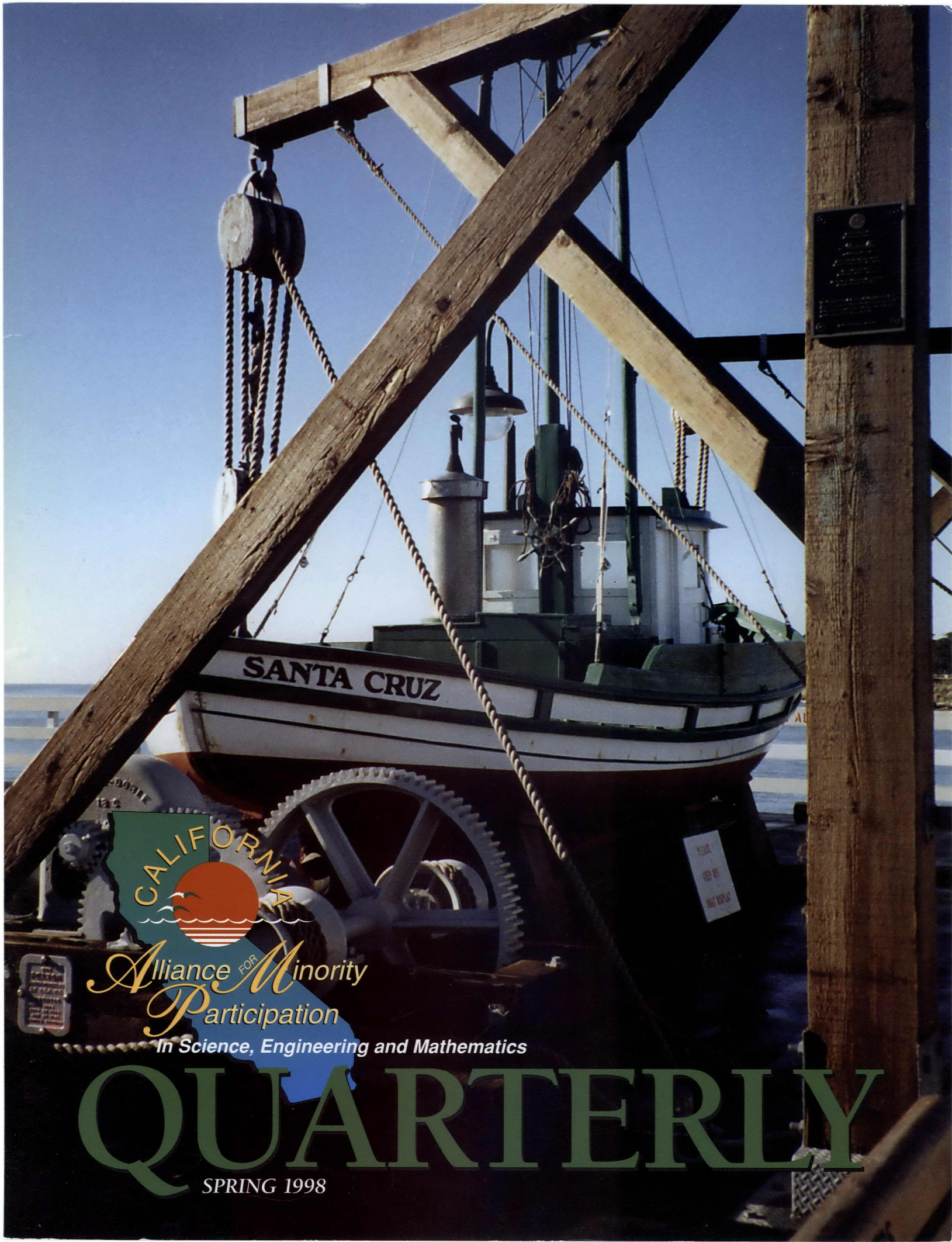

CALIFORNIA

Alliance FOR Minority Participation

In Science, Engineering and Mathematics

QUARTERLY

SPRING 1998

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COVER: Part of the UC Santa Cruz seaside experience includes a stroll on the picturesque city pier, home to the restored Monterey Clipper, Marcella. Dedicated in 1995, the restoration was a joint project of the City of Santa Cruz, Rotary Club, and Santa Cruz Museum Association, "To preserve a part of Monterey Bay history for the enjoyment and education of Santa Cruz residents and visitors to the wharf." The Marcella is one of the local sights that Chancellor M.R.C. Greenwood enjoys. She shares her goals and objectives for the campus in our interview, beginning on page 20. Photo by Marjorie DeMartino.

CAMP STATEWIDE

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

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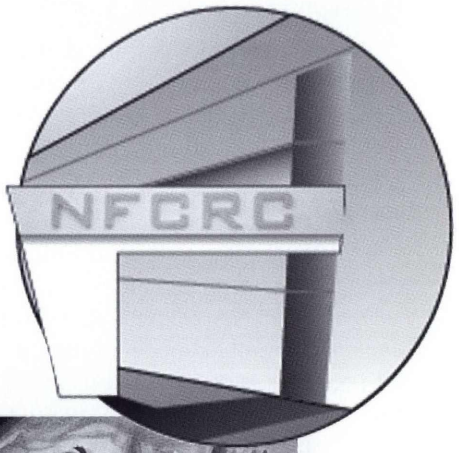

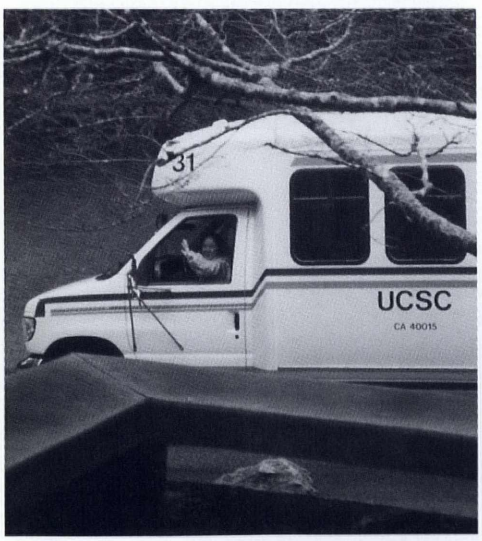

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UC NEWS

UCI School of Physical Sciences Dean **Ralph J. Cicerone** will become UCI's fourth chancellor on July 1, 1998. Cicerone was one of the founding co-principal investigators for the CAMP proposal. . . . **Nicolaos Alexopoulos,** Dean, UCI School of Engineering, has been appointed by Chancellor Laurel Wilkening to take over as principal investigator for CAMP July 1, 1998.

Two of the world's leading chemists have accepted endowed chairs in the UCLA Department of Chemistry and Biochemistry and will be teaching undergraduate and graduate courses as well as conducting research. **Fred Wudl** is a top expert on organic superconductors and **J. Fraser Stoddart** ranks among the finest and most innovative organic chemists in the world.

A 30-year quest to solve the structure of one of the most important types of proteins in a living cell has been achieved by scientists at the Lawrence Berkeley National Laboratory. By creating the first three-dimensional atomic model of tubulin, a protein that makes such vital life processes as cell division possible, biophysicists **Eva Nogales, Sharon Wolf** and **Kenneth Downing** were then able to take a detailed look at tubulin. It included a site where the protein interacts with taxol, an anti-cancer drug derived from the yew tree, used in ovarian cancer.

Frederick A. Eiserling was appointed early this year as senior associate dean of the UCLA School of Medicine. He has been on UCLA's faculty since 1965, holding appointments in both the College of Letters and Science and the School of Medicine. Eiserling, an early and strong supporter of CAMP, will remain Dean of Life Sciences.

Glenn Seaborg was appointed by Governor Pete Wilson to the Academic Standards Commission. The Nobel laureate, 87 and a teacher for 60 years, is in charge of writing the science standards. During World War II Seaborg played a central role in developing the first atomic bomb. Since then he has participated in a number of discoveries with applications in research, industry, and medicine, including cancer treatment. Seaborg, for whom element 106, Seaborgium was named, has stated that the point of standards is not to control what students do in the classroom but to define what they should ultimately know.

UC Riverside researchers have been awarded a two-year, $1 million grant from the **W.M. Keck Foundation** of Los Angeles to build a gamma ray telescope to study objects like black holes, pulsars and rapidly moving neutron stars. . . . **Rockwell International Corp.** has given UC Irvine $1.5 million to create a hightech multimedia learning and research center that will be the first of its kind in the UC system.

UCLA's Academic Advancement Program (AAP) directed by Adolfo Bermeo, hosted a national conference, **Excellence and Diversity in Undergraduate Education,** February 26 and 27, 1998. More than 150 key players in undergraduate education represented 14 major research universities in addition to the eight general campuses of UC. CAMP regional directors Russell Flegal, Santa Cruz; Kenneth Millett, Santa Barbara; Richard Weiss, Los Angeles; and Mel Green, San Diego, participated in a faculty panel that complemented a CAMP presentation by Juan Francisco Lara, UCI regional director. CAMP coordinators also attended the conference, which centered on models to effect campuswide change and programmatic change.

EDITOR'S NOTES

Congratulations to all our June 1998 graduates. Take a moment to scan our senior salute–including selected achievements of UC's brightest. Artistic talent is celebrated in "Science Majors and the Arts," featuring undergraduates who pursue dance, drama, music, and painting.

Marjorie DeMartino

We welcome Dr. A. James Hicks, new NSF program director for the 27 national alliances for minority participation (AMPs). Hicks is a plant scientist.

In our personal interview with the Chancellor of UC Santa Cruz, M.R.C. Greenwood speaks with clarity, certainty, and passion about her campus and her positions in national leadership.

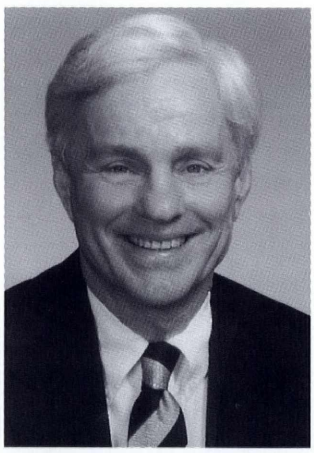
Peer and mentoring relationships are essential in developing California's professional and scientific workforce. Expanding these opportunities is a priority for Nicolaos Alexopoulos, Dean of UCI's School of Engineering, who will take the lead as CAMP principal investigator upon Chancellor Wilkening's retirement June 30, 1998. The recently dedicated National Fuel Cell Research Center and two additional "centers of excellence" will expand undergraduate research and mentoring experiences.

UC Riverside's Andrew Grosovsky, professor of environmental toxicology, ("Genotoxic Risk") provides similar opportunities in his lab, where two CAMP students have contributed to aspects of research on environmental carcinogens. Peer mentoring is the order of the day for Berkeley's Physics Scholars Program, in which participants take on dual roles as teachers and learners. And San Diego undergraduates enhance their education through the Faculty Mentor Program and CAMP Peer Counseling. Two students offer a glimpse into their academic development through these activities.

Marjorie DeMartino

EDITORIAL

By Richard C. Atkinson



UNIVERSITIES: The Center of U.S. Research

There has been much discussion in recent years about the need for a new national science policy, on the premise that the current model, forged in a Cold War environment, cannot provide a blueprint for the 21st century. Vannevar Bush's 1945 report to President Harry S. Truman, "Science—The Endless Frontier," is sometimes dismissed in such discussions as an historical relic. Bush, who had an intuitive sense of the shifting social and political contexts of science policy, would be the first to acknowledge that words written during the final, exuberant months of World War II should not be regarded as holy writ on the threshold of a new century. He might also admonish his critics to study his text carefully, rather than relying on latter-day interpretations, before discarding his entire vision.

It is true that some of Bush's arguments are now questionable and that some of the issues he considered important are now of interest only to students of the period. What remains pertinent is the report's vision of the role of government in research, including his assertion that the federal government had both the authority and the obligation to support basic research. More boldly, by arguing for the primacy of basic research supported according to norms set by scientists themselves, "Science—The Endless Frontier" implicitly asserted that universities defined the U.S. research system. Before World War II, universities were regarded as peripheral to the U.S. research enterprise. Bush gave them pride of place at the center because, as he argued, they had the potential to energize the entire system.

He was unerringly right on that issue. Bush's vision of research universities as the vital center of the U.S. research enterprise has indeed come to pass, thanks in large measure to an extraordinarily successful partnership with the federal government. As a result, both the research enterprise itself and the U.S. economy have prospered. Today, almost one-quarter of all papers by university-based authors published in the peer-reviewed scientific literature are co-authored with at least one scientist from an industrial or government laboratory.

A striking indicator of the wisdom of U.S. science policy is provided by its foreign imitators. Perhaps most tellingly, the Japanese government's July 1996 Basic Plan on Science and Technology, which commits the government to double its research and development (R&D) investments during the next five years, emphasizes the promotion of basic research and proposes specific steps, such as improving education and research in graduate schools, to integrate universities more effectively into Japan's research system. Today, Japan looks to the U.S. system as a model to help it maintain its position as a leading scientific nation in the 21st century.

