Angeles
Mentor: Roland R. Roy, Ph.D.
"Effects of Inactivity on Myosin Heavy Chain Composition and Size of Rat Tibialis Anterior Fibers"

MICHAEL W. PALMER
Biochemistry, San Diego
Mentor: Randolph D. Christen, Ph.D.
"Amifostine Acts as a Novel Chemotherapeutic Enhancer in Hormone Refractory Prostate Cancer Cells"

ESPERANZA RAMIREZ
Psychobiology, Los Angeles
Mentor: Pinchas Cohen, Ph.D.
"IGFBP-3 Inhibits Glucose Transport"

CAROLINA REYES
Microbiology & Molecular Genetics, Los Angeles
Mentor: Harumi Kasamatsu, Ph.D.
"The Interaction of SV40 Capsid Proteins, Vp1 and Vp3"

DESIRÉE SALAZAR
Neuroscience, Los Angeles
Mentor: Jean S. de Vellis, Ph.D.
"Effects of Transferrin and Insulin-Like Growth Factor Intraparenchymal Injection in the Normal and Myelin Deficient Rat Brain"

ANNEMARIE SELAYA
Physiology, Los Angeles
Mentor: Nancy L. Wayne, Ph.D.
"Physiological Effects of the Cytokine Interleukin 1β on Excitability and Secretory Ability in *Aplysia californica*"

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jellyfish and octopus and other marine life, as well as the interactive museum.

A special part of the awards luncheon was the tribute to Dr. Carlton Bovell, UC Riverside founding regional director.

Vice Chancellor Manuel N. Gómez presented a plaque on behalf of CAMP Systemwide. In part, it read: "Presented in grateful appreciation to Carlton Bovell for dedication and leadership."

By the time the event drew to a close, James Shackelford, Associate Dean and Professor of Engineering at UC Davis, offered to host the symposium in 2001. Planning was already underway by the time students gathered for the return trip to their home campus. See you next year in Davis—Aggie territory.

CAMP Salute to Carl Bovell

Symposium 2000 provided the setting for a warm CAMP salute to Professor Carlton "Carl" Bovell, founding UC Riverside CAMP regional director. Bovell, Professor Emeritus of Biology, is retiring—again. This time for sure. Although his students remain in his heart, he has a list of pursuits planned for his retirement. With more than forty years in the University teaching and mentoring students, he has spurred countless undergraduates to achieve their degree goals. In 1999 Bovell was honored by the UC Academic Council with the Oliver Johnson Award for Service to the University of California's Academic Senate. He received recognition for his highly visible participation on senate committees.

Boaz Cotton and Awilda Jimenez, UCR students, came to the podium to express their appreciation.

"Dr. Bovell has been like a compass, showing us the way," Jimenez said. "He set CAMP at UC Riverside in the right direction and he has kept us going in the right direction. In recognition of his defining role—showing us and guiding us to the future—we present him with this gold pocket compass."

Monica Villarreal sent her support in writing: "Dr. Bovell understands the needs of all students, and is sensitive to those who are having a particularly hard time adjusting to college life, academically and socially." She adds, "It is nice to see someone with a similar background be successful in the sciences, and who is willing to take time to counsel a student. Although Dr. Bovell is retired, his dedication to students has not."

Thank you, Dr. Bovell for establishing CAMP at UC Riverside and setting the pace and precedent for the future in undergraduate support programs.

THANK YOU, DR. BOVELL

Dr. Bovell's eloquent form of speech caught my attention the first day I met him, back in 1995, and he has managed to keep my attention ever since. As Director of CAMP-UCR, Dr. Bovell has offered me invaluable advice about college, graduate school, careers and most importantly, about life. He has encouraged me to strive for higher levels of education, to obtain a master's and a doctoral degree. His own graduate school experience made me realize that even successful people encounter difficult moments but nonetheless they are able to attain their goal. Since Spring Quarter in 1996, I made the Dean's List every quarter and I was placed on the Chancellor's list for the 1996-1997 academic year. I credit my success to CAMP and my faculty mentors, and especially the influence of Dr. Bovell, who gave me the courage to believe in myself.

—Maria T. Martinez
B.S. Environmental Engineering, '99
Graduate Student, Stanford

STUDENT TESTIMONIAL

Committee of Presidential Award for Excellence and Science,
Engineering and Mathematics Mentoring, UCR Academic Senate Office

Dear Committee,

It is with the highest commendation that I submit this letter in support of Professor Carlton Bovell for the UC Riverside Presidential Award for Excellence and Science, Engineering and Mathematics Mentoring for 1997-1998. I have known Professor Bovell since 1994 as a student involved as a tutor and peer counselor with CAMP. I have had the opportunity to know him personally, and know that Professor Bovell spends countless hours searching for career opportunities as well as financial aid resources for students. He has touched the lives of many students in a priceless manner.

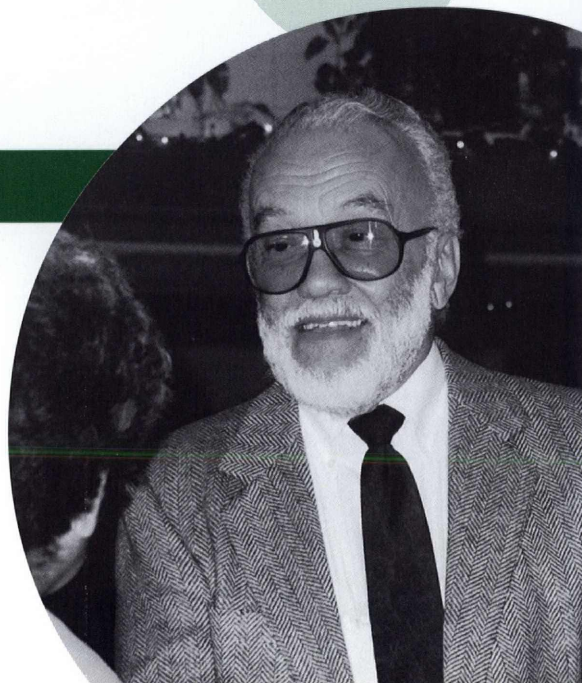
—Marissa S. Vasquez
Biochemistry and Spanish Literature

"Dr. Bovell has been such an inspiration to me during my undergraduate experience."

—LaKrecia Sanders
Senior, Mathematics, UC Riverside

"Thank you for your gracious words. I want to thank Teresa [Cofield]—we call her Mother Teresa at UCR—she's there for us at every turn. Thank you, students, for making my six years with CAMP at UC Riverside a very enjoyable experience. The thing that amazed me most in the presenters at this symposium is their innocence. You don't know how good you are."

—Carlton Bovell, Professor Emeritus
Founding UCR-CAMP Regional Director



RICHARD SILVA
Biology, Irvine
Mentor: Olivia M. Martinez, Ph.D.
"Expression of Recombinant Rat CD30 and Detection with an Anti-Peptide Antibody"

DANIEL A. SMITH
Biology, Riverside
Mentor: David E. Crowley, Ph.D.
"Functional Redundancy of Xenobiotic Degraders in Soil"

LANISE TEKELHAIMANOT
Biochemistry, Riverside
Mentor: David R. Johnson, Ph.D.
"Backbone Flexibility of Cobra Alpha-Toxin Free in Solution and Bound to the Acetylcholine Receptor"

CHRISTINA THOMPSON
Biology, Santa Barbara
Mentor: Ian K. Ross, Ph.D.
"Identification of a Blue Light-Induced Gene in *Coprinus*"

CLAUDIA VARGAS
Biopsychology, Santa Barbara
Mentor: Ian K. Ross, Ph.D.
"Mitochondrial and Nuclear Interactions in the Fungus *Coprinus*"

JENNIFER A. WOO MENDOZA
Physiology, Los Angeles
Mentor: Roland R. Roy, Ph.D.
"Effects of Inactivity on Fiber Size and Composition of Rat Fast Muscle"

MAYELA ALSINA-GUERRERO
Biology, University Metropolitan, San Juan, P.R.
Mentor: Antonio A. Mignucci-Giannoni, San Juan Puerto Rico
"Marine Mammals and Sea Turtles of Vieques Island and the Eastern Coast of Puerto Rico" (Guest Presenter)

PHYSICAL SCIENCES & ENGINEERING

ROBERTO ARELLANO
Mechanical & Electrical Engineering, Riverside
Mentor: Frank Jacobitz, Ph.D.
"Micro-Vascular Model Network Design of Skeleton Muscle Blood Vessels"

LETICIA AYALA
Chemistry, Irvine
Mentor: Donald R. Blake, Ph.D.
"Atmospheric Carbon Monoxide-Potential Health Hazard"

SKIP BETTENCOURT
Physics, Berkeley
Mentor: Edward C. Morse, Ph.D.
"Thomson Scattering of Laser Light in Magnetic Confined Plasma in the Berkeley Compact Torus Experiment"

KIMBERLY M. CROSS
Chemical Engineering, Riverside
Mentor: Duncan J. Maitland, Ph.D.
"Polarized Light Propagation in Turbid Water"

ALEJANDRO R. DEARIE
Biochemistry & Chemistry, San Diego
Mentor: Michael J. Sailor, Ph.D.
"Optimization of Porous Silicon Biosensors for Molecular Size Estimation"

DAVIANNE A. DUARTE
Chemical Engineering/Materials Science, Irvine
Mentor: Martha L. Mecartney, Ph.D.
"Anisotropic Fracture Behavior and Microstructure of Seashells from the Pacific Ocean"

ANDRES O. ESPINOZA
Civil & Environmental Engineering, Davis
Mentor: Rob Y.H. Chai, Ph.D.
"Precast Lightweight Concrete Wall Panel Test under Seismic Loading"

BENJAMIN A. GARCIA
Chemistry, Davis
Mentor: Carlito B. Lebrilla, Ph.D.
"Differentiation of Chiral Molecules Using Mass Spectrometry"

BRIZ B. GARCIA
Mechanical Engineering, Irvine
Mentor: James E. Bobrow, Ph.D.
"Reducing Friction and Air Leakage in a Pneumatic Robot Arm"

ROBERTO GARCIA
Mechanical Engineering, Davis
Mentor: Mark S. Duvall, Ph.D.
"Development of Data Acquisition Programs and Drivetrain for a 2000 Chevrolet Suburban"

SERGIO R. GARCIA
Electrical Engineering, Irvine
Mentor: Guam-Pyng Li, Ph.D.
"Microfluidics"

DIANA J. GÓMEZ
Mathematics, Santa Cruz
Mentor: John B. Little, Ph.D.
"The Maximal Workspace of a Planar Robot: A Gröbner Basis Approach"

FERNANDO GONZALEZ
Engineering, Irvine
Mentors: Guann-Pyng Li, Ph.D. & Mark Bachman, Ph.D.
"Optical Characterizations of Biomedical Microfluidic Devices"

JENNIFER L. KEELING
Biochemistry & Molecular Biology, Santa Cruz
Mentor: Glenn Millhauser, Ph.D.
"Synthesis of 2,2,6,6-Tetramethylpiperidine"

FABIAN C. MARTINEZ
Mechanical & Electrical Engineering, Berkeley
Mentor: A. Carlos Fernandez-Pello, Ph.D.
"MEMS Rotary Internal Combustion Engine"

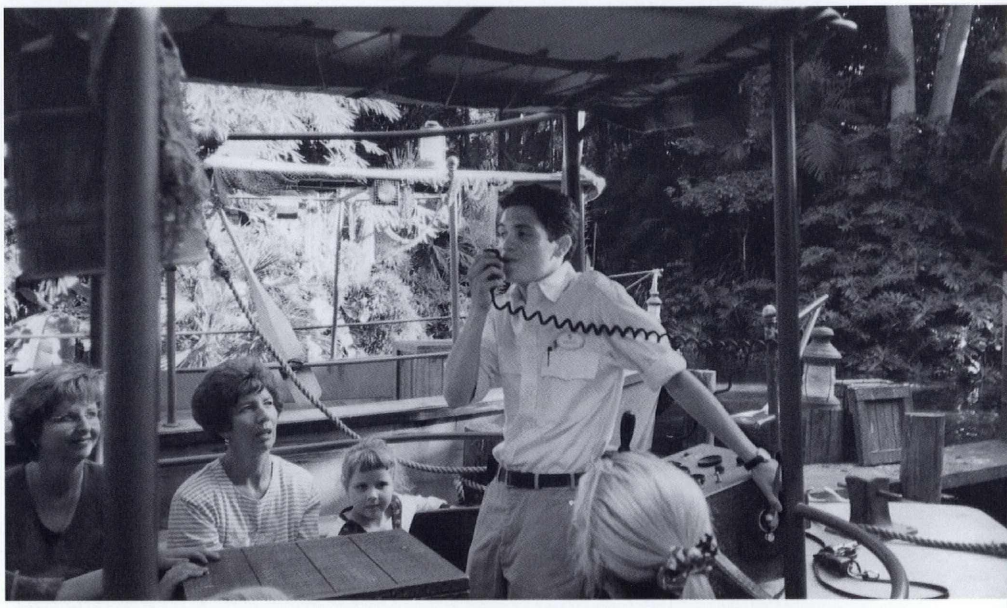
Symposium Features and Presentations continue on page 34

SEE YOU AT UC DAVIS IN 2001!