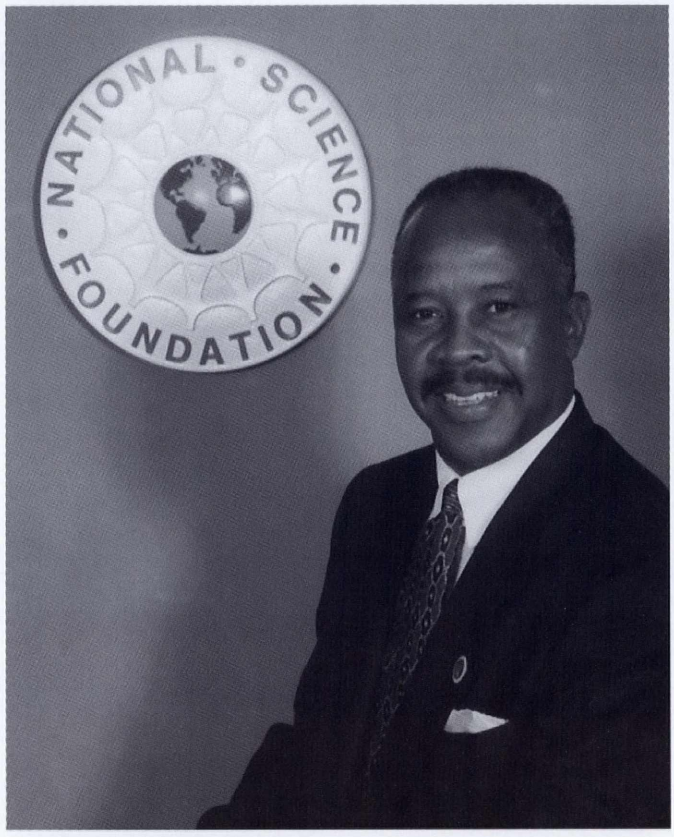
But federal investment in R&D is likely to decline as the government struggles to balance its budget. The implications are unsettling not only for universities but also for the U.S. economy. Almost 25 percent of current federal R&D expenditures are invested in universities, compared with less than three percent of industrial R&D expenditures.

Can industry take the place of universities as the vital center of the American research enterprise? The evidence suggests not. As recently as a decade ago, several large U.S. firms performed significant basic research in their own corporate laboratories; today, virtually all industrial research focuses on the solution of specific short-term problems, often by building on the results of long-term university research. And even if industry could take on a more central role, the consequences to the nation of a research system dominated by the short-term needs of private industry—similar to the Japanese model so widely admired a decade ago—have yet to be seriously addressed.

In its simplicity and flexibility, Bush's report remains a model for future blueprints of U.S. science policy. Any such blueprint should continue to place universities at the vital center of the U.S. research system. On this point, Vannevar Bush was prescient indeed. His 50-year-old vision remains remarkably current.

—University of California President Richard C. Atkinson's editorial appeared in SCIENCE Vol. 276, June 6, 1997. By permission.

A. James Hicks Appointed to Lead National AMPs



Dr. A. James Hicks, former dean of arts and sciences at North Carolina A&T University (North Carolina AMP), became program director for the National Science Foundation Alliances for Minority Participation Program on September 1, 1997, succeeding Dr. William McHenry.

Dr. A. James Hicks is the new director for the National Science Foundation's Alliances for Minority Participation (AMP) program. Hicks replaces William E. McHenry, the program's first director, who was appointed Assistant Commissioner of Education for Academic Affairs by the Board of Trustees of Mississippi State Institutions of Higher Education.

As the former Dean of the College of Arts and Sciences at North Carolina A&T State University, Hicks is well known on the national scene for his work with the Council of Colleges of Arts and Sciences (CCAS) and the North Carolina Plant Conservation Board (NCPCB). He is a frequent speaker at CCAS training seminars for new deans, and a long-standing member of the NCPC board of advisors. Hicks, a plant scientist, received his B.S. degree in biology from Tougaloo College. He earned his Ph.D. at the University of Illinois-Urbana, with postdoctoral work at the Missouri Botanical Garden, St. Louis. His administrative training includes participation in the Institute for Educational Management, at Harvard University, the Extramural Associates Program at the National Institutes of Health in Bethesda, MD, the Lilly Foundation's Liberal Arts Program for College Administrators in Colorado Springs, CO, and the Christian A. Johnson Foundation's Leadership Program in New York City.

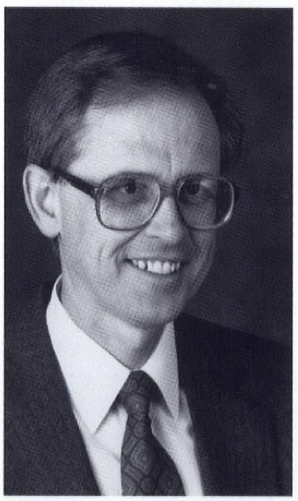
Hicks has received numerous awards and recognition for his work with minority students and faculty in North Carolina. Undoubtedly, one of his most notable awards was the 1988 White House Initiatives Faculty Award for Excellence in Science and Technology. Additionally, he was a member of North Carolina's 12-member delegation to Baden-Wurttemberg, Germany in November 1995. That official visit led to a signed Memorandum of Understanding, which now allows both student and faculty exchanges.

Hicks has administrative experience spanning twenty years at the levels of department chairperson and college dean. Under his leadership at North Carolina A&T State University, major facilities renovations were completed in the physics, chemistry, and fine arts buildings. During his tenure, the University also upgraded its research capabilities by acquiring a state of the art Nuclear Magnetic Resonance (NMR) machine, two election microscopes, and other major equipment. His experience in proposal reviews and evaluation in research and a prior Intergovernmental Personnel Act (IPA) assignment at NSF are expected to pay important dividends in his new role as National AMP Program Director.

In the Spring 1997 CAMP Quarterly, I introduced bioceramics, a long standing area of interest to me and the subject of my new book published by Gordon and Breach Scientific Publishers. For those interested in a spectrum of topics associated with the broader field of bioengineering, I am happy to recommend an excellent book, "Introduction to Bioengineering," published in 1996 by the Oxford University Press.

BOOK REVIEW

By James F. Shackelford



Introduction to BIOENGINEERING

For perspective, the broad topic of "bioengineering" would include the subtopic of biomaterials, which, in turn, would have the subtopic of bioceramics. "Introduction to Bioengineering" grew out of a course taught at UC Berkeley for over twenty years. The book is edited by Berkeley faculty S.A. Berger, professor of engineering science, W. Goldsmith, professor emeritus of mechanical engineering, and E.R. Lewis, professor of electrical engineering and computer science. Consistent with their course, the editors define "bioengineering" as "...the concepts and methods of the physical sciences and mathematics in an engineering approach to problems in the life sciences." The common application of these methods to human medicine leads to another label for the field: biomedical engineering.

"Introduction to Bioengineering" contains an appropriately broad spectrum of contributions from instructors in mechanical, electrical, chemical, and nuclear engineering as well as from orthopaedics and human biodynamics. The level of presentation is sensitive to the fact that many readers will be interested in chapters outside their area of expertise. This can include engineering students moving among chapters or biologists and surgeons without engineering training learning more about bioengineering applications.

Of course, I was personally most interested in Chapter 8, "Biomaterials," by R. Bruce Martin, Director of the Orthopaedic Research Laboratories at UC Davis. Professor Martin routinely guest lectures in my own graduate course on biomaterials, and our students use his chapter as a mini-text. Closely related is Chapter 9, "The Interaction of Biomaterials and Biomechanics," by Harry B. Skinner, MD, Ph.D. Dr. Skinner is formerly the Vice-Chair of Orthopaedics at UCSF and currently Chair of Orthopaedics at the UCI School of Medicine. Taken together, Chapters 8 and 9 give an excellent introduction to the practical applications of engineered materials in modern medicine.

Others with a primary interest in solid or fluid biomechanics, mass and heat transfer, or electronics and instrumentation will find other sets of chapters of great value. In all, there are 14 chapters with an appendix on linear transforms for those needing that additional material relative to circuit theory. I believe anyone would benefit for reading the chapter on Medical Imaging by Thomas F. Budinger, from Lawrence Berkeley Laboratory. Imaging techniques such as CAT scanning and MRI have been an integral part of modern medicine since the early 1980s.

I strongly encourage anyone interested in the emerging field of biomedical engineering to use this important and comprehensive book.

—James F. Shackelford is the UC Davis CAMP Regional Director. He is the Associate Dean of Engineering and teaches in the Department of Chemical Engineering and Materials Science and is a member of the Biomedical Engineering Graduate Group. Shackelford is on sabbatical leave at the Center for Materials Science at Los Alamos National Laboratory, Los Alamos, NM, during spring and summer 1998.

ANNOUNCEMENTS & ACCOLADES...

Congratulations to the June 1998 Graduates!

BERKELEY

Graduating seniors at Berkeley planning to enroll in graduate school in the fall: **Sally Daganzo,** B.S. chemistry, graduate program in physics; **Gerardo Dominguez,** B.S. physics, graduate program in physics; **Gabriel Acevedo-Bolton,** (please turn to Science Majors and the Arts, page 24) B.S. physics, graduate program in engineering; **Dezba Coughlin,** B.S. mechanical engineering, graduate program in engineering. Coughlin attended the SACNAS conference with CAMP support. Also graduating this spring are chemical engineering majors **Jose Buera, Martha Cava, Willis Costello, Tarek Radwan,** and **Eli Weiss;** chemistry majors **Ronitte Libedinsky** and **Tony Siu;** biology major **Milan An;** and molecular and cellular biology, **Arash Jamshidi.**

Fall 1997 B.S. degree recipients who participated in the Physics Scholars Program (please turn to page 30): **Ala Moshiri** and **Veronica Mayorga,** chemistry; and **Rebecca Anne Blum, Ramiro Trinidad Godina,** and **Alvaro Padilla,** chemical engineering.

DAVIS

Graduating seniors **Mari Chinn,** biological systems engineering and **Eric Rossetter,** mechanical and aeronautical engineering have received GEM fellowships to attend graduate school in Fall 1998. GEM, the National Consortium for Graduate Degrees for Minorities in Engineering and Science, Inc., has awarded Chinn and Rossetter master's degree fellowships to cover tuition and fees, and a stipend at the graduate institution of their choice. Chinn plans to attend Cornell University in Ithaca, NY, for a masters in biological and agricultural engineering, and Rossetter will enroll at Stanford University for graduate study in mechanical engineering. Both students have actively participated in the Mentorships and Opportunities for Research in Engineering (MORE) program this year, supported by CAMP. Chinn has conducted research under the guidance of Dr. Jean Vandergheynst, with a focus on the enhancement of production of environmentally safe biocontrol agents for mosquito control. Mosquitoes represent a serious problem for rice growers in Northern California. Rossetter has been a research assistant in the laboratory of Dr. Ronald Hess, working to advance the application of adaptive control systems to high performance aircraft. They will present their research at the 9th Annual UC Davis Undergraduate Research Conference, May 1998.

In other news, **Vanessa Meuniot,** senior in physiology/human development, has worked for the past four years under Drs. Hansen and Walzem, School of Veterinary Medicine. The lab's focus is primarily on lipoprotein assembly and metabolism. Meuniot says, "I have presented my research at several conferences, including twice at the national AMP conferences. I feel fortunate to have had these opportunities because they gave me a real sense of what will be expected of me as a graduate student and future scientist." . . . **Diana Norman,** senior, animal science, transferred to UC Davis in Fall 1995 and immediately applied to the CAMP-MURALS program. For her project, "The Restoration of the California State Fish: Onchorynchus Mykiss Whitei," Norman created computer generated maps using Geograph Information Systems software and incorporated the specific allele frequency of the Golden Trout onto the maps. She says that presenting at national research conferences has helped her decide on a career, and cites the experience as "instrumental" to her success at UCD.

IRVINE

The B.S. degree recipients in the biological and physical sciences, mathematics, engineering, and computer science that follow have participated in an array of activities offered by CAMP, including core course tutoring, peer mentoring, faculty mentored research, travel to scientific conferences and presenting their research, as well as teacher preparation experiences in local classrooms. They have received stipends as Summer Science Scholars and won scholarships for academic performance, including awards from Toshiba America Companies of Southern California,

MAES, UC Regents and the Chancellor. Some tutored in the Saturday Math Academy at local middle schools, and others have experienced classroom teaching through CAMP-Teacher Prep and plan to enroll in a K-12 credential program. Congratulations to UCI CAMP participants upon achieving their goal: **Sara Abdella, Pearl Abarca, Daniel Acosta, Roger Guy Adams, Jr., Mohamud Ahmed, Veronica Ayala, Cesar Anchiraico, Noemi Barragan, Hiram Channell, Esmeralda Casas-Silva, Eluid Chavez, Aracely Cordova, Ray Diaz, Ernesto DeLeon, Erik Espinoza, Jenny Espinoza, Jose Ferran, Rene Flores, Gisela Gamboa, Sara Garcia, Fernando Haro, Cameron Hernandez, Cynthia Herrera, Rocio Jimenez, Maria Lopez, Evangelina Neri, Daniel Nunez, Marisa Magaña, Silvia Navarro, Ruben Pedroza, Javier Rangel, Monica Rodarte, Bartolome Rivera, Jose Rivera, Armando Rodriguez, Rocio Rodriguez, Paul Ruiz, Shewit Semere, Bettina Thornton, Steven Toscano, Wendy Velasco, Ricardo Viramontes, Ethan Walters,** and **Susana Zarate.** Best wishes to fall quarter graduate **Sindy Bolanos** who has received a full scholarship to enroll in the M.D./Ph.D. program at Rutgers University. Her mentor at Rutgers is Professor Barry Komisurak.

Rocio G. Jimenez

Winter quarter 1998 graduate, **Pearl Abarca,** B.S. civil engineering, accepted a position with Psomas and Associates of Costa Mesa, having selected from among job offers from top California engineering firms even before completing her degree. Abarca, who won a MAES Regional Chapter scholarship in her junior year, will be working on a variety of civil engineering projects for land development and water resources. . . . **Fernando Haro,** June 1998 degree recipient with a double major in electrical engineering and mathematics, gained admission to UCSC's Ph.D. program. A transfer student from Cypress Community College, Haro won a Toshiba America Scholarship and was a CAMP Summer Science Scholar. . . . **Cesar Anchiraico** has received admission to the UCI Ph.D. program in mathematics. . . . **Sara Garcia,** also a Summer Science Scholar, gained admission to the UCI Ph.D. program in chemistry. . . . **Richard Anthony Bailey** (see Winter 1998 issue) has completed a master's in health science at Johns Hopkins University, and received his acceptance letter from UCLA Medical School. He will enroll in Fall 1998.

Graduating senior **Rocio G. Jimenez,** B.S. mathematics, has built a strong resume during her undergraduate career at UCI. Currently applying for the single subject credential program, she has taken advantage of every opportunity to build her academic strength and career pathway. She is currently a program assistant for Project SMART, a teacher preparation program and has tutored for the Saturday Math Academy. As a teaching assistant in the Young Educators Program, she traveled to Washington, D.C. and New York City for summer 1995 and 1996, respectively, where she was responsible for teaching a college level statistics course to high school students. She says, "I want to teach mathematics at the junior high or high school level because it will give me the opportunity to influence, encourage and motivate students to pursue higher education." She adds, "I really enjoy working with students because I am able to relearn what I have taken for granted in mathematics." In addition to CAMP and tutoring in the Saturday Math Academy, Jimenez has enriched her education by actively participating in MAES (Mexican American Engineers and Scientists) and its PACES program, Promoting Awareness of Careers in Engineering and Science. Additionally, she was a McNair Scholar. Jimenez has recently learned of her admission to the masters in mathematics program at Western Illinois University.

Jose Valle

MAES and AAAS conference participants: UCI civil engineering major **Jose Valle** (see Fall 1997 *Quarterly,* "Shotcrete Project") won first place at the Mexican American Engineering Society (MAES) Symposium for his research presentation. His faculty mentor is Professor Gerard Pardoen. **Mayra Marin,** mechanical engineering, received a MAES scholarship. Chemical engineering majors **Reyna Paniagua, Lyhner Ramirez** and **Pamela Valerade** interviewed with Lawrence Livermore Laboratory for the lab's summer research program. . . . Fourteen CAMP/McNair students presented their posters at the annual meeting of the American Association for the Advancement of Science (AAAS) in February 1998. AAAS is the most prestigious scientific conference in which undergraduates can compete. Jose Valle again won first prize in the physical sciences (engineering) category—believed to be a first for a Latino engineering major from UCI. **Herman Villalba** received honorable mention in life sciences. Student

travel to both conferences was funded by CAMP and the McNair program, coordinated by the UCI Center for Educational Partnerships.

SAN DIEGO

Tinh Alfredo Villarreal Khuong, B.S. chemistry, Fall 1997, spent his last quarter in the K. Barry Sharpless lab producing an "amazing quantity of important results" on improving the scope and practicality of the Murai Reaction. He will be sole author on the paper. . . . Another fall quarter graduate, environmental chemistry, **Montserrat C. Anguera,** has been accepted to several graduate schools. Her difficulty will be deciding between bio-organic chemistry or general biochemistry. . . . **Steve Hassid,** biology, senior is continuing his work with Dr. Patrick Lyden, looking at a more complicated model for new drug treatments in cases of stroke. . . . **Mike Gerhold,** biophysics, senior, continues his research with Dr. Randolph Christen on new chemotherapy agents and reports that he will be publishing as soon as the proverbial "one more experiment" is completed. . . . **Sharon Okonkwo,** senior, biology and ethnic studies, is also working as a chemistry TA at local Lincoln High School. . . . **Carla Uranga,** biochemistry, senior, continues work with Dr. Philip Groves at the Dept. of Psychiatry to study the chemical processes at the neurons with which our brains process movement information. She asks specifically why some neurons degenerate as we age. Uranga says, "Research in science is an excellent experience because it is important to learn that understanding concepts in science is always a team effort, and the sense of solidarity in the fight against disease is what keeps science interesting, dynamic, and necessary."

CAMP students new to research this quarter: **Esmeralda Iniquez,** biochemistry, senior, began research with Dr. Lawrence Palinkas in the Department of Family and Preventive Medicine on "Health Care Utilization Patterns of the Latino Population in San Diego." She is looking specifically at the immigrant population and examining barriers to seeking medical care. . . . **Jose Otero,** physics, junior, is investigating "Dark Matter and Possible Gravitational Lensing Events" with Dr. K. Griest. They hope to examine data which indicate the direct gravitational effects of dark matter and thus contribute to proving that dark matter exists. . . . On other fronts: **Michael Palmer,** biochemistry, sophomore, is working in a bioengineering lab on implanted glucose sensors for insulin dependent people. He is looking in particular at the healing process and how it may disrupt the sensor readings. . . . **Agustin Diaz,** chemistry, junior, is working with physical science and algebra students at Morse High School through the outreach component of the Hughes Program.

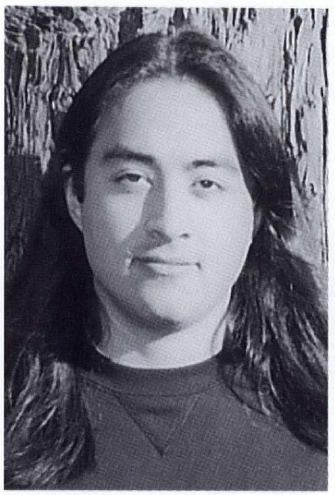
SANTA CRUZ

Graduating seniors: **Annette Pizano,** chemistry; **Michel Perez,** biology; **Samuel Valeriano,** biology & molecular biology; **Juan Luis Maldonado,** computer science; **Jasmine Peterhans,** chemistry; **Lorenzo Rodriguez,** mathematics; **John Sanchez,** biology (see Winter 1998 *Quarterly,* "Biochemistry of Urticating Caterpillars"); **Francisco Quintero,** physics. Sanchez is studying at Cornell University this quarter, continuing his research under Dr. Eloy Rodriguez, and plans to return to Venezuela this summer to extend his field research. Quintero, mentored by Dr. Sue Carter, gave an oral presentation at the March 1998 meeting of the American Physical Society in Los Angeles. Rarely are undergraduates invited to present. Quintero's abstract is entitled, *Charge Transport, Degradation and Recombination in MEH-PPV Polymer Light-emitting Electrochemical Cells,* F. Quintero, B. Ruhstaller, S. A. Carter (UCSC), P.J. Brock (IBM Almaden Research Center).

1997 Undergraduate Research Symposium presenters: **Pedro Ibarra,** senior, chemistry, Syntheses of Compounds that Resemble the Active Side of Nitrile Hydratase, mentor: Pradit Mascharak; **Michael Paglinawan,** senior, molecular cellular and developmental biology, The Effects of Lead on Bone and the Efficacy on Hormone Treatment, mentor: Donald Smith; **Michel Perez,** senior, biology, Decoding the Language of Lizard Land, mentor: Barry Sinervo; **Paul Perez,** junior, computer engineering, Simulating and Modeling a Queuing Network, mentor: Alexandre Bradwajn; **Jasmine Peterhans,** senior, chemistry, The Temple Syntheses of a Tetraazotetraene Macrocycle, mentor: Pradit Mascharak; **Annette Pizano,** senior, biochemistry/BMB, In Search of Plasmids, mentor: Lynda Goff; **Francisco Quintero,** senior, physics, Polymer Light-Emitting Diodes, mentor: Sue Carter; **Josue Reyes,** senior, computer science, The CG Mars Lander, mentor: Robert Levinson; **Lorenzo Rodriguez,** senior, computer science/mathematics/developmental biology, Coding Theory, mentor: Bruce Cooperstein.

Future plans for June 1998 graduating senior **Josue A. Samayoa** include a Ph.D. He will receive his degree in molecular, cellular and developmental biology. A transfer student from Skyline College in San Bruno, Samayoa was selected to receive a full scholarship to UCSC from the college. He completed a Minority Access to Research Careers Fellowship and participated in the CAMP summer internship program, in which he was the first transfer student. Samayoa presented at the Bay Area Science Symposium, and was a co-leader and tutor in the ACE biology program. In February 1998, he participated in the National Institute of Allergy and Infectious Diseases introduction to biomedical research program in Washington, D.C. His faculty mentor is Dr. Lynda Goff.

Samayoa says, "I am working on a project characterizing several plasmids from the red algal family *Bangiaceae*. Plasmids are small, circular, extra chromosomal pieces of double stranded DNA that replicate autonomously inside the cell. Plasmids help us study phylogenetic relationships between different algae and can be used to tell species apart. My task is to find plasmids from *Bangia fusco-purpurea* DNA extracted from locally collected specimens. Our goal is to characterize the plasmids present and to determine how conserved they are throughout this group of economically valuable red algae. With this information we can find valuable cloning vectors for transforming economically important red algal species."



Josue A. Samayoa

SANTA BARBARA

June graduates anticipate entering graduate school, K-12 teacher credential program, or professional careers. Following are the CAMP fellows and B.S. degree recipients, by discipline: Aquatic Biology: **Xochitl Casteneda, Maurico Gomez, Marquez Garrett;** Biology/ Biological Sciences: **Fernando Baustista, Sandra Garcia, Kristin Andrade, Darleen Valdiva, Roxana Cervantes, Jorge Torres;** Biopsychology: **Analilia Garcia, Jennifer Rodriguez;** Chemistry: **Brendi Makepeace;** Geology: **Leland Green, Javier Santillan;** Mathematics: **Manuel Salcido, David Avalos, SuGen Shin** (mathematics and computer science degrees), **Glazell Espiritu, Oralia Loza, Sonia Cisneros, Nicolas Rodriguez;** Physiology: **Ricardo Avila.** The Mathematics Graduate Student Achievement Program Academic Workshop staff members **Nancy Heinshcel** and **Karen Horton** will have masters' degrees conferred in June and **Ana Garza** expects to complete a masters' in the fall. . . . **Jorge Calvo** will complete the Ph.D. in June 1998.

Brendi Makepeace

Former CAMP staff, teaching fellows and scholarship recipients **Jacqueline Hodge** and **Gustavo Gonzalez** will be receiving their mathematics teaching credentials June 14 from UCSB. Former teaching fellows also receiving credentials are **Joyce Adriansen, J.P. Clark,** and **Stephen Glaholt. . . . Miguelangel Arellano** and **Monica Marquez** worked as volunteer teachers for local elementary school students and are the leaders of *La Esculita.* Arellano and **Danielle Hill** are resident assistants for the Summer Transition Enrichment Program, and **Dynse Urbina** has been appointed as the Undergraduate Coordinator for SIMS '98.

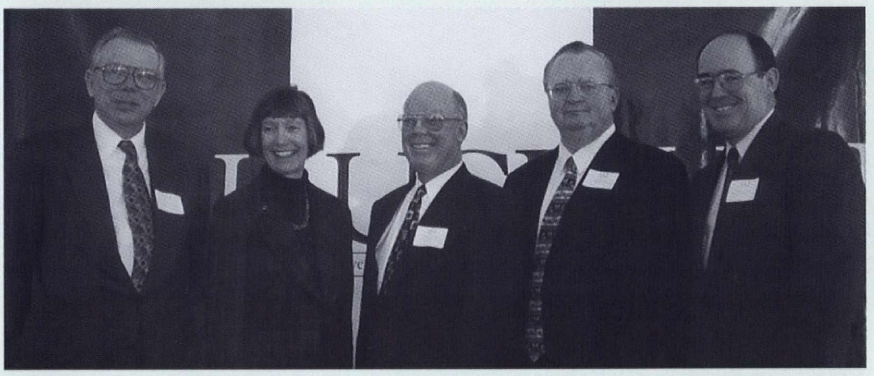
Diana Albay (see profile, Winter *Quarterly*) made the USA Today All Academic Team. From a pool of 1,200 students, twenty each were selected to first, second and third teams. Albay will present her research in San Francisco at the West Coast Biological Sciences Undergraduate Research meeting. . . . **Katrina Jimenez** and **Nicolas Hernandez** are members of the Honors Program. Jimenez is also a member of the 1997-98 Provost's Honors Council. . . . **Ahmad Yamato** received a Hearst Foundation Scholarship. . . . **Diego Gonzalez, Katrina Jimenez** and **SuGen Shin** have become members of the Golden Key Honors Society. . . . **Nicolas Hernandez** has been inducted into the Alpha Lambda Delta Honor Society. . . . **Erica Ocampo** and **Hector Garcia** attended the Society for Hispanic Professional Engineers meeting in Orlando. . . . **Diego Gonzalez** has been accepted to the EAP Tropical Biology program in Costa Rica where he will enroll in Fall 1998. He has received certification as a research diver and is working on a UCSB ocean research project. . . . **SuGen Shin** was recognized as an outstanding undergraduate mathematics major and received a student membership in the Mathematical Association of America. She won the Department of Mathematics 1998 Wilder Award given to an outstanding undergraduate. . . . Graduating senior **Judah Jeng Vang,** a participant in the Achievement Program Workshops, received the 1998 Mochizuki Award for outstanding academic performance. . . . **Miguelangel Arellano** was recognized as an outstanding EOP peer advisor. . . . **Diego Pedreros'** Environmental Studies thesis, "Determining the Effects of Fires in Vegetation and Water Flow in Chaparral Ecosystems in the Santa Monica Mountains, California, Using Geographic Information Systems (GIS)," was completed in March 1998 under the direction of Professors Dar Roberts and Hugo Loaiciga. Diego is now employed as a researcher with Professor Loaiciga. . . . In addition to leading an AP workshop in chemistry, **Patrick Murphy** has served as an undergraduate student Teaching Assistant for Economics 3B.

Announcements & Accolades continues on page 33

ENGINES OF THE

National Fuel Cell Research Center

The National Fuel Cell Research Center represents a partnership between public and private interests. U.S. Department of Energy, California Energy Commission, State of California Air Resources Board are Center affiliates. Founding members include the California Institute for Energy Efficiency, Energy Research Corporation, EPRI, Horiba Ltd., M-C Power Corporation, Southern California Edison, Southern California Gas Company, South Coast Air Quality Management District, and Westinghouse.



Chancellor Laurel Wilkening with NFCRC partner representatives.

The dedication of the National Fuel Cell Research Center, February 25, 1998, at the University of California, Irvine, Engineering Gateway Plaza, brought together education, government, and industry to formally establish the principal site for fuel cell technology in the United States. Originally established in 1992 at Southern California Edison's Highgrove Generating Station in Riverside County, the center was transferred to UCI with all rights and obligations.

"This center represents a new commitment to the advancement of fuel cell research," said William J. Keese, chairman of the California Energy Commission. He said that the fuel cell has the potential to significantly reduce fossil fuel consumption, and to direct us to "rethink the way we produce our power."