STUDENT SPOTLIGHT

Briz B. Garcia

UC IRVINE MECHANICAL ENGINEERING MAJOR
HENRY SAMUELI SCHOOL OF ENGINEERING



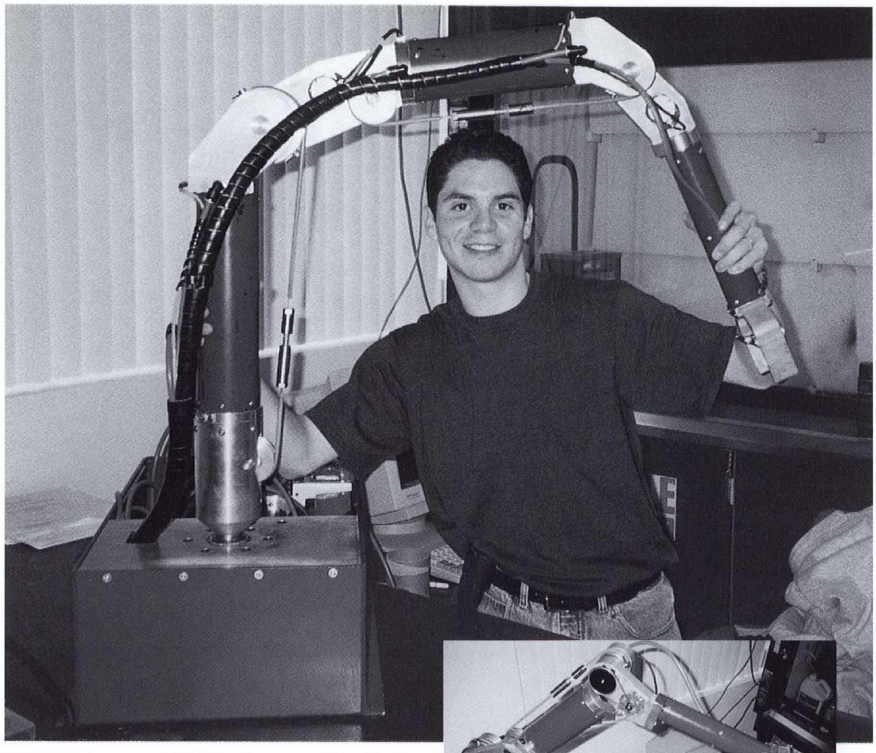
My path toward mechanical engineering and robotics began well before I enrolled at the University of California, Irvine. I attended Canyon Springs High School in Moreno Valley, where I held leadership positions in Rotary International Interact Community Service Club, and National Honor Society. My main participation, however, was in band—jazz band, marching band, drum line, concert band, and wind ensemble. I played saxophone, xylophone, and quads. I will never forget waking up at five in the morning to be at zero period rehearsal at six. The early hours paid off at competitions when we would consistently take first place. That level of discipline later supported my university goals.

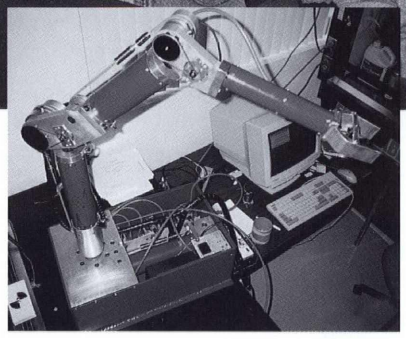
While still in high school, I participated in the launch of a new program developed by Ford Motor Company to link business and manufacturing—the Ford Academy of Manufacturing Sciences. It was through the two years of classes that I was able to acquire my first paid job. At sixteen, for $6 per hour, I was commuting five days a week, 120 miles a day into Los Angeles—during the summer when my friends were playing video games or watching movies.

At the start of my senior year, I applied to the Disneyland Resort. I was placed into the restaurants department because that is what a seventeen-year-old could do. My reasons for deciding to get a part-time job 50 miles away was to help myself attain my professional goal of becoming a Disney Imagineer. I have always had an interest in mechanical systems—including reverse 'engineering' most of my fathers power tools. My parents would take us to Disneyland often when I was young. The more I went, the more I became interested in how the attractions worked. I found out that Disney Imagineering employed many mechanical engineers, and that it was a prestigious place, difficult to hire into. I pursued a summer internship and found the right people that facilitated meetings with heads of the different engineering departments. Since that time, I have, as an undergrad, discovered that conducting research in robotics has increased my knowledge in the subject matter as well as improved my scientific, analytical, and presentation skills.

I will graduate June 2002 with a B.S. in mechanical engineering. My goals include attending graduate school. Once I earn a masters degree I would like to work in industry for several years then return to school to earn a Ph.D. in mechanical engineering and teach at the university level. My industrial career goals include positions at Disneyland Engineering and Walt Disney Imagineering, both of which involve the design of attractions involving mechanics, pneumatics, hydraulics, transmission systems, and control systems. These subjects are associated with robotics and this is why my interest remains strong in this field.

—Garcia is the UC Irvine Campus Representative for Community Outreach and Campus Recruiting and Disneyland Resort University Leader. He is the "middle child" in the family of three brothers and two sisters.





It's a breeze... UC Irvine mechanical engineering major Briz Garcia strives to "connect the dots" between study, work, play. At left, he narrates the jungle tour at Disneyland. Above, Garcia demonstrates the robotic arm, the object of his research.

ABSTRACT

REDUCING FRICTION AND AIR LEAKAGE IN A PNEUMATIC ROBOT ARM

Briz B. Garcia, Robert B. Leinbach, Professor James E. Bobrow,
Department of Mechanical and Aerospace Engineering,
University of California, Irvine.

Most modern machines and robots utilize electric servos and motors as their actuators. These motors and servos are usually inefficient, heavy, and costly. A robot arm having fluid (pneumatic) actuators requires minimal friction in piston cylinder seals to properly function by a modern nonlinear control system. This includes reducing the Coulomb and viscous friction while maintaining tolerable air leakage as compensated by the control program. Various combinations of different seal materials are implemented on the robot arm. Under these various states the arm undergoes transient response testing. Results show reduction in both Coulomb and viscous friction. Reduced friction allows for improved accuracy on position and time taken for arm movement. Fluid powered actuators can be made to meet or surpass the performance of electric motors with much less weight and cost.

BRIZ B. GARCIA ACHIEVEMENTS AND AWARDS

- High Achievement, CAMP 2000 Undergraduate Research Symposium
- Honorable Mention, American Association for Advancement of Science Annual Meeting, February 2000, Washington DC, poster presentation
- Research Presentation, CAMP Statewide Advisory Board Meeting (January 2000)
- Orange County Tourism Award for Service Excellence (1999)
- Society of Chicanos and Native Americans in Science Conference Vigil Award (1999)
- National Minority Symposium research presentation (1999)
- Spirit of Disneyland Award (1999)
- Summer Science Scholar, UC Irvine, Robotics and Automation Laboratory (1999)
- Dean's List, UC Irvine Henry Samueli School of Engineering (1997)

ACTIVITIES

- CAMP
- Center for Opportunities and Diversity in Engineering
- Rock Climbing

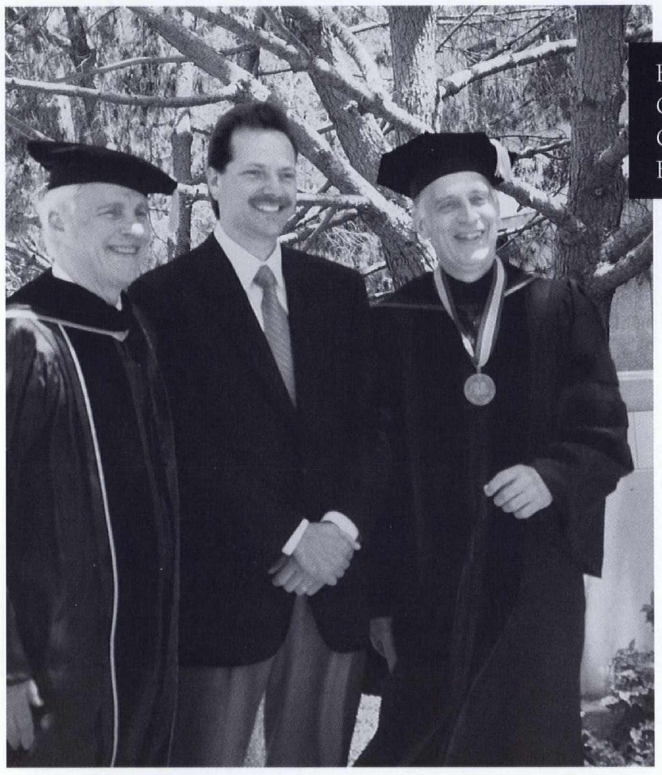
"When he's presenting, he wears competency like a badge."

—Dr. Nicolaos Alexopoulos,
Dean, The Henry Samueli
School of Engineering

Music remains a passion for Briz Garcia, and the discipline required later paid off in his university experience. Here, Garcia poses with his brother and band trophies.

BY MARJORIE DEMARTINO

CAMP *Quarterly* Interview with Henry Samueli



Henry Samueli, Ph.D.
Co-Chairman of the Board
Chief Technical Officer
Broadcom Corporation

Impeccable.

That's the first word that comes to mind when someone asks what it's like to meet Henry Samueli in his Irvine high tech headquarters. From his personal appearance to his intellectual acumen, everything in the office, including the conference table, gleams. It's a streamlined world, with not an in-basket in sight. The man and his environment provide but a glimmer into the long hours of research and hard work that it took, together with partner Henry T. Nicholas, III, to create Broadcom. They light a technology path, and together they are a force to be reckoned with, competing for market share, talent, and visibility.

From his vantage point of leading one of the world's most successful broadband communications businesses—with sales offices in The Netherlands, United Kingdom, Japan and Singapore and with international distributors in eight countries—Samueli has become the newest and perhaps the youngest patron of the University of California. UCI and UCLA are recipients of substantial personal support from Samueli, and the two campuses have named their schools of engineering after him.

The position he enjoys today began with a solid foundation in academics. Samueli admits to having been a focused, driven student who did 70-80% of his learning in class. He was gracious in indulging my question—what put you on track to eventually found Broadcom—and answered it with the enthusiasm of a first telling. His moment of epiphany came from constructing a radio kit in junior high.

"In and of itself," Samueli says, "it's unusual to make a career choice in seventh grade."

The experience created a spark that led him to major in electrical engineering and continue through the Ph.D. He has published more than 100 papers and has four patents.

His favorite subject is digital signal processing. "It's an important market; people need this technology," he says.

Samueli's commitment to education includes fostering a solid foundation in K-12. To do his part, he joined Project Tomorrow, and serves on the board of directors. He says, "Part of the discussion among the directors concerns the programs we want to fund and who are the particular teachers who are interested in doing new programs." It surprises and pleases him that it's not just schools, but teachers who are submitting most of the proposals.