Directed by UCI Professor Scott Samuelsen who also directs the Combustion Laboratory, The National Fuel Cell Research Center (NFCRC), is dedicated to addressing the challenge of efficiently providing for the world's increasing demand for energy while sustaining the quality of the environment.

"The Center ushers in a new era of clean, low-cost electric power,"

NFCRC ELEMENTS

- Beta testing — multi-month testing of prototype units for demonstration of technologies and application to the marketplace.
- Research—developing fuel cell technologies through market, analyses, operations, systems, component, and enabling technologies research.
- Education—providing a trained professional population in the technical and socio-political issues and ramifications associated with the development and deployment of fuel cell technology.
- Technology transfer—a two-way bridge of communication and information exchange between the application of fuel cell technologies to the marketplace, and the development of the technology for the marketplace.

Technology and Clean Air: Dedication the New Millennium" for fuel cell tech

FUTURE
Opens at UCI

said Chancellor Laurel L. Wilkening.

Fuel cells represent the "quantum leap" needed to mitigate the conflict between energy generation and the associated environmental impact. The focus of the National Fuel Cell Research Center is on the development and research of fuel cell technology, application of the technology in the marketplace and education of energy professionals in the dynamics and application of advanced power generation.

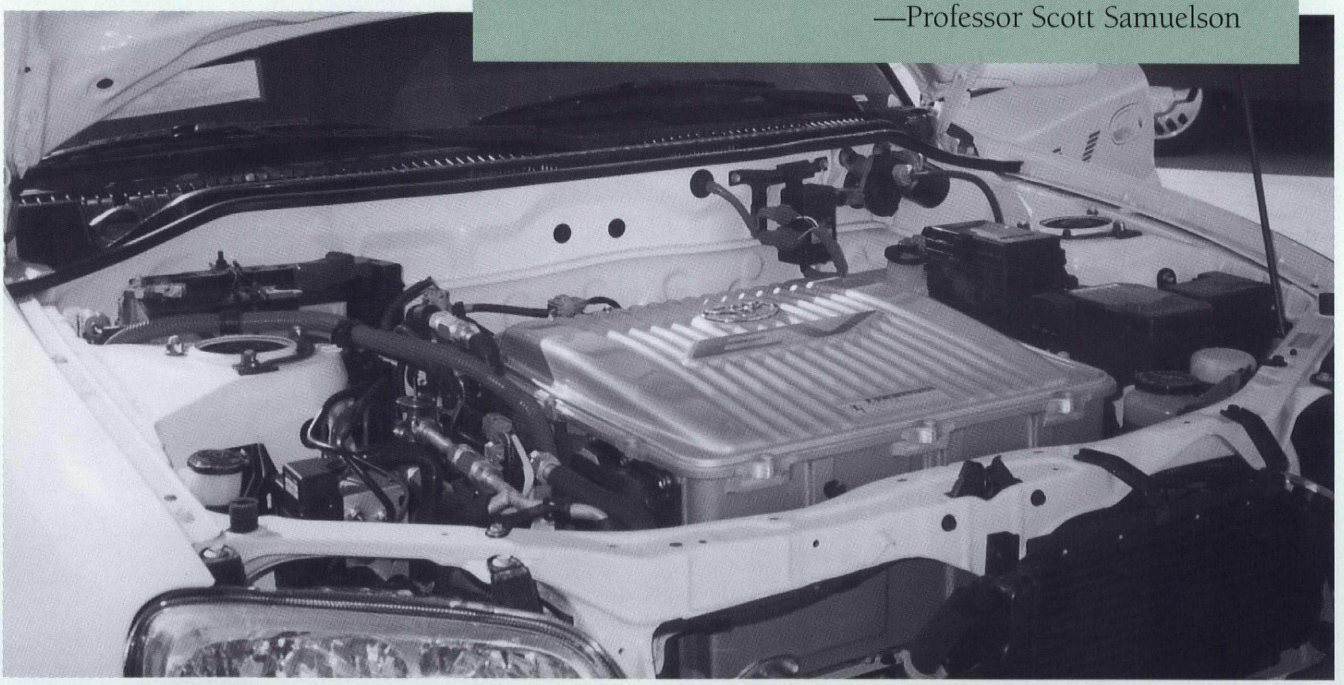
The NFCRC is supported through a series of partnerships with energy companies, governmental agencies and other research institutes. Southern California Edison, the first member company, has led these partnerships.

The University of California, Irvine acknowledges the collaboration and contribution of time and resources from Southern California Edison to establish the center at UCI. Edison is the first founding member of the Center. It will start life with a $1-million operating budget and plans to land about $4 million in research contracts for industry clients interested in the technology.

Guided tours of the facility followed the ceremony. Information provided by the UCI School of Engineering, Nicolaos Alexopoulos, Dean. http://www.nfcrc.uci.edu

"The center's operation will represent a major shift in university-based research. Instead of expecting industry sponsors to fund research projects that are conducted by UCI researchers, the center will provide a place where academic, government and industry researchers will work side-by-side."

—Professor Scott Samuelson



Fuel cells, which convert hydrogen directly to electrical and heat energy, are considered by many specialists as the best possible source of clean, cost-efficient energy for the future. Fuel cells convert about 60% of the fuel they consume into electrical energy, versus an average efficiency of 35% for other types of generators.

Forges "Strategic Alliances into nology in the United States

THE VIRUSES THAT MAKE US:

A role for endogenous retrovirus in the evolution of placental species

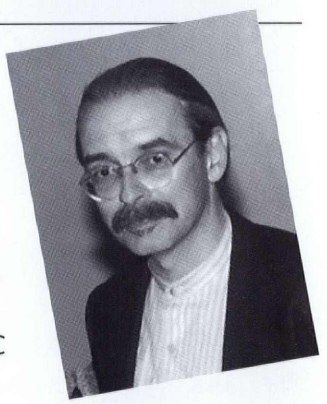
By Luis P. Villarreal

The following article is excerpted from a seminar delivered to the University of Washington for the Minority Scientist Seminar Program in December and in July of 1997 to the Department of Genetics at the University of Valencia.

The year 1997 marks the 100th anniversary for the discovery of virus as a filterable causal agent of plant and animal disease. During this time we have witnessed the growth of biological thought that has included the synthesis between genetics and evolutionary biology and the subsequent advent of molecular biology. These fields encompass broad themes in biology that link the study of all living things. However, in spite of the apparent long history of the study of viruses, the modern concept and definition of a virus as a molecular genetic parasite was not clearly presented until Salvador Luria published his first essay on this topic in 1950, well after the development of much of the thought behind our understanding of evolutionary mechanisms.

We currently think of viruses as agents that necessarily reduce host fitness and generally cause disease, together with other pathogenic microorganisms, such as bacteria and fungi. In this presentation I will develop the idea that in addition to this role, viruses can also invent systems of molecular genetic identity and superimpose a new combined identity onto the infected host. In so doing, a virus can allow itself to adapt to the environment and evolve quickly, providing a creative force that the host may further develop into systems of identity and immunity that can contribute directly to host evolution.

Along these lines, in this lecture I will examine the evidence that endogenous retroviruses might be crucial to the evolution of placental orders. Because placental species give live birth, they face an immunological dilemma in that their highly adaptive immune systems fail to recognize their own embryos which have 'foreign' father derived (allogeneic) antigens. As the genomes of placental mammals are also highly infected with retroviruses found only in their genomes (endogenous) and because retroviruses are generally immunosuppressive, I examine the possibility that the



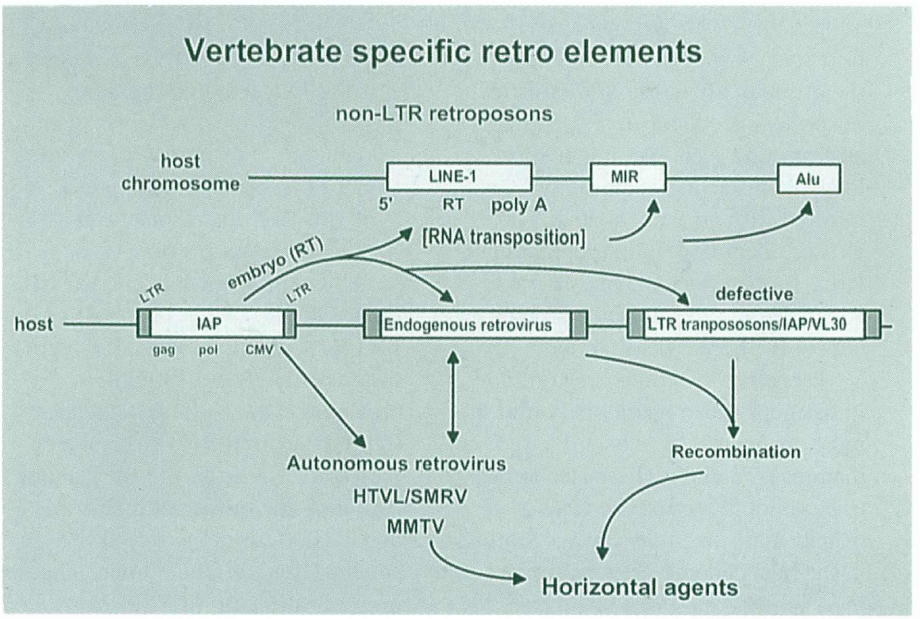
CAMP Statewide congratulates
Professor Luis P. Villarreal
on receiving the Distinguished Alumnus Award from the California State University Los Angeles, where he earned his B.S. in biochemistry. Villarreal then earned his Ph.D. in virology at UC San Diego. In 1985 he joined the UCI faculty in molecular biology and biochemistry. He was recently honored by SACNAS with the Distinguished Scientist Award, and by CAMP Statewide with the Luis Villarreal Science Prize for undergraduates pursuing research in preparation for advanced study. Villarreal is featured at the new California Science Center in an exhibit honoring minority scientists.

embryo is acting like an infectious agent that produces virus to suppress the mother's immune system. I will compare this situation to that of another genomic virus, the polydnaviruses which are symbiotic in parasitoid wasp species and are also immunosuppressive. And I will conclude by arguing that the persistence of parasitic viral-like genomes may represent one of the primary mechanisms for the evolution of higher order living systems.

Our current and prevailing view of the relationship of a virus to its host is similar to how we think of a predator and its prey. The virus can be considered like a predator and the host, its prey, in terms of their interactions as well as how we model this dynamic using mathematical models of disease. This predator-prey model assumes that the affect of virus infection on host is to decrease host fitness via disease. In this model, efficient virus replication is often linked to host induced disease. This type of model appears to work well when applied to numerous acute viral infections of human and animal disease, such as smallpox, measles, influenza and, more recently, HIV and AIDS. This type of model also seems applicable to other microbiological agents, such as pathogenic bacteria and fungi, in terms of affects on host fitness. Thus it appears that we have a well established and accepted explanation of virus host dynamics that fits known human viral epidemics.

The view that viruses are principally major agents of disease is richly deserved. In human history, viral epidemics have accounted for more human deaths than all known wars and famine combined. This was especially evident in the New World following the introduction of smallpox, then measles, influenza, and mumps into the then naive Native American population from Europe. In Europe, these diseases had already established a childhood pattern of infection. Essentially all adult Europeans were literally the survivors of childhood infections with smallpox and measles. Smallpox was particularly significant in New World demographics. The first epidemic on the mainland was to hit the Aztec population around the time of the infamous 'noche triste' on June 20th 1520, killing all the leaders and many warriors of the Aztec revolt that expelled Cortez. This revolt, one that killed many of Cortez's conquistadors and drove them from Tinochtitlan (the Aztec capital), was to ultimately fail in spite of the seemingly enormous numerical advantage of the Aztecs. This smallpox epidemic and resulting social chaos was to deliver a death blow to this numeric superiority and clear the way for the successful return of Cortez and his allies the following year.

Subsequent epidemics were to continue their inexorable march through the Inca and Mayan civilizations, then later into the North and South American continents, including Indians from the Mississippi valley, the Eastern seaboard, then into California and the Columbia River valley, resulting in the greatest demographic catastrophe in human history. Viral epidemics continue to threaten the human population. In this century the great influenza pandemic of 1918 accounts for the most human deaths of any event, while the new HIV pandemic is the newest worldwide epidemic threat. Clearly, viral epidemics seem to prey on human populations. However, when we consider virus host relationships during evolutionary time scales, none of these acute epidemic infections were likely to have been prevalent during most of human evolution, for they are not able to establish stable persistent infections needed to survive in small groups of hunter gatherers that characterized much of early human history. Yet other viruses were almost certainly prevalent.



It is clear that there exists another **relationship of virus to host** that does not fit the predator-prey model noted above and works well in hosts that live in small populations. This other relationship is characterized by a stable persistence of the virus once the host has been infected. The stability of the virus-host linkage is often seen even on an evolutionary time scale. In the vertebrates, this relationship is easily apparent in the viruses I study, the small DNA viruses such as papillomavirus and polyomavirus. Once the host becomes infected by such viruses, they are usually present for the life of the host.

These viral infections and many other spend the majority of their existence as persistent non-pathogenic infections with little apparent effect on host fitness. As these agents can be highly prevalent in their host species and can be found in most related species, they are often conserved phylogenetically. That is, these types of virus appear to be co-evolving with their host and diverge from each other at the same rate that the host species themselves have diverged. In addition, such viruses are generally host species-specific, which raises the question about the mechanisms of species specificity. In any human audience, for example, it is highly likely that the great majority will be infected with an array of such viruses, including human papilloma virus, human polyomavirus, human adenovirus as well as several members of the herpesvirus family.

Persistent infections are common in nature and can readily be found in most organisms, from bacteria to mammals. Some of these also appear to be genomic in that the virus is usually and sometimes always found in the host genome. For example, most bacteria have one or several prophage in their genomes. In mammals, it appears all species have endogenous retroviruses as part of the host DNA. In spite of how common such infections may be, we do not have a well developed mathematical model of persistent virus-host interaction for it draws much less attention and study then disease causing infections. Only when such infections occasionally lead to disease, such as in the association of otherwise inapparent Human Herpes virus type 8 with Kaposi's sarcoma in AIDS patients do we pay attention to such persistent agents.