He speaks ardently about quality education at all levels, and when it comes to teaching concepts to engin-

Dr. Samueli delivered the first in the 1999-2000 UCI School of Engineering Distinguished Lecture Series, "Broadband Communications Chip Technology: Enabling the Connected World of the 21st Century." Today, the school carries his name.

Q&A with Henry Samueli

Besides your inner resources, what early experiences put you on track?

It clearly started in seventh grade when I took electric shop. I had asked the teacher if I could build a Heathkit catalog short-wave radio with five vacuum tubes. He initially said, that's ridiculous—that's a ninth grade project. I told him don't worry, I'll work really hard. Every night I was busy soldering wires. It was a very challenging project because I didn't understand a thing I was doing. I just followed the instructions—connect wire A to point B and solder this and that—a full menu of things that took the whole semester. So when I plugged it in and it really worked—it blew me away. To think, you could plug something into the wall and magically sound comes out of it from around the world. I put it as my mission in life to find out how that worked. So that set me on my course to become an electrical engineer.

How did it happen that you finished high school early and enrolled at UCLA at sixteen?

I skipped two semesters, one in sixth grade and one in the eighth grade. It helped that I was always good in math. I took AP courses and it was easy me for me to maintain that track because I enjoyed the classes. I loved the sciences—physics especially—classes like that were my favorite.

Was it unnerving to begin college at such a young age?

It was. The biggest shock when I got into college was, 'You're on your own kid.' There's nobody there to hold your hand and tell you what to do. You show up to class, fine. You don't show up to class, fine. Nobody cares. If you're 100% self motivated – and fortunately again, I was a highly motivated kid—you'll be ok. In my entire college career I missed one class because I was sick. You'd have to knock me out to keep me from class. I actually did most of my learning in the classroom and then going home and doing the homework solidified it. I focused in class to understand, to listen intently and absorb it on the spot.

And fitting in socially?

The fact that I was the youngest one in my classes didn't bother me because I didn't have a very active social life anyway. I was pretty shy and introverted. I wasn't much of a party person. After studying, I'd run and jog, play basketball— informally, since I didn't try out for a team.

Did you do any research as an undergraduate or did that come later?

Just the normal labs that you take with your courses. As a senior I took one independent study course, but for the most part focused on the coursework. I didn't just do the minimum needed for the degree. I took every course that I found to be interesting—a full load every quarter. That was all I did.

What do you think about offering mentored research experiences?

I think that plays a nice role to motivate kids. Involving undergraduates in the research process gives them a chance to see what's going on. It's a great motivator. It's good for young people who don't know what higher education is all about. A mentor can show them what can be done. But if you've got somebody who is already motivated, like I was as an undergraduate—you don't need anyone to get you excited about engineering. I was an unusual case. The fact that I didn't go through that type of experience is an anomaly – because I'm an anomaly.

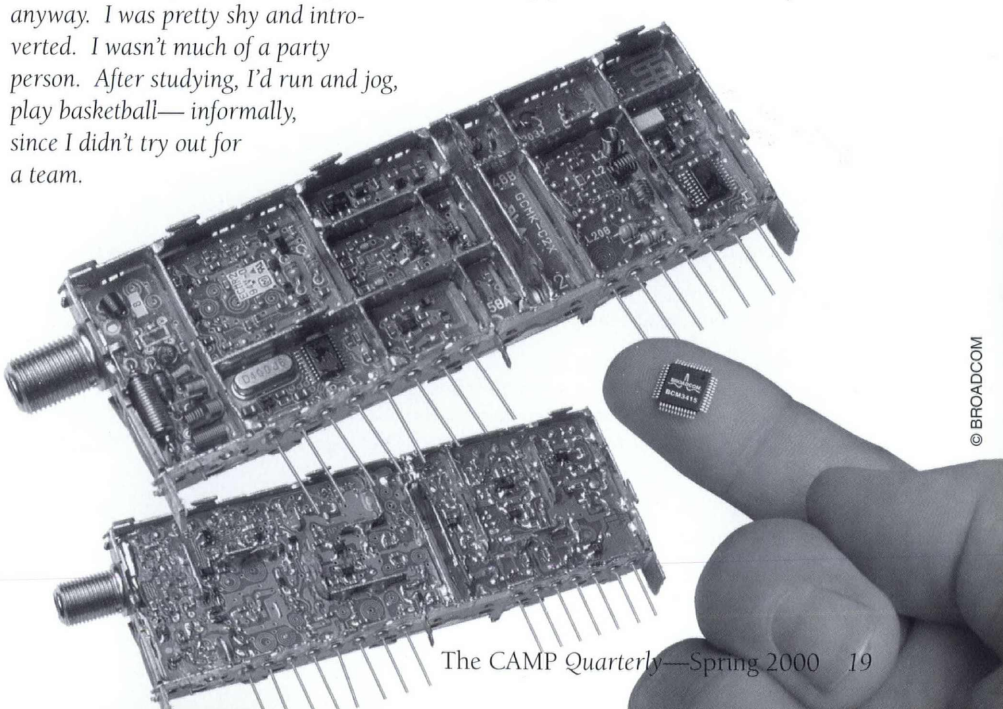
As a UCLA professor, was there a course you most enjoyed teaching?

My favorite course—actually

eering students in the university classroom, he says, "I love that stuff." Of his own commitment to excel in science and engineering, he concedes, "It was just my personality."

Personality and a lot of dedication and hard work plus long hours attached to a vision tell the Henry Samueli story—one of the great success stories that keep California at the frontier of the technological revolution.

Facing page: Dr. Henry Samueli, center, joins in celebration at Ralph J. Cicerone's inauguration as UC Irvine chancellor. Richard C. Atkinson, president of the University of California, stands at left. Right, Broadcom's tuner is a microchip that fits on a fingertip.



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Broadcom Glossary of Technical Terms

Adaptive Equalization: Receiver technique that compensates for distortions in transmission media.

ADSL: Asymmetric Digital Subscriber Line. Twisted-pair modem technology that achieves data rates of up to 8 Mbps downstream to the subscriber and up to 1 Mbps upstream to the network at distances up to 18,000 feet.

Analog Decoder: A circuit that performs decoding using analog circuit techniques rather than digital circuit techniques. (For example, decoding a video signal)

Bandwidth: A range of signal frequencies, measured in cycles per second or Hertz (Hz). Also refers to the speed at which data is transmitted, measured in bits per second (bps).

Broadband Communications: Data transmissions at speeds of greater than 1.5 Mbps.

CMOS: Complementary Metal Oxide Semiconductor. Technology used to manufacture silicon integrated circuits.

CMTS: Cable Modem Termination System: The cable headend device which serves as a bridge between a DOCSIS cable data modem and the internet.

DBS: Digital Broadcast Satellite: A broadband communications technology that broadcasts digital television programming from satellites directly to dish antennas.

DSP: Digital Signal Processing. A signal processing technique that takes real-time, high-speed signals, such as radio cellular phones, or satellite TV broadcasts, then mathematically alters it to improve the signal. This technology includes filtering, speech recognition, image enhancement, data compression, and noise reduction.

Ethernet (10BASE-T): Networking protocol widely used in local area networks (LANs) for connecting devices by means of copper twisted-pair wiring at speeds of 10 Mbps.

Fast Ethernet (100BASE-T): An extension to the 10BASE-T Ethernet network access method, Fast Ethernet operates at 100 Mbps.

FEC: Forward Error Correction: A receiver technique for correcting errors in the received data.

GHz: Giga Hertz. One billion cycles per second.

Gigabit Ethernet(1000BASE-T): An extension to the 100BASE-T Ethernet network access method which operates at 1,000 Mbps or equivalently 1 Gbps.

Gigabit PHY: Gigabit PHY is the specific description for a PHY operating at 1000Mbps

HDTV: High Definition Television. Offers six times the resolution of current TV and a full 60 frames per second temporal resolution which is twice the vertical and horizontal resolution of current NTSC analog television broadcasting.

Headend: The central distribution point in a cable television system. Typically serves tens to hundreds of thousands of homes.

several in that area—was and remains digital signal processing. It was an emerging field, and at the time I started applying digital technologies to the processing of signals it was a brand new field. It's very mathematical and very applied as well. I don't like to do pure math just for math's sake—I like to see an end result. So this was an ideal field which combined the mathematics and the applications to real engineering problems. I just loved it. That's what I've devoted my entire career to—the

PROFILE
Dr. Henry Samueli

EDUCATION
B.S., M.S. and Ph.D., Electrical Engineering, UCLA

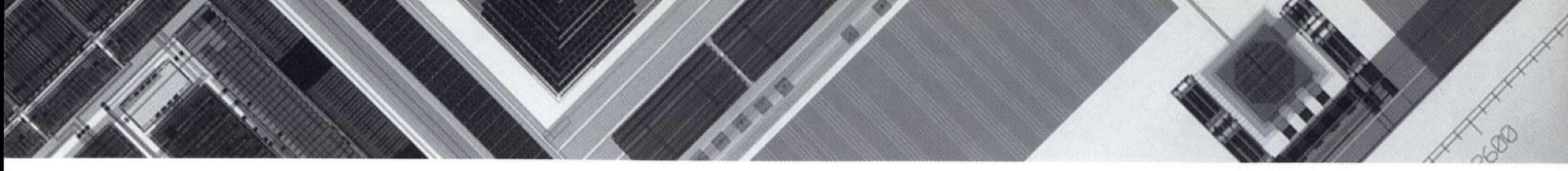
EMPLOYMENT
Co-founder and chief technology officer (CTO) of Broadcom Corporation
Professor, UCLA, 1994-present
PairGain Technologies, Inc., Co-founder and Chief Scientist, 1988-1994
TRW, 1980-86

HONORS
B.S. degree magna cum laude
Tau Beta Pi, Sigma Xi, Who's Who in the World, Who's Who in Science and Engineering, Who's Who in America
Dr. Samueli is the recipient of the 1988-89 TRW Excellence in Teaching Award of the UCLA School of Engineering and Applied Science; Meritorious Paper Award of the 1991 Government Microcircuit Applications Conference; 1995 Best Paper Award from the IEEE Journal of Solid-State Circuits; and Jack Kilby Best Paper Award from the 2000 IEEE International Solid-State Circuits Conference. He received the 1999 Engineer of the Year Award from the Orange County Sectiion of the IEEE. In 2000, he was elected Fellow of IEEE "for contributions to VLSI architectures and realizations for high bit-rate digital communication systems" and received the 2000 IEEE Circuits and Systems Society Industrial Pioneer Award.

COMMUNITY SERVICE
UCI Foundation Trustee
UCI Henry Samueli School of Engineering, Corporate Affiliates Program chair
UCI Chief Executive Roundtable vice chair
Orange County Project Tomorrow board member
Orange County Performing Arts Center board member

PERSONAL
Born Sept. 20, 1954, Buffalo, NY
Married to Susan Samueli, three children

TECHNICAL PAPERS
Over 100 published papers



general field of digital signal processing. And then ultimately applying that to the more specific field of broadband communications. I had taught some undergraduate as well as graduate courses on the subject and those were by far my favorites.

In your business, you have to keep thinking long term—

Always. If you stop innovating and moving forward, you die. Literally, you'll get trampled over by the competition. It's a very fast moving field and it's been that way since day one, when we formed the company. We are always at the forefront of R&D, and developing new technologies, new products. And it's endless, just nonstop. Which is why we so heavily recruit some of the top talent in the world. We have over 100 Ph.D.s on our staff right now. Out of a total of 1,000 employees, two-thirds are engineers; so roughly one in six of our engineers are Ph.D.s. It's a staggering number. Almost all the rest have masters degrees.

What is the Broadcom management profile?

Most of our managers are technical people and have engineering backgrounds and strong marketing skills to drive the future of our products as well as how to interface with customers. It's a unique talent, a unique mix of someone who is smart and skilled and understands the technology, coupled with someone who has the right personality and interpersonal communication skills to interface with customers and vendors and get a broad vision of what the market is doing. We don't have many classical MBA-types at Broadcom. We do not believe that in a high-tech company you can take somebody who is a pure business-educated MBA-type. Every manager here, if they have an MBA, for sure they have a bachelor's in engineering. And some didn't get an MBA at all. Look at myself and Henry Nicholas—neither one of us took any business classes; we just have an innate skill.