Persistent infections by viruses and virus-like parasites, such as bacterial plasmids, are known to often provide genes to the host that can be of adaptive value. For example, bacterial pathogenesis is often due to the ability of certain bacteria to adapt to specific environments of a host such as a human, but in so doing also cause disease. Many of the genes that make bacteria pathogenic are due to persistent viral infections or infections with virus-like plasmids, including the ability to produce diphtheria and botulinum toxins. Those genes that are not directly part of a virus usually reside in clusters know as pathogenic islands that appear to have arisen from horizontal transmission events and thus resemble viral transmission, as recently reviewed by Stanley Falkow. It therefore seems curious that one of the most adaptable organisms we know, bacteria, use horizontally transmitted elements as a major mechanism of adaption. Why don't all organisms use this highly successful process?

However, if we examine **what happens to genomic DNA** as it has evolved to higher order, certain trends become apparent. Most notably is the clear trend to accumulate a virus-like or parasitic DNA as part of the genome. Although the human chromosome is about 1000 times the size of the smallest bacteria, the human genome only has about 50 times as many genes as bacteria have. However, as all organisms evolve to higher order, they appear to decrease the density of genes within DNA from about 1.2 kb per gene in bacteria, 4 kb per gene in drosophila to about 29 kb per gene in the human genome, and not simply accumulate more genes. There is no accepted evolutionary theory that accounts for this pattern of genome evolution. Thus in mammals about 95% of the DNA is noncoding; a great part of this noncoding DNA is made up of various families of repeated DNA such as Alu, SINES, LINES, retroposons and endogenous retroviruses. Placental mammals are especially prone to the presence of these types of DNA, relative to avian and reptile species. In fact each mammal has it own unique version of LINE DNA present at up to a million copies per genome.

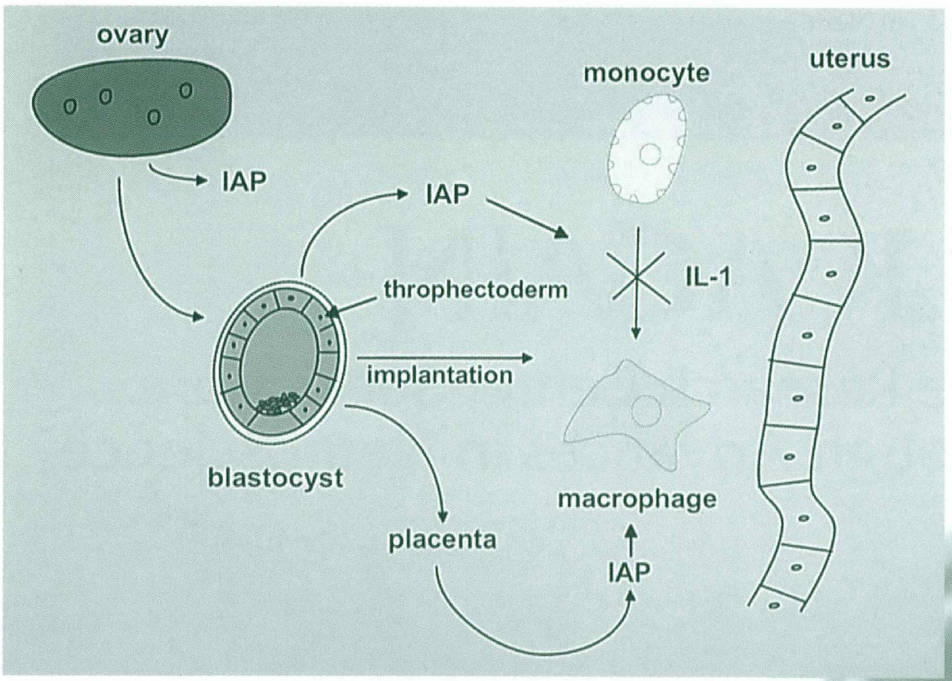
All of these 'parasitic' DNAs appear to derive from the action of reverse transcriptase on various cellular and retroviral RNAs and thus they have precise 5′ ends, a part of the reverse transcriptase coding sequence and DNA copies of the poly-A tail. Yet we know of no selective force that should conserve the presence of reverse transcriptase to generate such DNA families. Avian and reptile species have much less if any of this type of DNA. Although avians do have some families of repeated DNAs, these avian repeat sequences lack these features seen in LINES. There is currently no explanation for the presence of so much of this DNA in the mammalian genome. In addition, placental species all appear to have also conserved intact version (with all the genes for making a virus) of endogenous retrovirus that is co-evolving (phylogenetically congruent) with the host species. However, these intact copies, unlike the retroposons noted above, are present at a very low copy level, sometimes only one copy per haploid genome. There is no explanation currently available to account for such conservation, especially given that these endogenous retroviruses bear no resemblance to existing free retroviruses and would not likely provide possible protection against free living versions of such retroviruses.

The **genesis of placental species is a relatively new development** in the evolution of organisms and dates to the Cretaceous-Paleocene boundary about 65 million years ago. Although not well appreciated, the first mammals, known as the Multituberculates, came into being well before this and even before the dinosaurs during the Triassic period about 210 million years before the present. These mammals were most likely egg laying monotreme like creatures that resembled rodents, thus they most likely did not face the immunological dilemma of modern placental species. Early mammals were to

become very well distributed, surviving past the demise of the dinosaurs but mysteriously becoming extinct about 35 million years ago. The closest relative to the placental mammal are the marsupials, yet marsupials have only limited immunological contact between the fetus and the mother. Their embryos are much more egg-like than those of placental species. A main distinction between marsupial embryos and placental embryos is the presence of the outer cell layer of the early placental embryo known as the trophectoderm. This cell layer is the only one to express paternal genes and is involved directly in implantation into the uterus and then goes on to develop into the placenta. This tissue is the first cell type to differentiate in the placental embryo, yet is also the most recently evolved relative to early mammals. It therefore appears that the trophectoderm is crucial for the biology of placental life strategy.

In terms of implantation and escape from immunological rejection, the trophectoderm appears central to the ability of a placental embryo to prevent immunological recognition. Unlike most any other tissue, mouse trophectoderm can be implanted across strain barriers without being rejected. In addition, the trophectoderm can protect the inner embryo from attack by macrophages. However, it has been unclear what aspect of the trophectoderm protects the embryo. Various models have been proposed including altered expression of antigen presenting molecules (MHC) but these models all have significant problems.

However, one activity that is rather unique to the trophectoderm (syncytiotrophoblast) is remarkable; they express extremely large quantities of endogenous retrovirus genes and retroviral particles, which include the envelope gene. The envelope gene is deleted from most of the defective copies of retroviruses found in the genome but has been conserved in these intact copies. In addition, the envelope gene is generally responsible for the ability of many retroviruses to suppress the immune system of the host. Other endogenous retroviral genes, such as *gag*, also appear to be able to modulate the immune response. The retrovirus that are being expressed in the embryo's trophectoderm are also highly conserved in all placental species examined so far. It therefore seems possible that this endogenous retrovirus may be providing protection to the embryo from the mother's immune system.



The model being proposed is as follows. Placental embryos make an extraembryonic tissue, the trophectoderm, which produces an endogenous retrovirus at high levels. **This retrovirus, however, is not fully competent to replicate,** but instead it can **only infect local immune cells** (such as macrophages) of the uterus, thereby compelling those cells to express viral genes and prevent them from initiating an immune response. Thus, the mother's immune system will remain competent to respond to other infections but is specifically prevented from mounting an immune response to the embryo. Only the presence of the embryo itself prevents an immune reaction. However, there are numerous consequences expected from such a situation. For one, the placental embryo must conserve this endogenous retrovirus in order to allow live birth. Therefore, early embryos will always be expressing the reverse transcriptase enzyme. The required expression of this 'viral' enzyme can have other effects, such as allowing a high rate of reverse transcription to occur with various cellular or retroviral RNA transcripts of genes. Thus placentals will be prone to accumulate retroposons, such as LINE elements. However, given the immunosuppressing activity of the *envelope* gene, it is expected that most displaced copies of endogenous retrovirus will have deleted this gene. In addition, these endogenous retroviruses may also on occasion lead to the generation of free living retroviruses following recombination with various cellular or other viral genes. Placental species should thus be prone to retrovirus infections.

Placentals therefore are proposed to maintain a genomic virus, an endogenous retrovirus, that is

VIRUSES continues on page 32

PHOTO: ALAN EYERLY

TO WALK AGAIN

The Reeve-Irvine Research Center Seeks Cure for Paralysis Through Advances in Neuroscience

BY JENNY ESPINOZA

The worlds of entertainment, politics and science have collided at UCI with the establishment of the Reeve-Irvine Research Center. Actor Christopher Reeve, known by many as Superman, was rendered paralyzed in an equestrian accident in 1995. As stunning as the accident was, the truly amazing part of this story resides in the events that transpired afterwards. Reeve, a longtime activist, launched a campaign to find a cure for paralysis. With support gained from Capital Hill, the entertainment industry, corporate and private donations, a new thrust in neuroscience, calling for a cure for paralysis, has emerged. The most notable donation was a one million dollar gift from Joan Irvine Smith, which played a central role in the establishment of the Reeve-Irvine Research Center.

Consciousness has been raised about the trials of spinal cord injured persons. There are more than 250,000 spinal-cord-injured persons living in the United States. About 11,000 spinal cord injuries occur yearly, mostly in young people between the ages of 16 and 30, with the most frequent age being 19. Over half of them are paralyzed and confined to a wheel chair. The staggering costs associated with

spinal chord injuries can reach into the millions during the lifetime of a paralyzed person. Until recently, doctors told them to surrender hope of recovery. But this is changing, as research has made significant strides in uncovering the mechanisms of nerve cell death and enhancing nerve regeneration. The Reeve-Irvine Research Center will be at the forefront of the crusade to regenerate the spinal cord.

Opening in the fall of 1998, the Reeve-Irvine Research Center will serve as a world-class research facility aimed at studying injuries and diseases of the spinal cord resulting in paralysis or other losses in neurologic function, with the goal of finding a cure. Dealing with loss of neurologic function, the Reeve-Irvine Research Center has great potential to make advances in the treatment of strokes, multiple sclerosis, Alzheimer's, Huntington's, and Parkinson's disease. It will also function as a much needed communications base for scientists worldwide to stay apprised of each other's research.

One of the nation's leading research universities in neuroscience, UCI is a well suited home for the Reeve-Irvine Research Center. UCI houses distinguished researchers in neuroscience who have interests that are aligned with the goals of the Reeve-Irvine Research Center. Carl Cotman, Ph.D, a professor of neurology, psychobiology and psychiatry at UCI, is also the founding chair of the American Paralysis Association's Advisory Council. Known for his research on the plasticity of connections in the brain, his research focuses on recovery after spinal cord injury. Arthur Lander, M.D., Ph.D., UCI molecular neurobiologist, is studying nerve growth factors and their ability to repair and restore function to the central nervous system.

The Reeve-Irvine Research Center promises to yield advances in neuroscience leading to the recovery of spinal cord injuries. It just goes to show that scientific progress is an amalgamation of calculated design and chance events. And at the heart of it are the people who will someday benefit from its discoveries.

PHOTO: UCI COMMUNICATIONS OFFICE

From left, Joan Irvine Smith, actor/director Christopher Reeve, William J. Gillespie and UCI Chancellor Laurel Wilkening at the dedication of the William J. Gillespie Neuroscience Research Facility at the UCI College of Medicine. The Gillespie facility is the first of five buildings planned for the Irvine Biomedical Research Center, and will be home to a core group of prominent scientists who will integrate basic and clinical neuroscience in search of cures for neurological diseases. It also is the site of the Reeve-Irvine Research Center.

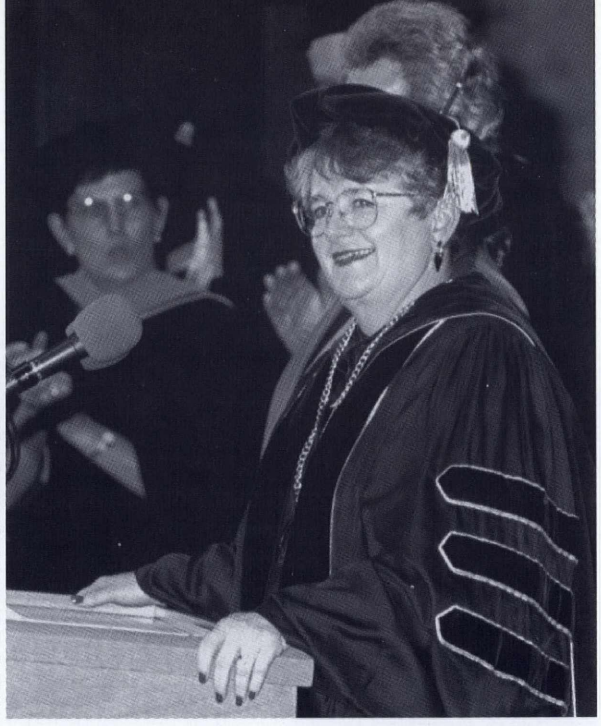


PHOTO: DON HARRIS/VICTOR SCHIFFRIN

A Conversation with Chancellor M.R.C. Greenwood

BY MARJORIE DEMARTINO

"Lucky," the Siamese fightingfish, is alive after all. It was only a lapse into suspended animation. His ribbon-like fins ripple delicately in his self-contained ecosystem, a glass cylinder with magic marbles that simultaneously emit oxygen and detoxify waste. Lucky provides a facinating segue to my conversation with Chancellor M.R.C. ("Marci") Greenwood at her office at UC Santa Cruz. Getting here requires dusting off one's pathfinder skills and crossing a foot-bridge over a gulch. It has been raining steadily all morning, which adds to the mystique. We admire the magnificent redwoods outside the Chancellor's window, then turn again to the fish in the jar. "My son named him Lucky," she says, "because he took one look and said he's lucky to be alive." With that delightful introduction and knowing a group of student leaders is next on the Chancellor's tightly packed schedule, we begin.

It takes but a moment to realize that Greenwood's influence extends beyond the vegetation that engulfs the Santa Cruz campus to the policy-making boards of Washington, D.C. to the top institutions who, along with UC, set the agenda for higher education. National leadership includes her service as President of the American Association for the Advancement of Science (AAAS), and member of the National Science Board, comprising the nation's top two dozen leaders in science and education. Both positions open doors for the Chancellor, who takes every opportunity to share "what works" at Santa Cruz with higher education and K-12 leaders. She is open, friendly, and efficient, and immediately projects a spirit of optimism. There is no doubt that she is sure of her place within the university. There is also no doubt that having graduated *summa cum laude* from Vassar College set her extraordinary career in motion. Like her Lucky, she thrives in her own ecosystem of state-of-the-art facilities among giant redwoods, with dedicated faculty and spirited students. Together with the campus community, she established the Millennium Committee, a task force to develop "a renewed consensus of our values, priorities, and opportuni-

ties for excellence," that will guide the campus into the new century. UCSC's seventh chancellor and first woman appointed to the post, Greenwood says the campus has "seasoned and matured." It is no longer an experiment. Early in her tenure (her inauguration was held May 1997), she posed four priorities to the academic senate: increasing the effective presentation of the UC Santa Cruz story; continually strengthening the quality and effectiveness of teaching, research, and management; building internal and external partnerships; and increasing assets and resources. Among the latest achievements is the establishment of the first professional school, the School of Engineering, named in honor of Jack Baskin, whose $5 million gift is the largest in campus history.

Tell me, what is your long-term vision for the campus?

I have some ideas of where the campus might go, but the vision is something that the campus and I have to develop together and we're in the process of doing that right now. We strive to be very clearly known as the best research university in the country, in which we have an uncommon interest in undergraduate education. That's our goal—to be the best research university in the country with an uncommon interest in undergraduate education. I believe this is a particular signature, a particular objective for our campus because of the way we started, by focusing on developing the undergraduate program. We added the graduate program later, and only recently added our professional schools, starting with our School of Engineering, which officially opened last year. So unlike Irvine and San Diego, which were established at the same time, we began with a collegiate undergraduate system. And because of that, we have the largest percentage of undergraduates in the system. While we are clearly a research university—all the UC campuses are—and we've recently been recognized as being number fifteen among 209 research universities in the country for the quality of our faculty—our goal is to continue to develop our reputation as a superb research university but not lose the special attention we pay to undergraduate education.

Among your immediate goals, have you set a few priorities?

My immediate goal is to encourage our research base so that we are able to open up some of the creative programs that the faculty have in mind and for which we do not yet have the resources. Unlike UCLA and Berkeley, and Irvine for that matter, we don't have as large an alumni base and consequently we don't have as big a donor base. Another obvious immediate project is the establishment of the School of Engineering. We have electrical engineering, computer science, and applied mathematics, which is an undergraduate program, and we will be adding several more programs over the next four or five years. Eventually we will have nine programs. One will be engineering management and a graduate program

THE CHANCELLOR'S PROFILE

M.R.C. Greenwood is Chancellor of UC Santa Cruz, a position she has held since July 1, 1996. As chief executive, Greenwood oversees a comprehensive teaching and research institution with combined undergraduate and graduate enrollments of 10,600 and an annual budget of $212,000,000.

Prior to her arrival at Santa Cruz, Greenwood served as Dean of Graduate Studies and Vice Provost for Academic Outreach at UC Davis, where she also held a dual appointment as Professor of Nutrition and of Internal Medicine. Previously, she taught at Vassar College where she was the John Guy Vassar Professor of Natural Sciences, Chair of the Department of Biology, and Director of the Undergraduate Research Summer Institute.

From November 1993 to May 1995, Greenwood held an appointment as Associate Director for Science at the Office of Science and Technology Policy in the Executive Office of the President of the United States, providing advice on a broad array of scientific areas in support of the President's objectives.

She is currently President of the American Association for the Advancement of Science. In 1996, President Clinton nominated her to serve as a member of the National Science Board, comprising the nation's top 24 leaders in science and education. In 1992, she was elected to the Institute of Medicine of the National Academy of Sciences. She is Vice President of the American Society for Clinical Nutrition.

She has previously served as the reporting Dean for Education, Director of the NIH Obesity Research Center Animal Model CORE Laboratory, Chair of the Food and Nutrition Board of the Institute of Medicine of the National Academy of Sciences, NIH Nutrition Study Sections, and President of the North American Association for the Study of Obesity. In 1997, she was elected to the board of directors of the California Healthcare Institute, a nonprofit public policy research organization representing leading California academic institutions, biotechnology, pharmaceutical and medical device firms.

Greenwood graduated *summa cum laude* from Vassar College and received her Ph.D. from The Rockefeller University. Her work over the past 25 years, focusing on the genetic causes of obesity, is recognized world-wide.

in network engineering, so we can utilize industry experts. Every division in the university has some kind of a major project developing right now.

In the short term, what is your biggest challenge?

Probably my biggest challenge over the next year or so will be to help the campus collectively agree to a general vision of the campus, and then of course we will be using those principles to gage our success. For example, have we gotten better as a research institution? Are our students getting a more coherent undergraduate major? Are they utilizing their narrative evaluations, their performance evaluations? Are they understanding that those prepare them for work in the real world? . . . In order to develop a vision, you have to have a process. We have convened a group called the Millennium Committee, which is probably the most concentrated body this campus or any other campus has ever had, focused on the general principles of who we are and where we are going.

Integrating your national roles into your chancellorship seems a natural extension. In what ways do these roles mesh?

I see this all as part of the appropriate role of the chancellor. By being the president of AAAS I get the opportunity to talk about our campus in a lot of different environments. And because I get asked to speak at some high profile events as chancellor, it gives me an opportunity to use examples from our campus when I'm illustrating points about an important issue in science or technology. So by being president of AAAS, I not only get to speak on behalf of the largest scientific organization in the world but I also get the opportunity to show how Santa Cruz participates in the scientific world. And that scientific world is broadly construed because AAAS includes the social sciences as well. And the other major role, and one of my priorities as president, is the quality of math and science education in the country. And so this is clearly consistent with both CAMP and the University of California, Santa Cruz, and for that matter, the whole University of California. The AAAS president has many opportunities to talk to members of the administration, to Congress, to state legislators, to teachers and opinion-makers on the importance of science and math literacy—the big issues this country faces.

What are some of the issues?

As a member of the science board, I get to help NSF set the agenda. I have a marvelous opportunity to speak to congressional hearings about important issues—not just on science and technology as it relates to the economy, but also on the important issues related to education, whether it's K-12 or undergraduate and graduate science education. It's all so tightly tied together. Right now we have this tremendous focus on K-12. It's a wonderful change, but we had best not take our eyes off continuous improvement in undergraduate education and maintaining and improving the graduate education we are providing.

PHOTO: LAURA LIDDY

In June, 1997, Chancellor Greenwood honored 30 students from Aromas School for researching and writing a children's book about UCSC and college life. In the photo above, Vanessa Moreno receives an honorary Certificate of Admission from Chancellor Greenwood.

SANTA CRUZ: HOME OF THE BANANA SLUG

- Opened 1965
- 2,000 acres of hilly terrain on Monterey Bay
- Redwood forest covers most of the campus
- Eight residential colleges shape the SC experience
- Student body: 10,638 enrolled in fall 1997—more than ever before
- New students include 48 Regents Scholars
- UCSC offers 22 graduate programs
- Graduate and professional programs acceptance rate 93%

There is a tendency to focus on one and forget the other. If we have a deficit in K-12 and we don't do the right things for undergraduate and graduate education, in ten years we'll be back talking about how we have a crisis in producing trained professionals.

Some of your concerns for higher education obviously extend beyond the undergraduate experience. What shape does this focus take?

One of the biggest concerns I have is that we need to recognize the importance of higher education in structuring student capacity for lifelong learning. People tend to think of education in bits. You get your baccalaureate degree and you've done it. Students face five to seven career changes in their life. So nothing we are going to teach them factually will serve them for the rest of their life. All we can hope to do is to teach them how to think, how to approach problems. One of the issues is coherence in the undergraduate curriculum. How do we create coherence without creating an obligating core; how do we create coherent programs in general education while maintaining the depth of the major? It's a nationwide problem. We're addressing it by thinking about the options to help students preserve their right of choice while structuring opportunities so they build on the experience from one course to another, broadening their background. For example, an engineer who is interested in multimedia might be well advised to take a set of courses in the arts.

What is the most compelling need in undergraduate education?

Money. The most compelling need is financial aid. Many of our students find the cost of college a significant problem. Our students are working on the average of 16 hours a week; we have some who work forty hours a week and carry a full load. Those are impossible challenges. Another is how are we going to maintain diversity under 209. That's a huge challenge. I think some of the new outreach programs, really partnerships with the schools, will pay off. But they aren't going to pay off for a decade, and anyone who thinks they will is wrong. We are going to see quite a substantial dip in minority students. We have to work more closely with high schools and much more closely with community colleges. We are giving more aid to transfer students than we have in the past.

PHOTO: DAVID ALEXANDER

Chancellor Greenwood hosted a reception for the members of Grupo Folklorico at University House following their performance last spring.

You also continue to carry an appointment as professor of biology; what is critical for faculty success?

A vital intellectual community is always the most important thing. I think that universities in general have had a deterioration of campus community. Everyone's life is getting busier, and disciplinary devotion often takes priority over institutional devotion. The most important thing for most faculty is to be in an environment that inspires them. That gets down to resources. Most faculty will tell you that what they don't have enough of is time. So what we need to do is invest in things that free up their time, and give them an opportunity to teach and study what they enjoy.

Tell us about the campus features you especially enjoy.

It's the people and the place. I really enjoy the students and the faculty and the staff. A campus is about people, it's about ideas, about forming the future. The real essence of a campus is who's there. We have terrific faculty and very energetic and excellent students. And unusual students, many of them. They have an independent spirit that I haven't seen as often on other campuses. The other thing is the place. This is a physically beautiful place beyond compare. It's one of the most beautiful public university campuses in the country. Just gorgeous.

Do you have any time left for hobbies?

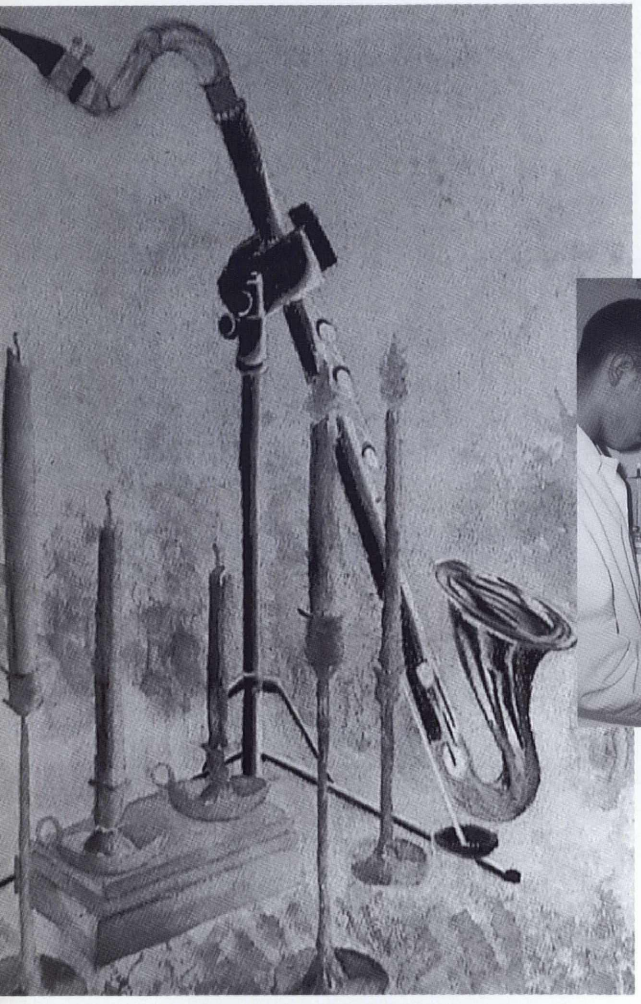
I have two blue-point Himalayan cats that I am madly devoted to: Élan, French for classy, and Darwin—what else would you expect of a biologist, right? I play golf. I am a devoted swimmer. And I like to sail and this is the place to indulge in that a little.

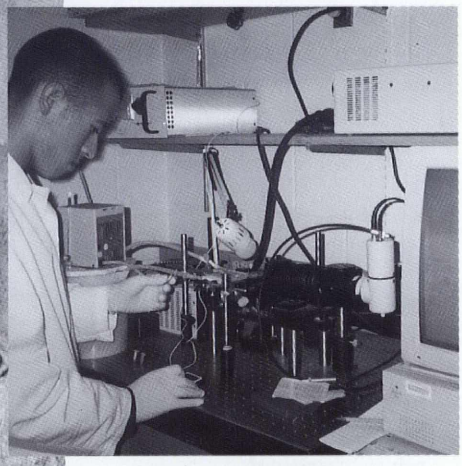
Will you leave us with a final thought?

The best piece of advice is one which I try to take myself. Conduct your life in such a way that you keep your options open. And when an interesting opportunity presents itself, take it. On personal development, young women are always asking me, when is the right time to have a baby? Who knows? I had one when I was eighteen. I don't know that I would advise others to do that, but it worked out fine for me.

CAMP participants blend science, engineering, and mathematics with creative expression in the visual and performing arts for a balanced undergraduate experience.

Science Majors & the Arts





UCI junior Andres Madrigal has won several awards for his artistic talent. Here, he has rendered one of his favorite instruments, a bass clarinet, in watercolor. He also provided the Native American portrait for our contents page. Madrigal, upper right, in the lab at MIT, where he completed a summer internship.