What were your expectations for the company. Did you have an inkling that it would explode?

We never, ever, would have predicted the success of Broadcom today. People would have told us we were crazy, out of our minds to even think we would be this successful. We never conformed to the masses. People always gave us advice, and we always ignored it. We probably broke every rule there is in founding and creating Broadcom. The last thing a start-up should do is go after a large obvious market with huge multi-billion dollar competitors. What chance do you have? You'll get crushed.

But you knew you were smart and you had a plan.

We said, 'we have a vision.' We know we can execute on that vision. We know we've got the talent or we can bring in the talent, and what if every major multi billion dollar corporation wants to do the same thing? We're smarter than they are. They may be bigger, but we're smarter. In this field, IQ is the number one factor in your success. You have to execute on the technology. There's no magic here. This is a lot of very hard work. It takes a lot of brain power. There aren't many companies with that capability, no matter now big they are. You just can't turn dollars into IQ points. If you don't have the right people, there is no amount of money you can spend to get the job done. And these are very specialized people—there aren't that many around on the planet.

So you took the risk with what money you had?

We took all our savings and started, hoping to make a living. That was our objective: maintain profitability. So that from year to year we didn't have to go back asking venture capitalists for money and then losing control of the company. And we did that. We were profitable from inception. We never took a dollar of venture capital investment into Broadcom. The first outside investment we took was three years into the company, from a corporate investor with whom we had a strategic partnership. Scientific Atlanta got us into the cable TV market and Intel into the networking market, which are two of our biggest markets today. They are partners, so we collaboratively develop products. They funded development of the product and got an equity stake in the company so that we would share in the success of Broadcom. So that was a strategic relationship. And that's what we have done historically: we only take money that provides some strategic value. Other examples are Cisco and General Instrument, two of our largest customers today. Henry Nicholas and myself control the company in terms of voting power. We determine what happens. We don't have to get permission from other people and that has enormous value.

> "Being a free market economy, we get the talent wherever we can. But I would rather that we create talent from within and grow it."
> —Dr. Henry Samueli

Did you have other talent at the outset?

In the early phases of the company, we had a very high percentage of Ph.D.s. We took the Ph.D. students that we had fostered for the last ten years into our research group. We grew this brain power and know-how. The value that we got out of the university research program is not any particular piece of technology, it's the training of all these very bright people. We brought them into the company. And we also brought a lot of people from a former company, TRW, at which both Henry Nicholas and I had worked. TRW was really the starting point for all of this because we were doing the chips and the communications technology for military applications there. I had the first job in my career at TRW from 1980 to '85,

HFC: Hybrid Fiber Coax. Upgraded cable plant which uses a combination of fiber optic cable in the backbone and coaxial cable in the subscriber feeder plant.

IC: Integrated Circuit.

Kbps: Kilobits per second.

LAN: Local Area Network. A private data communications network linking a variety of data devices such as computers and printers within an office or home environment.

LMDS: Local Multipoint Distribution System. A broadband wireless communications network that uses microwave frequencies around 28 GHz to transmit video and data to residences over a cellular-like network at distances under a few miles.

MAC: Media Access Control. Protocol for controlling the upstream and downstream traffic flow in a local or wide area network.

Mbps: Megabits per second. Million bits per second.

MCNS/DOCSIS: Multimedia Cable Network System / Data Over Cable Service Interface Specification. Industry specification that defines the technical equipment for high-speed cable modem and headend equipment.

MII: Media Independent Interface. Replaces 10Base-T Ethernet's Unit Interface (AUI), and is used to connect the MAC layer to the physical layer. The MII establishes a single interface for 100Base-TX, 100Base-T4, and 100Base-FX.

MMDS: Multichannel Multipoint Distribution Service. A broadband wireless communications network that uses microwave frequencies around 2.5 GHz to transmit video to residences at distances up to tens of miles.

MPEG: Moving Pictures Experts Group. Industry standard for compressing and decompressing digital audio video signals.

NIC: Network Interface Card. Plug-in adapter card enables a computer to connect to a LAN.

PHY: Physical Layer Device. A PHY can be a fiber optic device or a copper device. It can operate at any speed... 1Mbps, 10Mbps, 100Mbps, 1000Mbps, etc.

QAM: Quadrature Amplitude Modulation. A digital modulation technique that allows very efficient transmission of data over media with limited available bandwidth.

QPSK: Quadrature Phase Shift Keying. A digital technique which is widely employed in direct broadcast satellite transmission systems.

VDSL: Very High Bit-Rate Digital Subscriber Line. Twisted pair modem technology that achieves data rates up to 52 Mbps downstream to the network at distances up to 4,000 feet.

WAN: Wide Area Network. A data communications network, such as the Internet, which links a variety of data devices over a large geographical distance.

XDSL: Generic representation of the entire family of Digital Subscriber Line technology spanning data rates from 128 kbps to 52 Mbps depending on the distance between the central office subscriber.

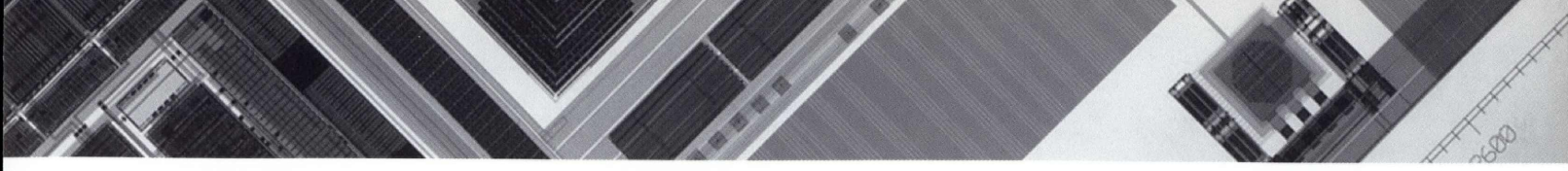
***$50 MILLION TO ENGINEERING:** Dr. Henry Samueli personally gifted $20 million to UCI's School of Engineering and also presented UCLA, his alma mater, with $30 million. "It's payback time," he said. Samueli holds patents for DSP-based receiver architectures for a number of digital communications transceivers, including ones for cable television, satellite television, Ethernet, and high-bit-rate digital subscriber line services. Broadcom's new family of fiber-optics-related products will be introduced over the next year through a new division of Broadcom, the company's seventh. The company has made millionaires of hundreds of employees with surging stock price over the past two years.*

and I was working on high speed military communications systems. Same type of technology we are developing today at Broadcom, but for commercial and consumer applications. Ten to 20 years ago, it was a military-exclusive application. Henry Nicholas was in the chip design group, developing chips for communications satellites and so forth. So that's what started the whole thing. And when I moved to UCLA, Nick joined me. We took a lot of that core understanding and figured out how we could apply it to the R&D program at UCLA to further advance it. When we founded Broadcom we brought in people from the defense infrastructure to get the more experienced talent plus the fresh talent out of the university. It became an ideal combination of people to move the vision forward.

"The Samuelis' gift is particularly notable because it comes from someone whose involvement with UC began as a student, continued as a faculty member, and has developed even further as a business leader."
–Ralph J. Cicerone
Chancellor, UC Irvine

What does it sound like, to hear "The Henry Samueli School of Engineering"?

It's great. Especially for UCLA, where I've spent probably two-thirds of my life. I started in 1971 as an undergraduate, got my Ph.D. in 1980, and started teaching part-time in '82—and have been on the faculty ever since. To have the school named after me is an unbelievable dream come true — actually it's not even a dream. I would have never dreamt that because it's ridiculous, not even a fantasy. Quite frankly, the idea never crossed my mind. It has real meaning because I'm an engineer, so naming the schools after me and my accomplishments is a tremendous honor. I'm very grateful to the



University of California for that, and thrilled that I'm in a position to make that kind of donation.

Miracles do happen...

What's happened to me really is a miracle, a fairy tale. I'm not saying that I don't deserve the success. It's been a lot of incredibly hard work. I wasn't born with a silver spoon in my mouth. I started with nothing. What I'm most excited about is that I can start giving back at a younger age. It's a real joy in life to be begin to do that and see the impact. I can start philanthropy now, at age 45 instead of at 70.

Creating a flow of talent in the educational pipeline is something you have a personal commitment to. How do you view the level of support in California and the nation?

We're now starting to see the commitment, not only from entrepreneurs—and entrepreneurs are very committed because of the future of their entire industry. We're also seeing politicians become serious and committed to education and that's something we haven't seen for a long time. Unfortunately it will probably take a decade for that to have an impact. Nothing happens overnight. You can throw billions of dollars at it, but it takes a generation to retrain. I think the current state of our [K-12] system is abysmal. Our higher education in this country is second to none in the world. While there is always room for improvement, there's no crisis in higher education. There is, however, a crisis in K-12 education. It's going to take a long time to fix, but at least now we have the mind share of the political leadership. We obviously have the support of the national technology industry. In fact, I was at a dinner for a group called Tech Net, starting up in Silicon Valley. It's a group of high tech leaders, mostly CEOs who band together to promote the issues of the technology industry to the political infrastructure. It turns out, this year, the number one issue on their agenda is education. And that's very important because now you're seeing the technology community saying, 'number one on my list is education.' You're going to start seeing substantial money flow from both the private sector, from philanthropy, through company donations and through government programs.

Will you describe a new recruit, a new hire from UC Irvine?

Bottom line is we want somebody who has fundamental sound training in the field we're interested in: circuit design, communications, digital signal processing, computer technology, information technology—a solid foundation there. We don't expect someone coming out of the university to be fully up to speed and ready to be an instant contributor, because there's a lot of practical training that has to occur. We're expecting people to come in green, so to speak, but as long as the raw talent is there—a highly intelligent individual who has good fundamental skills—then you train them on more specific detail areas. Now at the graduate level, ideally, students get a lot more practical training through research. There's where we want to collaborate with faculty on specific research programs. For masters and Ph.D. students you want a more targeted focus, then they can continue on that same path.

"You are 100% responsible for what happens to you. No excuses."
—Broadcom

Is there an aspect of the curriculum that you would like to see bolstered and enriched?

UC Irvine needs to enhance the number of faculty in these areas. The school is planning on growing substantially over the next several years, so they need to bring in faculty interested in the areas I just mentioned, as well as some of the other areas not directly relevant to Broadcom. It hinges on recruiting faculty. That's the bottom line. They create the courses, they create the graduate programs. Some of the chairs established by this gift will be invaluable because you can then recruit star talent to UC Irvine and create a new program in these areas. That is what will benefit students long-term.

What are your thoughts on the integration of technology in daily life?

The thing that's astounded me the most is the dramatic change in the standard of living. Previously, it was only the elite who were exposed to technology and computers. It has now moved down so that everybody in society has access to technology and most are using computers and technology. That's what I have observed over the last few years: the ability in society to push down the leverage of technology to benefit more and more people. The single benefit over the last decade and in my career is the widespread use and technology of computers. We're helping to enable that.

You have said that those who are afraid of technology will not be successful. Where do you see the greatest impact of technology over the next ten years?

I think it ties into the last question. When you start making the use and infrastructure of computing pervasive, where you can gain access to whatever information you want by going to a screen somewhere and punching in something and boom, whatever you want is there. That is going to have enormous impact on, not just technology, but every field: the life sciences, health sciences, social sciences—because we're making information a commodity.

Samueli continues on page 35

UCSB/South Coast Community Teaching Fellowship Builds Alliances

By Xochitl Castañeda and Bill Theiman

University of California, Santa Barbara's Community Teaching Fellowship in Mathematics and Science (CTFMS) program received funds from the University of California to expand a campus-based program into a multi-institutional alliance. With roots in the '60s, the Community Teaching Fellowship program has grown from a small group of six or seven in mathematics to one with 60 participants and expansion to the sciences. Undergraduates are placed in high schools and middle schools in Ventura and Santa Barbara counties across 180 miles from south to north. Mathematics Professor Kenneth Millett, CAMP Regional Director, has led the unprecedented growth.

UC Santa Barbara has joined with Santa Barbara City College (a partner in earlier efforts), Westmont College, Allan Hancock College, Ventura College and Oxnard College to create a South Coast regional consortium of locally based programs. Faculty and administrators at these institutions have collaborated on a new and broader program.

The principal goals of CTFMS are to attract highly qualified mathematics and science students to teaching careers through direct classroom experience under the supervision of master teachers; to create effective ambassadors of higher education to the diverse student groups in our schools; and to create stronger professional relationships among college mathematics and science faculty members, secondary teachers, and students at all the participating institutions.

Top students are encouraged to consider teaching careers in an effort to help meet California's need for qualified math and science teachers. The state continues to face a serious shortage of teachers in these subjects. The fellows gain practical experience by presenting lessons in the classroom. They learn hands-on what it means to manage a classroom with its many demands and dimensions. Many have exciting research experiences to share, such as the Antarctica adventures of Diane Poehls. Students are exposed to the options available to them in college and they are able to identify with the fellows who are not much older than themselves, many of whom come from similar circumstances.

Information sharing is another benefit. The latest research is regularly discussed in the CTFMS Fellow Seminars that bring fellows, professors and teachers together for discipline dialogues. Effective strategies for teaching across the grade levels is one of the more frequent topics of discussion.

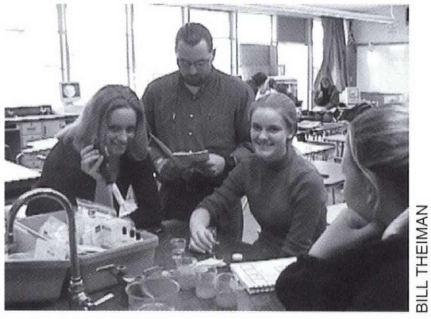
At the schools, teachers are given the much-needed assistance in their work to make their students successful. Many of the fellows have special knowledge and skills in technology or in the laboratory that bring new ideas into the classroom. In many cases the fellows are bilingual; they provide a critical bridge to learning for many second language learners and their parents.

Community college students are given a rich preview of University life. They have the opportunity to work with faculty who assist them in transferring to the University of California. The experience across the full range of institutions enriches all participants.

While most of the fellows will become secondary teachers, a few will select other career paths for which this experience has special importance. For example, some are doctoral students at leading research universities working in laboratories and classrooms and sharing what they have learned. The sharing across the full range of grade levels has become one of the most exciting dimensions of the experience. We're looking forward to next year!

—Xochitl Castañeda is the UCSB CAMP Coordinator. Bill Theiman is Professor and Chair, Biology, and Biotechnology Programs Director, and the Principal Investigator for the Technology Preparation, FSS Articulation Project, Ventura College.

PHOTOS BY CARLOS AVILA



BILL THEIMAN

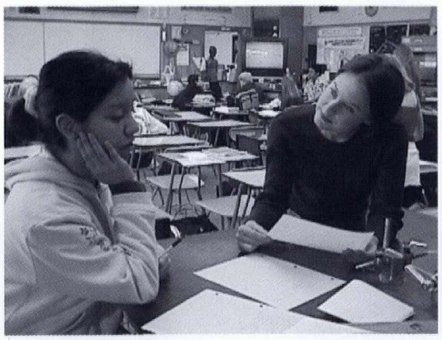
PRIGNA MOSES KANHUKAMWE is a sophomore at Santa Barbara City College, an established partner in student and teacher development efforts. Kanhukamwe is one six students engaged in the fellowship program from Santa Barbara City College. She hopes to "make a difference in people's attitude toward math," fostering new ways to look at the subject. "When I was younger," she says, "I always wondered why others could not understand math." Now she is doing something about it. Of the students she has tutored, she has managed not only to encourage appreciation and a positive attitude about the subject, but to help them build strategies to study effectively. The Teaching Fellows Program has afforded an opportunity for her to share her own abilities and cultivate a difference in perceptions about mathematics. Katherine Raschka served as teacher mentor.

"Being a teaching intern is challenging, and I definitely enjoy it."

—Prigna Kanhukamwe

Will Smith, a Ventura College student teacher/intern under teacher Richard Smith at Buena High School, wrote:

"When I arrived, the class was about half way through their science fair projects. One group in particular decided to run a salinity test from soil taken from Anancapa Island. The instructor had never used the test kit before so I volunteered to assist the group with their test. In retrospect this may not have been such a wise course of action on my behalf, having never seen the kit myself. We set up a time to run the experiment. The first run did not go quite as planned, due to a small oversight on my part. We rechecked the instruction book, found the error and proceeded with the experiment. The rest went off without a hitch."



BILL THEIMAN

Jennifer Stellar, a Ventura College student teacher/intern under teacher Richard Smith at Buena High School, responds:

"In my first few days I was assigned students who were doing well on their homework but having trouble with tests. I asked them to read the book section headings and formulate some questions they would like to have answered. Then they were to read the chapter for the solutions. If they had any trouble they were to write the problem and see me in class."

In the photo above, Jennifer is helping a student who was studying viruses and couldn't find an answer to one of her questions. Later, I asked her to tell me what she knew without looking at her notes. She showed an understanding of the material that she was having trouble with only the night before.

Our three interns worked at Buena High School and Ventura High in mathematics, chemistry and biology. In biology, the intern discovered that the teacher was working without microscopes. He brought in high power lenses for them to use. In chemistry, the intern borrowed slide materials we had in the biology department at the college, enriching the presentation. In math, the intern assisted students who had difficulty passing tests and helped them learn test-taking techniques. The faculty at the college are assisting in every way. We are so excited about the new training that I am submitting for three grants (one with UCSB) to expand this opportunity to as many students as we can.

"Teach ... it's what I want to do."

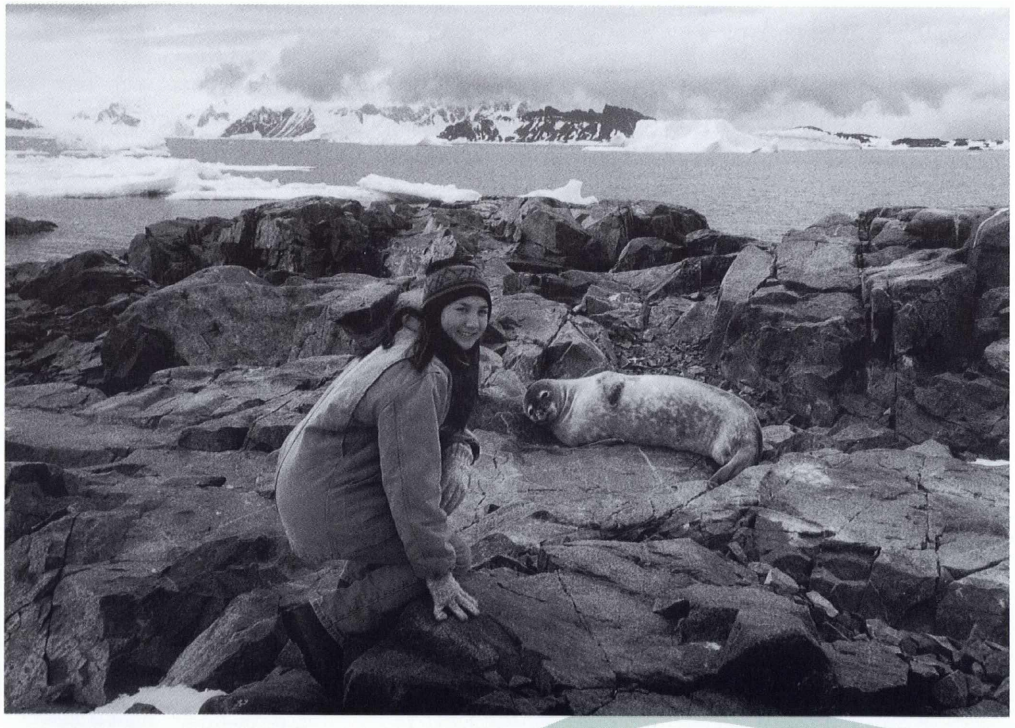
—Hazby Galindo,
UC Santa Barbara, Class of 2000

HAZBY GALINDO, UCSB graduating senior, math and aquatic biology. His fellowship is at Santa Barbara High School. Galindo says, "By being an EOP peer advisor and tutor, I've come to enjoy interacting with young adults, and I have decided that I want to teach at the high school and community college level." In the classroom he strives to build conceptual understanding within students and confidence in the subject matter. "I want to give confidence to students who are still in high school." Galindo's teacher mentor encouraged him to make lesson plans and lecture in front of the class. Later, he would share Galindo's strengths and weaknesses. The feedback proved very helpful. He says, "This has helped me to be a better teacher. I feel I can be a good role model, and I know that I care about these kids." Kelly Baeza served as teacher mentor. Galindo's fellowship was supported by CAMP.

"I am submitting for three grants (one with UCSB) to expand this opportunity to as many students as we can."

—Bill Thieman, Chair, Biology Department, Ventura College

DIANE POEHLS, UCSB junior, plans to pursue research in graduate school in aquatic biology. Poehls traveled to Antarctica to pursue her interest in marine life, and has completed a research internship on nutrient effects on phytoplankton physiology at Woods Hole Oceanographic Institute. She tutors high school math students, using model planes and backyard swings as tools for applied math. Poehls says, "I have tutored students since my freshman year of high school." She was a junior high counselor at Culver Palms Family YMCA in Los Angeles, which draws a wide range of socio-economic and ethnic backgrounds, from movie actors' children to those living in poverty. "The children had a lot to learn from each other," she says, and uses that experience in her teaching fellowship. Poehls also volunteers at the Sea Center. "Science and children are my two main joys in life." Her fellowship is supported by CTFMS, Office of the President, University of California. Irene Kasai is her teacher mentor. Poehls has won the prestigious Goldwater Scholarship. She has recently written for the Honors Program newsletter on her expedition to Antarctica and her research at Woods Hole. "Random skills like glass blowing and wood working came in handy," she said.



"I want to help people learn the science and math that I have come to love."

—Diane Poehls

UCSB Teaching Fellows supported by CAMP

Jenny Alvarez, senior
Maria G. Hernandez, senior
Javier Ledesma, sophomore
Christina Riad, junior
Claudia Vargas, junior

BILL THEIMAN

Robert Krizan, a student teacher/ intern under teacher Dean Wood at Buena High School, wrote:

"After receiving known masses of silver nitrate and copper metal, students washed the precipitate and prepared it for determining mass. They first tested with ammonia to ensure that all the copper had reacted and they determined the mass of the precipitate. It is a simple procedure, but the students wanted to measure twice to be certain."

mental biology; **Courtney Sams**, general chemistry; **Mauricio Vargas**, cybernetics and neuroscience (MD/Ph.D. program, Fall 2000).

UC SANTA CRUZ

Kendall Boutte, information systems management; **William Casher**, biochemistry and molecular biology; **Sarah Cordova**, biology; **Naomi Cotton**, biochemistry and molecular biology (graduate school, biochemistry, University of Washington, Fall 2000); **Julio Escobar**, biology; **Diana Gomez**, mathematics, (graduate school, mathematics, UC Santa Cruz, Fall 2000); **Jose Heredia**, biology; **Renee Manrique-Stromberg**, biology; **Melissa Mark**, psychobiology; **Chadonna McClain**, biology; **Carina Peritore**, chemistry; **Joel Ramirez**, biology; **Ruddy Rivera**, biology; **Gloria Rodriguez**, chemistry, recipient of the Talamantes Science Prize, (graduate school, UCLA, physical chemistry, Fall 2000); **Karina Rodriguez**, chemistry; **Maria Concepcion Rolon**, mathematics; **Erik Samayoa**, biology; and **Zoreisha Wesley**, biology.