Jazz musician with a paintbrush

Andres Madrigal

IRVINE BIOLOGICAL SCIENCES MAJOR

Not only is he a musician (saxaphone) and artist, Andres Madrigal also enjoys photography. Madrigal has won several awards for his work in both painting and photography. He pursues research in the department of molecular biology and biochemistry under his faculty mentor, Dr. Andrea Tenner, and he participated in the 1997 MIT Summer Research Program. Under Dr. William Thilly, he investigated: *"Mitochondria mutational spectra from human lung epithelial cells."* Previous summer research was completed at the University of Alabama, Birmingham School of Medicine, Minority Medical Education Program, Dr. Nancy Hinson, mentor. He has also participated in the Ronald E. McNair Post Baccalaureate Achievement Program, CAMP Summer Science Academy, and served as a UCI general and organic chemistry tutor. He presented a poster at the 1997 national SACNAS conference. He has participated in the UCI Wind Ensemble and, before coming to UCI, won special recognition as outstanding jazz musician at the Southern California School Band and Orchestra Association Royal Jazz Festival. Other honors include the UCI Dean's List and Air Force Distinctive Cadet, ROTC. Arts awards include the Westlake Art Guild photography award and the Newbury Park High School PTA Reflections Award. Community service includes Raptor Rehabilitation and Release Program Volunteer and the Conejo Wind Ensemble and Young Artist Ensemble. Madrigal's abstract from his MIT research, *Mitochondria Mutational Spectra from Human Lung Epithelial Cells,* may be viewed on the CAMP Web page.

Tenor saxophonist Gabriel Acevedo-Bolton enjoys playing in jazz ensembles. Music is a "nice change" from doing physics homework.

Music keeps the brain 'flexible'

Gabriel Acevedo-Bolton

BERKELEY PHYSICS MAJOR

"I play tenor saxophone, starting when I was about ten," engineering and physics major Acevedo-Bolton says of his passion for music. "In high school I started taking private jazz lessons and played in the Davis High Jazz Band." Performances have taken him to Victoria B.C., New Orleans, Monterrey, and Los Angeles. He also plays electric base. And he has a new instrument to explore. "While in Australia, as part of the exchange program, I picked up a didgeridoo, a native instrument consisting of a tree branch which has been hollowed out by termites, and is played by 'buzzing' lips." He says that the didgeridoo has a mystical quality when played by experienced players. Currently Acevedo-Bolton plays in the UC jazz ensembles, and to gain a better foundation for improvising, is taking an improv workshop. He says, "I have seen some of the science behind music, but for me personally music has always filled more of an emotional role—a way to express myself artistically." He plans to play saxophone "always," and continue to play other instruments through graduate school. He adds, "Music offers a nice change from homework sets and keeps my brain flexible."

Faculty-mentored research resulted in a co-authored paper, *High Amplitude Pulsatile Flow in a 2-D Model of Stenosed Human Carotid Artery,* Gabriel Acevedo-Bolton, Shilpa Shroff, Dorian Liepmann. The abstract may be viewed on the CAMP Web page. He is a tutor in the Physics Scholars Program (see page 30).

Acevedo-Bolton has been accepted for admission to Caltech for the Bioengineering graduate program. He also applied to MIT, Harvard, Johns Hopkins, University of Washington, and UC Berkeley.

Rhythmic gymnast teaches "Kids In Motion"

Cheryl Lynn Cox

BERKELEY PHYSICS MAJOR

Sophomore Cheryl Lynn Cox is a UCB physics major who has found other avenues of expression through acting, dancing, and rhythmic gymnastics. She is seriously considering a minor in the dramatic arts, concentrating in acting. Additionally, through rhythmic gymnastics, Cox has had the opportunity to travel, participating in international competitions and ranking in the top 15 in the nation. In 1996, she came close to fulfilling one of her life-long

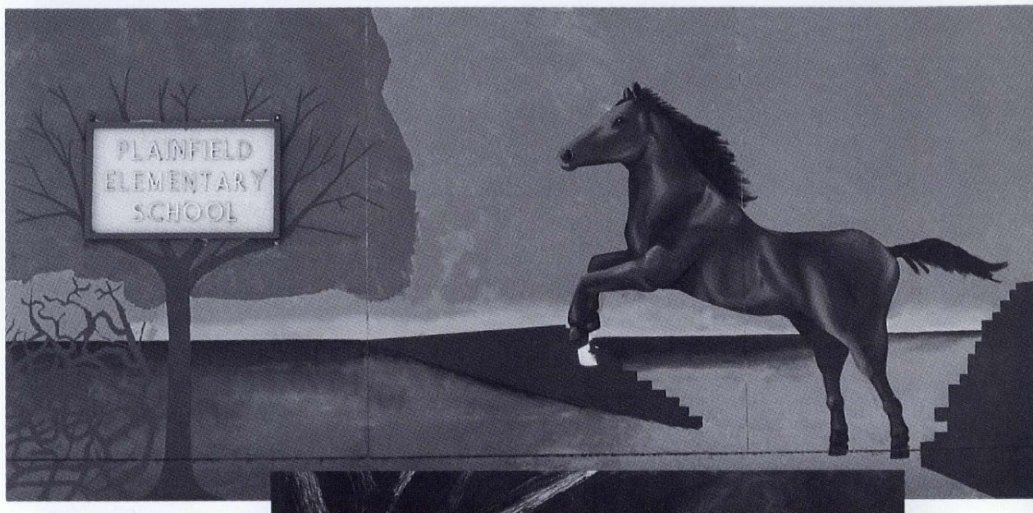
Rhythmic gymnastics is but one creative outlet for physics major Cheryl Lynn Cox, who also tutors in English and acts in the Black Repertory Group at Berkeley.

goals—to compete in the Olympic Games—just falling short of one of two open slots on the 1996 team. Cox also tutors in English for the America Reads "I have a dream" program, teaches artistic gymnastics at Kids In Motion, choreographs and dances for Danceworx (a student-run dance group at UC Berkeley), acts through UC Berkeley's dramatic arts department and the Black Repertory Group. She attributes much of her success to the CAMP-sponsored Physics Scholars Program (PSP) for fostering her explorations in the various genres that interest her and push her to excel—especially in physics. She says, "there is a legacy of excellence and achievement in my family." She adds that PSP is helping her lay the foundation for a future in experimental physics, engineering, medicine, or wherever her aspirations may lead.

Art and physics: curiosity and inquiry

Timothy McIntosh

DAVIS DOUBLE MAJOR: PHYSICS AND STUDIO ART



The mural at Plainfield Elementary School offered Timothy McIntosh, UC Davis junior, an opportunity to work with sixth-graders. He took the lead on a group project that resulted in the painting at right.

"I decided to double major after taking several art classes. In the fall of my second year, I took a technical drawing class with David Hollowell, an experienced figure artist. The final assignment was a group project that had to be no less than six feet across and four feet high. I quickly took control of the group. Ultimately we were amazed—and we amazed the rest of the class with our unified result: chair and light bulb watching a lighting storm. Professor Hollowell suggested we donate it to a school in Woodland, a nearby town, which his children attended. Part of my interest in the donation was that I would be able to present it to a class and teach them about making the piece. I went back to the class for the rest of the year and continued into this school year. Shortly after beginning my art instruction at Plainfield Elementary, I was asked to do a mural for the school, a horse jumping through a brick wall.

Working with children is great because it is easy to teach them. I like sixth grade especially because they are at a point where they can begin to understand complex ideas but they haven't had years of training to mute their creative minds. While working at Woodland I was amazed at the level at which the kids could understand the ideas I presented. Soon I was repeating some of the lecture from my college art classes. I see myself in every question the kids ask and remember when everything had the power to awe me. I am finding that this curiosity is terribly important to being a scientist. It is too easy to be caught up in procedures and publishing, and the technical aspects of research and science.

I find that it is pointless to learn things if you aren't interested in what it means and where the knowledge fits into the world. When I do research with my mentor in the MURPPS program, I let myself go back to when I was curious about everything. I always hear comments about how art and physics don't seem to fit well together but doing

both, I don't see how they cannot be together in me. Art is an expression of curiosity about the world and physics is an inquiry into the world. My mom used to call me a Renaissance man when I was young. Now she tells everyone I have always been trying figure out a way to save the world. She is incorrect about one aspect though—I have been trying to figure out how the world works."

McIntosh's faculty mentor is Professor Richard Scalettar. His research addresses characterization of magnetic field phase transitions in Type II superconductors.

In touch with her heritage

Claudin Gomez

RIVERSIDE BIOLOGY MAJOR

UCR junior in biology and a dancer, Claudin Gomez has received CAMP stipends to support her research under Dr. Prue Talbot, her faculty mentor. She presented her research, "Effect of KCN on Oocyte Pickup Rate by Hamster Oviducts," at SACNAS. She has been researching the effects of smoking on the female reproductive system with Dr. Talbot, professor of biology. Gomez has a particular interest in this research project because her career aspirations include educating women of color about gynecological health issues. She says, "What actually convinced me to major in biology was realizing that women, especially minority women, often do not receive adequate medical attention. I realized that many minority women don't seek the medical attention needed because of financial problems, inhibition, or religious beliefs. I could someday reach out to minority women and make a difference." Regarding her relationship with her mentor, she says, "It has made me more confident in my work, and I appreciate research so much more. I now know the long hours and dedication that a researcher puts into his or her work." Gomez has been a CAMP Research Fellow since June 1997 and presented her research at the 1997 SACNAS national conference. She dances with the group Ballet Algeria, which placed 2nd at a recent competition in Palm Springs. Mexican folk dancing puts her "in touch" with her heritage.

Future medical practitioner, Claudin Gomez enjoys performing with her dance group, Ballet Alegria. Whether promoting cultural appreciation through dance or providing health information to women, Gomez intends to make a difference.

GENOTOXIC RISK

UC Riverside CAMP Students Gain Research Experience in Environmental Toxicology

BY ANDREW J. GROSOVSKY

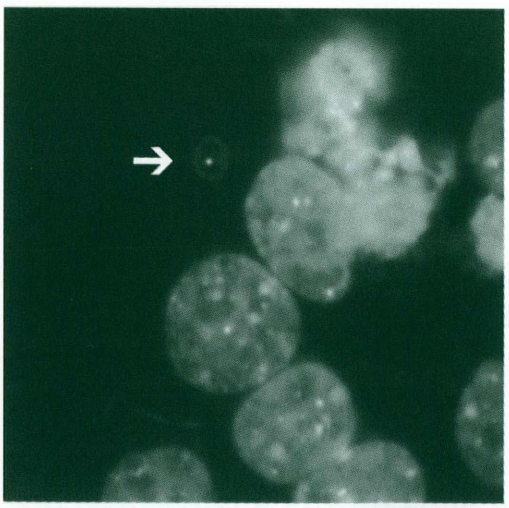
In the lab: Marissa Vasquez, left, with Dr. Andrew Grosovsky and Sylvia Garcia, a graduating senior in biology. Garcia also conducted research with CAMP support under Grosovsky, resulting in "Evaluation of Chromosomal Scale Deletions Caused by Low-dose Radiation Exposure in a Human Cell Line."

Research in my laboratory focuses on molecular and cytogenetic response of human cell exposure to environmental carcinogens. We were fortunate enough to have two CAMP students, Sylvia Garcia and Marissa Vazquez, participate in different aspects of this research. While Marissa and Sylvia gained valuable experience, the senior members of my laboratory and myself had the satisfaction of helping them to develop their research skills, and prepare for their presentations at the conclusion of the summer CAMP program. Marissa was also invited, and provided financial support, to attend a national research conference for undergraduates in Houston as a result of her experience.

Genotoxic risk, including the potential for carcinogenesis and birth defects, invokes substantial public concern. The need to understand the risks that these agents pose to human health is clear. The definition of biomarkers which can discern agent specific genotoxic damage can significantly increase the ability to detect low level effects. In addition, a fundamental understanding of the biological effects of the agents in question can be useful in developing such biomarkers, and in the formulation of risk estimates. Our approach is to utilize selectable markers as reporter genes for detection of point mutations, deletions, and loss of

heterozygosity events which also affect linked tumor suppressor loci. Unique patterns of mutation have been identified by molecular mapping and cytogenetic studies in mutants induced by prototype agents in controlled laboratory conditions. These mutagen specific patterns may ultimately be useful in retrospective investigation of tumors in populations exposed to agricultural and other environmental carcinogens, and in prospective population monitoring using selectable markers in blood cells.

Several types of agents are used for these studies. These include alkylating agents, which are important agricultural and environmental chemicals found in contaminated foods and beverages, in ground water, and in tobacco smoke-polluted environments. In collaboration with faculty in the Statewide Air Pollution Research Center, we are also investigating a variety of polyaromatic hydrocarbons (PAH)



Analysis of micronuclei induced by exposure of human cells to environmental toxins. Micronuclei may contain whole chromosomes or chromosomal fragments resulting from DNA damage.

which are emitted directly into the atmosphere from pollution sources, or which are formed following photooxidation and other chemical transformations occurring in the atmosphere. Marissa's research has involved measurement of mutations induced in human cells grown in culture by atmospheric PAH. She worked very diligently and became conversant in these scientific issues and methodologies, and learned about the excitement frustrations of scientific research. She clearly has an abundance of the necessary academic and personal skills to be effective in her stated career goal as a physician within underserved communities.

Among many environmental concerns, exposure to ionizing radiation exposure has been a particular and longstanding focus of research interest. Recent studies have investigated the mechanisms of genomic instability in human cells, which refers to an elevated rate of acquisition of new genetic alterations. It has emerged as an important focus of contemporary carcinogenesis research. Our investigations of genomic instability suggest a model involving critical chromosomal aberrations. Sylvia was directly involved in this aspect of our studies, learning techniques used for analysis of alterations in chromosomal structure. Similar techniques are used in routine screening of cells for pre-natal diagnosis. These skills will be useful to Sylvia's goal of establishing a clinic to provide health care to underserved communities, particularly to children.

Studies on the molecular mechanisms of mutagenesis have also been a longstanding interest. Our objective has been to advance mechanistic understanding of human cell response to DNA damage, and identify molecular genetic fingerprints which distinguish induced mutations from the spontaneous background. Sylvia also developed molecular biological techniques for mapping deletion or recombinational events associated with mutations.