UC SAN DIEGO

Franzwa Achie, pharmacological chemistry; **Carmen Carrillo**, animal physiology & neuroscience; **Anna Cervantes**, biology; **Agustin Diaz**, chemistry; **Alejandro Diaz-Lamas**, animal physiology & neuroscience; **Nuvia Guerra**, biochemsitry/cell biology; **Melissa Heagerty**, biochemsitry; **Lazaro Herrera Ayala**, mechanical engineering; **Esmeralda Iniguez**; animal physiology & neuroscience; **Romina Lopez**, environmental chemistry; **Berta Lyles**, biochemsitry & cell biology; **Tanya Mercado**, biochemistry & cell biology; **Abdi-Rizak Mohamed**, biochemsitry/chemistry; **Jean Mugo**, biology; **Babatunde Ogundipe**, chemistry; **Rogelio Oseguera**, microbiology/sociology; **Jose Otero**, physics; **Michael Palmer**, biochemistry; **Luis Rodriguez**, mechanical engineering; **Salvador Santoyo**, engineering physics; **Ron Smith**, molecular biology; **Gerald Tolbert**, biology/biochemistry; **Emilio Torres**, biophysics; **Veronica Vargas**, animal physiology & neuroscience; and **Christine Wesley-Willis**, biochemistry/biology.

UC BERKELEY

Roberto Barrueto-Cabello, physics; **Tatiana Becker**, mathematics and astronomy; **Skip Bettencourt**, physics; **Cheryl Cox**, physical sciences; **Adam Edwards**, engineering physics (Study Abroad Fellowship, 2000-01, England); **Eric Jones**, physics; **Gabe Lucero**, physics; **Sarah McClure**, astronomy (pursuing elementary school teaching credential); **Mario Perez**, engineering physics; **Marco Prado**, physical sciences; **Lorraine Sadler**, engineering and physics (graduate school, high-energy particle physics, University of Chicago or Harvard, Fall 2000); **Christopher Snead**, physics; **Joshua Volz**, physical sciences; **Elizabeth Wilcut**, physics, outstanding achievement CAMP 2000 Undergraduate Research Symposium; and **Mike Wong**, physics.

UC DAVIS

Cesar Acosta, biochemistry (Winter 2000); **Kelly Bollinger**, genetics; **Evelyn Cairo**, mathematics (Winter 2000); **Jaime Correa**, chemical engineering; **Andres Espinosa**, civil engineering (graduate school, civil engineering, UC Berkeley, Cornell, or Stanford, Fall 2000); **Samuel Ethiopia**, chemical engineering; **Javier Garay**, mechanical/materials science engineering (Fall 1999); **Benjamin Garcia**, chemistry; **Cathrine Gumbo**, neurobiology/physiology/behavior; **Kofi Inkabi**, civil engineering (Fall 1999); **Kenneth Johnson**, biotechnology; **Timothy McIntosh**, physics (Winter 2000); **Evelyn Rivera**; **Aquil Salahudeen**, electrical engineering; **Cinthya Miranda**, mathematics; **Armando Soto**, mathematics (Winter 2000); and **Nikisha Young**, food science.

UC SANTA BARBARA

Carla E. Billings, biology (Fall 1999); **Laura O. Bolanos**, electrical engineering; **Sonia L. Campos**, biopsychology; **Tavara N. Culpepper**, biopsychology; **Robert N. Daniel**, biopsychology; **Rosemary R. Flamenco**, biological sciences; **Claudia Gallegos**, pharmacology; **Duran Garcia**, chemistry; **Hector M. Garcia**, mechanical engineering; **Edwin D. Guerra**, mechanical engineering; **Jose A. Guevarra**, physiology; **Maria G. Hernandez**, biopsychology; **Lockell T. Keeling**, electrical engineering; **Christina Luna**, mechanical engineering; **Fabian I. Luna**, biological sciences; **Carlos A. Martinez**, microbiology; **Cesar Mora**, mechanical engineering; **Pascualita Morales**, environmental studies; **Carmen M. Nieto**, biological sciences; **Gelasio Ramirez**, mechanical engineering; **Veronica Reyes**, chemistry, outstanding achievement CAMP 2000 Undergraduate Research Symposium; **Andres Jose Salazar**, cell and developmental biology; **Adam Sanjurjo***, mathematics; **Edgar L. Torres**, mechanical engineering; and **Sandro Trujillo**, mathematics.

**Adam Sanjurjo will give the student commencement address. He says, "I can't think of a better way to end my career at UCSB, say goodbye to all my friends, and try to touch those whom I still have not met." Sanjurjo is in the UC/DC program and has served as a Summer Institute in Math and Science peer advisor.*

—Graduating senior information provided by the respective CAMP regional offices.

Introducing New Advisory Board Members

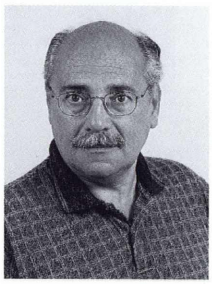
The CAMP Statewide Advisory Board welcomed two new members at its annual meeting held at the Arnold and Mabel Beckman Center of the National Academies of Sciences and Engineering: Michael Sampogna, Director of Graduate Student Relations for IBM Research, and Kenneth Washington, Director of Distributed Information Systems, Sandia National Laboratories. Of note, three advisory board members participated in SYMPOSIUM 2000 at UC San Diego: Sampogna, Professor Elma Gonzalez of UCLA, and Frank Robles of Lawrence Livermore National Laboratories.

Michael Sampogna

Director, Graduate Student Relations
IBM Research, San Jose, CA

Education: B.S. Physics,
City University of New York; M.S. Physics, Vassar College; M.S. Management of Technology, Polytechnic University

Professional Background:
IBM research engineer for 22 years; IBM Research manager of Ph.D. recruiting for seven years, and director of graduate student relations.



Area of Expertise: Diversity initiatives in recruiting, mentoring, and advising graduate students in science and engineering career paths. Managing technology, achieving a successful membership in academic consortia, and building and maintaining university relations programs.

Vision: Three major issues face the United States and its ability to remain competitive: 1) Business leaders identify the education of American workers as the priority concern. Demands for workers in the information technology arena show no sign of lessening and indeed have expanded into traditionally nonscientific/engineering positions. 2) Demographics show that the population of minorities and women in the workforce will increase through the year 2010 and beyond. We need to see that these new proportions are reflected in the number of college graduates, especially in science and engineering. 3) The problem of labor supply goes beyond the ability of individual organizations to effect change within reasonable time. These issues require enhanced partnerships among the private sector, government, and academia.

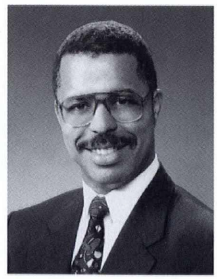
Kenneth Washington

Director, Distributed Information Systems
Sandia National Laboratories

Education: Ph.D., Nuclear Engineering, Texas A&M University

Professional Background: Director of Sandia's Distributed Information Systems Center in Livermore California. Previously managed Sandia's Information Systems Application department in Albuquerque. Over fifteen years, has held several technical, management, and program leadership positions in the computer modeling and information systems areas. Member of IEEE.

Area of Expertise: Computer modeling of complex physical phenomena as applied to national security and nuclear safety problems, and the development of decision support systems for government customers and industry partners. Currently responsible for leading the computing center at Sandia's California site, which includes a broad information science and technology research and development portfolio.



Vision: CAMP expands Sandia's opportunity to champion access and equity in science and engineering pathways for underrepresented students. Together with Sandia's diversity initiative and the Sandia African American Outreach Committee, engagement in CAMP will enhance our efforts to attract undergraduates to research careers and prepare them for the technological workplace. The talent we seek must fully represent California so that our scientific staff reflects the diverse backgrounds of all our citizens.

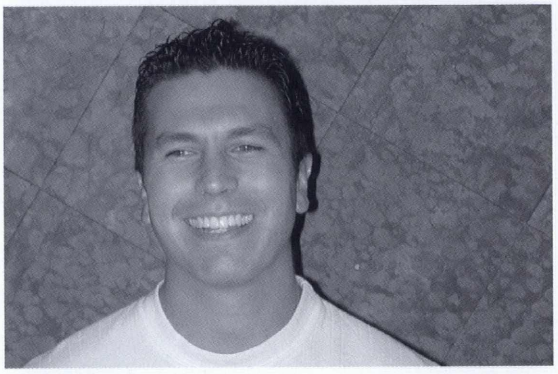
CAMP Advisory Board Members: Dr. Francisco J. Ayala, UC Irvine; Richard Colliver, American Honda Motor Co., Inc.; Dr. Dennis Galligani, UC Office of the President; Dr. Susan Hackwood, UC Riverside; Dr. Kenneth Washington, Sandia National Laboratories; Darrell Lynn, Toshiba America Electronic Components, Inc.; Gus Guichard, California Community Colleges; Alfred Paiz, Jet Propulsion Laboratory; Abad Sandoval, Los Alamos National Laboratory; Frank Robles, Lawrence Livermore National Laboratory; Dr. Elma Gonzalez, UCLA; Dr. Martha Mecartney, UC Irvine; Michael Sampogna, IBM.

CEA-CREST ("Sea-Crest"): FOCUSED, INTERDISCIPLINARY RESEARCH FOR CAMP ALUM

One of the opportunities CAMP students have for developing research experience is through CEA-CREST at California State University, Los Angeles. Directed by Dr. Carlos Robles and supported by the National Science Foundation, the program offers a pathway to careers in the environmental sciences.

Dominic G. Valdez, University of California, Irvine alumnus, participated in CAMP as an undergraduate. After completing his B.S. degree he wanted more laboratory experience to build his credentials. Valdez grabbed the chance to enter CEA-CREST—Center for Environmental Analysis, Centers of Research Excellence in Science and Technology.

Recently, he won a graduate fellowship from the Smithsonian Tropical Research Institute to conduct research on tropical marine organisms in the Caribbean. He will present the work for his master's thesis.



Q&A With Dominic Valdez

How did you hear about CEA-CREST and what enticed you to consider it?

Through CAMP Coordinator Kika Friend. Even after I had been away from UCI for two years, she tracked me down. I was impressed by the CEA-CREST program for their excellent interdisciplinary research in the environmental sciences, the state of the art technology, financial support and the interest their faculty conveyed to prospective students.

What is your area of interest?

My particular interest is in molecular ecology and biogeography, and I'm working with an expert in the field who encourages us to tackle both basic and applied research problems.

Who is your mentor?

Dr. Elizabeth Torres, Assistant Professor of Biology and Microbiology. She uses molecular genetics to trace evolutionary relationships among marine invertebrates.

Please describe your research.

We are working on the ecology and molecular systematics of the cypridinid ostracode, *Skogsbergia lerneri.* Ostracodes are aquatic crustaceans that are fully enclosed in a calcified bivalve carapace. The *S. lerneri* species is located throughout the Caribbean and is currently recognized as single species. Phylogenetic analysis of nucleotide sequences from the 16srRNA and cytochrome oxidase I regions of the mitochondrial genome are used to determine the extent of sequence divergence among individuals from different coral reef habitats.

What are the expectations?

CEA-CREST challenges students to excel academically and produce exceptional scientific research. Dr. Torres is extremely knowledgeable in the field of molecular genetics and systematics. She is incessantly supportive of her graduate students and is dedicated to developing our knowledge in all areas of molecular ecology.

What new lab techniques have you most appreciated this past semester?

In our laboratory, I have mastered a range of molecular techniques including DNA extraction, PCR and automated sequencing. I am currently learning how to perform phylogenetic analysis on my sequence data. Over the next few months I will be learning how to collect and identify cypridinid ostra-code crustaceans on the Channel Islands in Southern California.

After completing your master's, what lies ahead for you?

I am planning to continue my education by pursuing a doctoral degree in the areas of molecular and conservation ecology with a focus in population genetics.

For more information on CEA-CREST, visit http://cea-crest.calstatela.edu

Building

Dominic Gabriel Valdez

EDUCATION

M.S. Biology. California State University, Los Angeles (expected 2001)
Thesis: Genetic sequence divergence and morphological differentiation of the cypridinid ostracode crustacean, *Skogsbergia lerneri*, throughout the Caribbean.
B.S. Applied Ecology, 1997, University of California, Irvine

GOAL

Ph.D.

FELLOWSHIPS

National Science Foundation Centers of Research Excellence in Science and Technology (CREST)
California State University, Los Angeles
Fall 1999-Spring 2001

Summer Research
Summer 1999

CEA-CREST
California State University, Los Angeles
Learned molecular lab techniques: DNA extraction, PCR, DNA sequencing.

Minority International Research Training (MIRT)
Patagonia, Argentina
Fellowship Recipient
August 1997-December 1997
Conducted conservation and behavioral research on the Andean condor Vultur gryphus. Assisted in a population survey of southern elephant seals Mirounga leonine, off the coast of Peninsula Valdes.
Mentor: Dr. Leo Ortiz, University of California, Santa Cruz

National Institute of Health (MIRT)
Amazon Rainforest, Venezuela
Fellowship Recipient
June 1997-August 1996
Investigated medicinal compounds found in tropical flora for the potential use in the medical/ pharmaceutical fields.
Mentor: Dr. Eloy Rodriguez, Cornell University, Department of Biological Sciences

RESEARCH EXPERIENCE

University of California, Irvine
Irvine, California
Research Assistant
September-December 1997
Researched freshwater biology and wetland ecology; observed the effects of organic and inorganic pollutants on lotic and lentic freshwater systems.
Mentor: Dr. Peter Bowler, Department of Ecology and Evolutionary Biology

University of California, Irvine
Irvine, California
Independent study
January 1996
Independent study, "BOD Effects Upon Macroinvertebrate Diversity of Two Streams, San Juan Creek and Big Canyon Wash"
Mentor: Dr. Sharon Stern, Department of Environmental Analysis and Design

TEACHING EXPERIENCE

California State University, Los Angeles
Los Angeles, California
Graduate Teaching Assistant
Fall 1999-present
Instructor for Animal Biology Laboratory (Bio 155)

Cathedral High School
Los Angeles, California
Teaching Assistant
June 1993-August 1993
Taught summer high school students math and biology.

CONFERENCE PRESENTATIONS

Society for the Advancement of Chicanos and Native Americans in Science
Portland, Oregon
October 1999
Poster titled "Genetic sequence divergence of the cypridinid ostracode crustacean, Skogsbergia lerneri, from three distinct habitats within Discovery Bay."

Society for the Advancement of Chicanos and Native Americans in Science
Los Angeles, California
October 1996
Poster titled "Tannin degradation by microbial symbionts within the crop of the Hoatzin Opisthocomus hoazin."

PROFESSIONAL EXPERIENCE

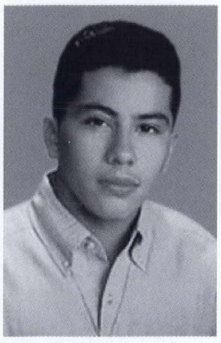
RHL Design Group, Inc.
Santa Ana, California
Job Captain
June 1998-May 1999
Contracted by major oil companies to upgrade underground storage tanks to comply with the Environmental Protection Agencies regulations.

Defend The Bay
Newport Beach, California
Researcher/Technical
January 1998-June 1998
A non-profit organization striving to keep treated sewage out of the Newport Back Bay Estuary. Researched surveys pertaining to the water quality of Newport Back Bay.

Buenos Aires Zoo
Buenos Aires, Argentina
Wildlife Management
August 1997-December 1997
Nurtured captive juvenile condors for future release into the wild.

a resume for the future

People ask me "why do you like physics so much?" I tell them, "because it's fun." Then I begin



to give them examples of everyday activities that involve physics. Being a gymnast, I can easily do a cross in the still rings because I am short, light, and have compact arms, therefore reducing the torque that my body weight exerts on my pectoral muscles. Secondly, the application of physics to gymnastics was essential for me to perform giants on the high bar, front summersaults, and more. But, the real joy of physics for me is to write about nature's most intimate secrets so that others can use this knowledge to better their lives. One small example is how I used Newton's equations and vector analysis to show my father how we could replace the clutch in his truck using minimum effort. We saved energy, time and money. Ultimately, I plan both to teach and do research.

STEP IN THE RIGHT DIRECTION:

SCIENCE AND TECHNOLOGY EDUCATION PROGRAM LAWRENCE LIVERMORE NATIONAL LABORATORY

BY MIGUEL A. GARCIA
UC Davis Graduate

Mid-January is traditionally the time for undergraduates to apply for summer programs. Seniors may well consider an intermediate step between undergraduate and graduate school. As a senior, I found that a structured research internship perfectly filled the bill.

Last year, UC Davis Professor Rodney Cole from the Minority Undergraduate Research Participation in the Physical and Mathematical Sciences (MURPPS) Program organized a trip to the Lawrence Livermore National Laboratory (LLNL). Here, Dr. Don Correll and Barry Goldman presented the various programs within STEP—the Science and Technology Education Program. This is how I learned about the Undergraduate Research Semester (URS) sponsored by the Department of Energy Defense Programs.

I completed a B.S. in physics in June 1999 and began working in July as a research intern with support from LLNL's diversity program.

The URS (see Spring 1999 *CAMP Quarterly*) has allowed me to conduct leading-edge research. More importantly, this type of interaction with scientists, which is not always

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NOVEL DIODE-PUMPED SOLID STATE HIGH AVERAGE POWER LASER DESIGN*

ABSTRACT: A proprietary laser design uses diode pump-light introduced at the edges of the device. Using ray trace models, we optimized the optical geometry and dimensions of the device to produce the highest efficiency and power output.

INTRODUCTION: A lens-duct concentrates the light of a diode laser array and conditions it to enter the edge of the composite solid. The diode pump light efficiently absorbed using the proprietary design.

METHODOLOGY: Trace Pro-Modeling. We measured the divergence of the diode array and used it in the code for our calculations. The geometry was optimized for efficient absorption. The source distribution was mapped.

DISCUSSION: Our results predicted a very efficient laser of high output power. Experiments are presently ongoing with the first generation prototype. There is a trade off to be made between pumping efficiency and pumping homogeneity. Ongoing experiments address this issue.

* UCRL ID-137915

available, complements my undergraduate education.

Research at LLNL was the primary focus. Under the supervision of my technical mentor, Luis Zapata, Ph.D., I used ray-trace models to investigate the optical geometry and optimized dimensions of a novel laser design that uses diode-pump light introduced at the edges. Our goal was to balance the laser design's efficiency and pump uniformity. Our design yielded an optimized source distribution for a 6-mm-aperture lasing crystal. Experimental results were in agreement with the predictions of the computer model.

At Lawrence Livermore Lab, students from most scientific fields learn important skills and training unique to the Laboratory. I strongly agree with Dr. Howard Powell, program leader of the Laser Science and Technology Program, who says, "there is no substitute for technical excellence." Certainly, a strong academic background helps students "see connections" in the world of science—connections that can transform personal goals.

I have found that my many long nights toiling through physics problems in school earned me the technical knowledge required to operate the various lab instruments used in my experiments. For example, the theories and equations that I learned in my optics class have been an integral part of my laser design. In addition, I must fully grasp the methods and equations used by the software code that I run to model the laser system.

I made research a major part of my undergraduate career and presented the results at various national and international conferences. This experience helped me realize how much I like research, particularly physics.

My ultimate goal upon entering graduate school is to obtain a Ph.D., which will allow me eventually to head a research group in industry or in academia. Up to this point in my academic career, I have yet to explore all areas of physics. So far, quantum optics and condensed-matter physics seem to be interesting fields with many opportunities.

I would like to encourage all my fellow students to participate in research programs and academic events. Engage yourself in a field that really excites you, because your work can last beyond your lifetime. The abundance of research opportunities gives students ample opportunity to explore their potential as professional scientists.

MIGUEL A. GARCIA

PUBLICATIONS

R. Cole, M. Garcia, S. Tooker, *"Web-Based Tutorials for Physics Education, Computer Applications in Engineering Education,"* Wiley, expected publication Spring 2000.

R. Cid, M. Garcia, *"Teaching Science and Engineering to Latino Students,"* Journal of Woman and Minorities in Science and Engineering, expected publication Spring 2000.

Cole, R.W., Tooker, S.C., Garcia, M.A., *"Web Based Lessons, Changing the Face of Electromagnetics Education,"* Progress in Electromagnetic Research 98, Nantes, France, Proceedings, 1998.

F.E. Fernandez, M. Garcia, A. Martinez, V. Pantojas, M. Pumarol, *"Structure and Properties of III-N Semiconductor Thin Films Grown at Low Temperatures by N-Radical-Assisted Pulsed Laser Deposition,"* MRS Symposium Proceedings, Nitride Semiconductors, vol. 482, 1997.

TECHNICAL TALKS

1999

"Novel Diode-Pumped Solid State High Average Power Laser Design," URS Symposium, Livermore, CA.

"Using JAVA to Teach Elementary Electromagnetism via Internet," CAMP Conference; Los Angeles, CA.

1998

"Optical and Crystal Characterization of AlN Thin Films grown by N-Radical-Assisted Pulsed Laser Deposition," National Conference on Undergraduate Research, Rochester, NY.

"Characterization of Aluminum Nitride Thin Films Grown at Low Temperatures by N-Radical Assisted Pulsed Laser Deposition," National Technical Career Conference, Orlando, FL.

"Using JAVA to Teach Elementary Electromagnetism via Internet," Undergraduate Research Conference, UC Davis.

1997

"Solitons in One-Dimension: Linearity vs Nonlinearity," Austin, TX, National Conference on Undergraduate Research; National Technical Career Conference, Philadelphia, PA.

"Ellipsometric Analysis of AlN Thin Films Grown by Pulsed Laser Deposition," Mexican-American Engineers Society, San Diego, CA.

"Surfing the World Wide Web for Physics," Undergraduate Research Conference, UC Davis.

1996

"Solitons in One-Dimension: Linearity vs Nonlinearity," Undergraduate Research Conference, UC Davis; National Conference, Louis Stokes Alliance for Minority Participation (LSAMP), Tallahasse, FL.

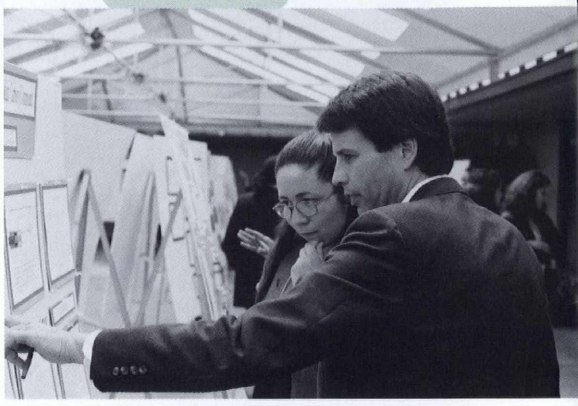
1995

"Solitons in One-Dimension: Linearity vs Nonlinearity," MURPPS, UC Davis Summer Institute.

For Information on MURPPS, see [http://maxwell.ucdavis.edu/~murpps/]

CAMP 2000 Statewide Undergraduate Research Symposium continues from page 15

"The students and professors made the trip a fulfilling and outstanding learning experience."
—Tino Wilson Sanchez, UC Davis



"Is undergraduate research important for the development of future scientists? Yes! It's not only important, it's essential. The time spent conducting research presents us with needed experience; it introduces us to scientists in our field of interest and to future colleagues. In short, it gives the opportunity to be introduced to the demands of laboratory research and a glimpse of the expectations of graduate school. Undergraduate research is the best avenue to initiate us into the scientific community."
—Maricela Covarrubias,
UC Riverside

"The evening at the Aquarium was beautiful."
—Nuvia Guerra, UC San Diego

"I learned something from every talk and presentation."
—Esayas Jirre, UC Santa Barbara

"CAMP has provided me with a multitude of opportunities that I otherwise would not have had access to as an undergraduate."
—Daniel A. Smith,
UC Riverside Graduating Senior

CAMP 2000 STATEWIDE UNDERGRADUATE RESEARCH SYMPOSIUM

CAMP 2000 Statewide Undergraduate Research Symposium Presentations continues from page 15

YIDNEKACHEEW Y. MITIKU
Computer Science, Santa Cruz
Mentor: Charles McDowell, Ph.D.
"Jini and Embedded Systems"

ABDIRIZAK M. MOHAMED
Biochemistry, San Diego
Mentor: Patricia A. Jennings, Ph.D.
"Making and Purification of Interleukin-1β Mutant Proteins"

RIHAM M. MORCOS
Chemical Engineering, Berkeley
Mentor: Clayton J. Radke, Ph.D.
"Protein Adsorption at Fluid/Fluid Interfaces"

CHUDI O. NDUBAKU
Chemistry, Berkeley
Mentor: Paul A. Bartlett, Ph.D.
"Combinatorial Chemistry: A Method for Optimizing the Design of a β-turn mimic"

SHIRLEY M. PAREDES
Mathematics, Santa Barbara
Mentor: Kenneth C. Millett, Ph.D.
"Identifying the Configuration Space of Equilateral Polygons in the Plane"

RAMON R. PINEDA
Chemistry, Berkeley
Mentor: Paul A. Bartlett, Ph.D.
"The Design and Synthesis of Macrocyclic Serine Protease Inhibitors"

LIZA M. REBAZA
Chemistry, Irvine
Mentor: Fillmore Freeman, Ph.D.
"Reaction of Aminomalononitrile (Amnt) and 2,4-Dichlorobenzaldehyde"

VERONICA REYES
Chemistry, Santa Barbara
Mentor: Peter C. Ford, Ph.D.
"Photochemical Studies of a Catalytically Important Rhodium Carbonyl Compound"

KARINA G. RODRIGUEZ
Chemistry, Santa Cruz
Mentor: Pradip K. Mascharak, Ph.D.
"Synthesis of Model Compounds that Resemble the Active Site of Nitrile Hydratase"

ADRIANA RUBALCABA
Mathematics, Riverside
Mentor: Alejandro Uribe, Ph.D.
"Shock Formation in the Toda System"

HELEN R. RUEDAS
Chemistry, Irvine
Mentor: Donald R. Blake, Ph.D.
"Impact of Urban Methane Emissions on Local and Regional Scales"

NOEL F. RUIZ
Information & Computer Science, Irvine
Mentor: Tatsuya Suda, Ph.D.
"The Improved Network Performance Gained by Implementing Bionet"

TINO W. SANCHEZ
Chemistry, Davis
Mentor: Krishnan P. Nambiar, Ph.D.
"Design and Synthesis of β-Ribbon Peptides"

CORINA V. SARMIENTO
Biochemistry, Santa Barbara
Mentor: Rolf E.Christofferson, Ph.D.
"Random Mutagenesis of 1-Aminocyclopropane-1-Carbonoxylic Acid Oxidase (ACCO), A Key Enzyme in the Biosynthesis of the Plant Hormone Ethylene"

ELIZABETH WILCUT
Physics, Berkeley
Mentor: J.C. Seamus Davis
"Heavy Fermion Refrigerator"

OMAR E. ZUNIGA
Mathematics, Riverside
Mentor: John B. Little, Ph.D.
"Conformations of Cyclic Molecules: A Gröbner Basis Approach"

Thank you, UC San Diego!

Samueli

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Traditionally, information has been somewhat difficult to find. You had to go into the libraries, search the card catalog, find a book. It took work. And now there is no difficulty in gaining access to information. You now have a tool to train, to educate, to inform everybody in society. I think that's a good phrase—the commoditization of information.

"Hands-on, interactive experience is essential to motivate kids with real life experiments."

What about privacy issues and ethics of technological access to our private lives?

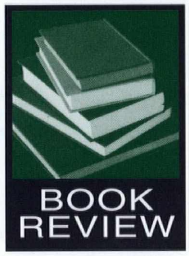
Once you make universal connectivity available, you have the ability now to be monitoring people a lot more than before, so people are going to be worried about their privacy because when they log onto the Internet and go to various sites, people are going to know. There are issues of security and privacy that we don't know yet how to fully deal with, and over the next decade we are going to go through some interesting turbulent times. I don't think we can stop the pervasiveness of networking technology. You can't suppress it and the government shouldn't attempt to regulate it, except to figure out the best way to make it reasonable and not impact our lives too severely.

Your personal motto?

Take control of your life. You are 100% responsible for what happens to you. Don't make up lame excuses as to why you didn't succeed. Take responsibility for your life. No excuses. If you fail, it's your fault.

Book Review continues from page 8

down for four days, crippling global surveillance. Private industry – business – has taken the electronic lead, but even the corporate sector is vulnerable, as witnessed in the recent attack on the Yahoo web site. With the very openness of the technological world of the 21st century, and all of its attendant risks, it is easy to understand the allure of a closed world mentality. It just may be that one of the most dangerous aspects of technology is not the threat of centralized control, but instead the proliferation of difference in an untamable electronic universe, where there is, in fact, no center at all. Who is governing the Internet? More importantly, who *can*?



I have simplified the argument of Edward's book to some degree to emphasize the importance of his work for an increasingly techno-dependent world. For while we remain mesmerized by the possibilities of technology, and while we run faster and faster toward those possibilities, we also remain deeply frightened of our inability to control what we can create. And it is this ambivalence which ultimately characterizes our relationship to technology.

Ambivalence in and of itself is not such a bad thing. In fact, in a world of science fiction movies like "Total Recall", "The Matrix", "Terminator", and "Blade Runner", the ability to hold two juxtaposed thoughts simultaneously in the mind may be the ultimate difference between humans and computers. More importantly, ambivalence often helps us find some kind of middle ground, even if the center of our technological world exists only in the intersections of invisible transmissions. But I do believe that we must remain mindful that at some point, we may shift, ever so subtly, from simply *using* technology to enhance the human experience of our lives, to *being used* by those who create these tools of efficiency and communication.

Without a doubt, we have been fortunate to make the world seem smaller with the assistance of computers. The revolution of email alone has allowed people to feel an immediacy that eclipses the disembodied nature of electronic space. But there is also a darker side to such disembodiment, reflected in popular images of cyborg villains like that of the Terminator and the Borg of "Star Trek" fame. Edwards discusses some of these cultural images at length, focusing on the contrast between the closed world of technology and the "green world" of nature, a space of freedom, transcendence, and humanity. For example, he demonstrates the contrast in the "Star Wars" trilogy between the enclosed militaristic darkness of the Death Star and the mystical world of Yoda in which Luke Skywalker becomes connected to the supernatural force which will allow him to defeat Darth Vader. The implication is clearly that the green world represents Edenic salvation and the cyborg world mechanistic damnation.

Of course, the green world is ultimately as much a fantasy as the cyborg-ruled closed world, as much a projection as the techno-hysteria of films like "Terminator" and "Total Recall". An interesting commentary on this genre of films is the recently produced "Matrix," which poses a much more problematic choice for the human race. In "The Matrix," cyborgs have actually created the "reality" in which humans live, as the physical earth has been destroyed by a nuclear holocaust. In this scenario, humans live in an ultimate closed world, one controlled entirely by technology so convincing, most don't know they are part of the "matrix." The movie's Christ-like hero, Thomas Anderson, is shown the truth in order that he may save mankind from the matrix. What is profoundly disturbing about the film is the fact that the world he is saving people from is materially much better than the world left after the apocalypse, a world in which the small legion of freedom fighters live in a dark space ship, the Nebuchadezzar, where the distinctions between good and evil become blurred. Freedom may be a precious thing, but we must wonder how valuable freedom is in a barren and desecrated world.

Ultimately, "The Matrix" reinforces my own ambivalence about technology. In one sense, I welcome the openings that computers and networks have created, but in another, I worry about the vulnerability we face within such open systems. Without becoming paranoid, we need to pay attention to the origins of computers with the understanding that evolution always brings change and variation. But even though the past does not necessarily determine the future, it does give us cause to be concerned, and to focus that concern on those who ultimately control the technology we use so willingly. We should be active, not passive participants in the further evolution of technology, and remember that technology is only valuable as long as it enhances the human experience. As Paul Edwards demonstrates, using technology does not make us more or less human, but it can open new portals we may or may not wish to enter.

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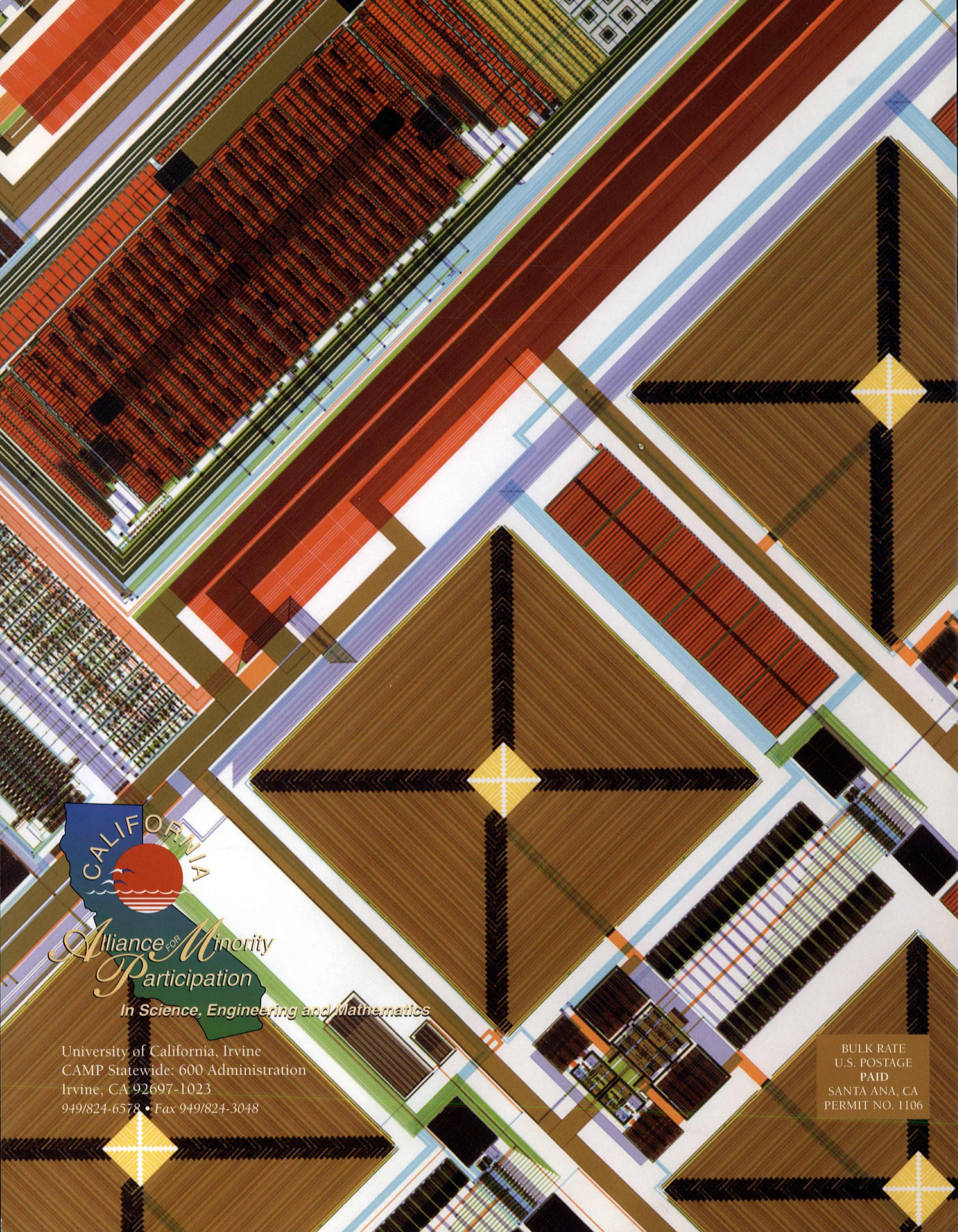

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