We were delighted to provide a research opportunity to bright undergraduate interns through the CAMP program. I look forward to hearing great things from Sylvia and Marissa as they pursue their academic and career goals in the future.

ANDREW J. GROSOVSKY RECENT PUBLICATIONS

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Dobo, K.L., Eastmond, D.A., and A.J. Grosovsky, Sequence Specific Mutations Induced by N-Nitrosodimethylamine at Two Marker Loci in Metabolically Competent Human Lymphoblastoid Cells. In press, Carcinogenesis (1998)

Frantz, C.E., Smith, H., Eades, D.M., Grosovsky, A.J., and D.A. Eastmond, Bimolane: In Vitro Inhibitor of Human Topoisomerase II., Cancer Letters, 120:135-140 (1997)

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Giver, C.R., and A. J. Grosovsky, Single and Coincident Intragenic Mutations Attributable to Gene Conversion in a Human Cell Line. Genetics,146: 1429-1439 (1997)

Grosovsky, A.J., Parks, K., Giver, C., and Nelson, S. Clonal Analysis of Delayed Karyotypic Abnormalities and Gene Mutations in Radiation Induced Genetic Instability. Molecular and Cellular Biology, 16:6252-6262 (1996)

Grosovsky has a doctorate in radiation biology from Harvard University. His academic career began as a research assistant at Harvard Medical School. He was a research fellow at the Harvard School of Public Health; research associate and later assistant professor at York University; and is an associate professor, Environmental Toxicology, UC Riverside.

BERKELEY'S

Physics Scholars Program

PARTICIPANTS ARE

teachers and learners

By Colette Patt

One too many students had hit the wall: introductory physics. The Minority Engineering Program (MEP) director was determined to get her students over it. She knew that a student who didn't master the concepts in lower division physics courses would struggle through the entire engineering major. She decided to find a way to help engineering students do well in the three introductory physics courses, Physics 7A, 7B, and 7C.

In collaboration with Andy Elby, then a physics graduate student, she experimented with a new approach to teaching. Elby's special discussion section, which enrolled mostly MEP students in 1993, focused on helping students "scale the wall" of introductory physics. It improved their conceptual understanding and developed the students' problem-solving. Some of these techniques were already in use in calculus classes, but before Elby, nobody had attempted them in physics. In the 1980s, Uri Treisman, who pioneered the collaborative learning model at Berkeley, demonstrated that it worked in calculus with impressive results. Could these and similar techniques work in physics?

When UC Berkeley joined the California Alliance for Minority Participation in 1994, it was clear that developing the teaching methods and expanding the reach of these fledgling sections in physics would be a top priority. Over the past four years, the intensive discussion sections (IDSs), as they are called, in physics and chemistry have become the cornerstone of CAMP's activities in the physical sciences. UCB CAMP has trained graduate student instructors to use Elby's approach to teaching, fine-tuned the worksheets for physics problems, acquainted the faculty with the IDS model, expanded the IDSs from Physics 7A to 7B and 7C, and modified the teaching techniques.

"PSP is a haven. They encouraged me to apply for the internships that I thought I wasn't worthy of. They gave me the job that I wasn't sure I could do. Most importantly, they stopped me from ever saying, 'I can't.'"

—Jan Bacchus

The expansion of these activities led to their formalization and institutionalization as the work of the Physics Scholars Program (PSP), now housed in the Physics Department. PSP supports several upper-division physics courses, sets up study groups, provides tutoring, offers workshops for the GRE and applying to graduate school, gives access to graduate mentors, steers students to research opportunities, and sends students to

conferences to present their scientific findings. Coordinated by Mia Ong Wenbourne, PSP is now an ongoing project, complementing Berkeley's long-established programs in mathematics, the biological sciences, chemistry, and engineering.

One of the unanticipated outcomes of the IDSs was the tremendous demand for them shortly after they became a regular feature. Graduate student instructors were forced to run lotteries and devise schemes for restricting admission to their sections, as PSP experiment to expand the IDS model. He explained, "We knew from the IDSs what worked to better help these small groups of students learn physics. Why not make the same thing available to all students? We're now doing that and the results are dramatically impressive. We're also working to convert our other courses to this new format."

While the mainstreaming of the PSP techniques is being piloted, the PSP intensives go on, winning positive reviews from students and showing good results. In part, this is attributable to the kind of students who participate in the IDSs—honors-level sections, demanding, rigorous, time-devouring sessions of hard thinking. The students who take them may not be pre-destined to do well in physics, sometimes coming from high schools without strong physics curricula, sometimes starting their undergraduate years without AP high school physics, but most of them are determined to succeed. The IDSs capitalize on the power of the students' will. As former-PSP graduate student instructor David Ponce-Marquez explains, "Minority undergraduates are not different from any other people. Once they realize that they can learn physics as well as the next person, there are no bounds to them doing whatever they want to do."

A remarkable feature of the PSP IDSs is the inclusion of undergraduates on the teaching teams. The third session of the IDSs, homework and exam reviews often are taught by exceptional undergraduates who work as in-class aides to the graduate student instructors. They also are paid to be head tutors and study group leaders. Mostly, these are students who have been through the program themselves. Their involvement in the advancement of others invigorates their own intellectual work by challenging them to better understand the course material and by connecting them to like-minded scholars.

Tutor Skip Bettencourt, right, with students Gelberg Rodriguez and Ricardo Ibarra, in Physics 7A intensive discussion section.

simply couldn't accommodate all the students who were willing to devote the extra hours. To meet the demand, the Physics Department, in 1996, began a two year experiment to apply several of the IDS techniques to all sections of Physics 7A and 7B.

This dynamic experiment foreshadows a new way of teaching physics at Berkeley and elsewhere. Dr. Bruce Birkett, a faculty member who taught a PSP IDS, spearheaded the National Science Foundation-funded

Ian Bacchus, a physics major in his senior year, and currently a third ses-

Dionne Harris is a junior physics major and program participant.

sion instructor for Physics 7A, tells how the Physics Scholars Program affected his education, "PSP takes you through an undergraduate physics career. It starts off teaching you the subjects and the concepts that are needed to learn the fundamentals of physics, then it provides the help necessary to fine-tune those ideas. And once you have a grasp, it asks you to do the same for someone else, which cements it. When I can get the point across, it is a real affirmation that I'm in the right major."

He adds, "PSP is a haven. They encouraged me to apply for the internships that I thought I wasn't worthy of. They gave me the job that I wasn't sure I could do. Most importantly, they stopped me from ever saying, 'I can't.'"

Bacchus is excited about his current position as an instructor for PSP because after several years serving as a tutor, it brings him to a point of achievement he hadn't anticipated. "The job that I have as an instructor in a 7A section means the most to me because the person who made me want to switch to physics was my Physics 7A discussion leader. I remember thinking that it would be great to have that command of the material. I remember looking at him in awe." As an instructor, he has come full circle.

Like other students in the program, Bacchus has found the opportunities available through PSP useful for his professional development. Through teaching and presenting his research at AMP conferences, Bacchus has found his place in the academic world. He says, "When I was at the National High Magnetic Field Laboratory, [at an AMP conference] I found out about a similar lab in Grenoble. I speak English and Spanish and I've always wanted to learn a third language and to travel. So next semester, I am taking a French class and hoping that I will be able to arrange an internship at Grenoble, France, for Spring of 1999 before entering graduate school."

PSP has been instrumental in identifying underrepresented minority students with promise in physics and has helped them meet their own highest aspirations. Another participant, David Ponce-Marquez says, "To really undertake physics you have to love it. The passion for physics is individual, but PSP helps in identifying it in people."

—Colette Patt, Ph.D., is the UC Bekeley CAMP program coordinator. For more information on the Physics Scholars Program, contact Maria Ong Wenbourne, coordinator, 510-643-3813 or e-mail: mwenbour@uclink2.berkeley.edu

Community, Goals, Research & Career Development

VIRUSES
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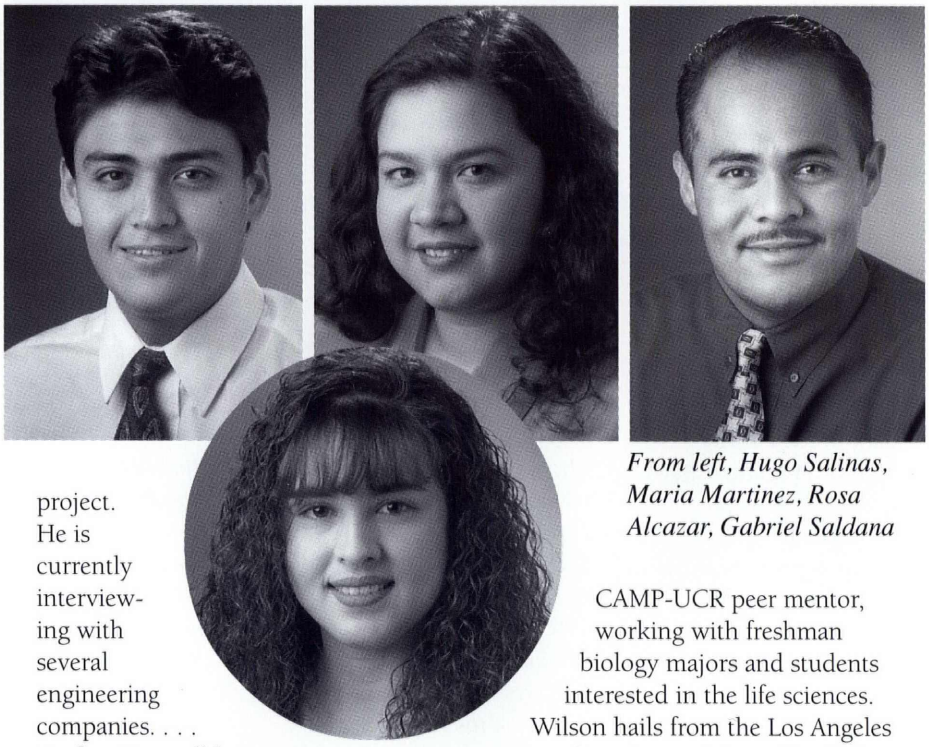
expressed in the early embryo. This virus is not competent to replicate but will infect local immune cells of the uterus and suppress the initiation of immune recognition. However, as remarkable as this proposal may seem, this type of relationship is not unique to placental mammals. There exists another completely different genomic virus in hymenoptera insects that is also expressed along with an egg whose role is also to suppress the immune recognition of a host in addition to other effects. This virus is known as polydnavirus, which are made in the ovaries of most parsitoid wasp species. This virus is injected along with the wasp egg into host larvae. The virus infects the parasitized larvae and prevents phagocytic cells from attacking the egg. The virus does not replicate in the larvae but does cause larval cells to express polydnaviral genes. In a very real sense, polydnaviruses are a natural system of gene therapy. In addition, there are no free living versions of polydnaviruses viruses known. They are all genomic in the hymenoptera species, suggesting that their relationship with the parasitoid wasp host dates to the beginnings of this life style of wasp.

These two situations appear to be examples of a persistent virus that can provide a new function for the host and allow new life strategies. I have called such a virus a 'metavirus' for it transcends the distinction of virus from its host. This concept raises a broader question about how viruses and their more defective cousins, such as plasmids or retroposons, can allow rapid host adaption. Viruses can pose a major evolutionary dilemma for the host. In some cases they can evolve at rates up to a million fold greater than that of the host. Given this enormous advantage in adaption, how is the host ever to stay ahead of potential viral parasites? This seems an

RIVERSIDE

CAMP-UCR congratulates June 1998 Graduates: Mechanical engineering major, **Hugo Salinas,** entered college undeclared. He explored courses in mathematics, computer science, and physics before deciding on engineering. He has learned that you have to look for guidance, be assertive, and attend faculty office hours because "it is the best place to learn." Salinas sees engineering as "a stepping stone to opportunities," and has applied to several graduate programs in engineering. A CAMP research fellow, he was a summer intern at Shell Oil Company. Research projects include the development of an adaptive learning control system for particle flocculation in water and wastewater. Salinas is completing his senior design project, "The Renewable Energy House," which will utilize solar and wind sources. . . . Biology major **Rosa Alcazar** pursues research interests in gene expression, gene regulation, and developmental genetics. Alcazar's honors and activities include being a McNair Scholar, University of New Hampshire; CAMP research fellow and CAMP chemistry study group facilitator; her research is "Mapping the Mut-2 Mutator Gene in the Model Organism *caenorhabditis elegans.*" She has received admission to John Hopkins University and UC Berkeley for doctoral studies. Both have offered excellent fellowships. Decisions, decisions! . . . Environmental engineering and Spanish double major **Maria Martinez** has received Chancellor's Honors. She was a Ford Motor Company intern as well as CAMP research fellow. Senior design project: "Microbial induced viscosity reductions of crude oil." Martinez's plans a career that will include addressing environmental concerns at the U.S.-Mexico Border. . . . Physics major **Gabriel Saldana** has participated both as a CAMP research fellow and a CAMP-Teacher Preparation (TP) fellow. He conducted research at UCI in the department of physics. Teaching high school physics and mathematics is Saldana's career goal. . . . **Roberto Arellano** has an internship with DIP, Inc. and will be graduating with an electrical engineering degree. Arellano is a CAMP research fellow and his current research is on PCB board design for the soccer-robot project. He is currently interviewing with several engineering companies. . . . **Carlos Cao** will be graduating with a degree in biology and a minor in ethnic studies. He has been admitted to the public health program at UC Berkeley with a research fellowship. Scholastic excellence has consistently earned him a place on the Dean's List during his undergraduate career at UCR. . . . **Francisco Renteria** will be graduating with a degree in biology. He has received admission to five doctoral programs in molecular biology, including the University of Wisconsin and UC Davis. Renteria will be pursuing an interdisciplinary program in virology to study HIV and lupus. He has participated in summer research programs at Harvard University and UC Davis. Graduating senior **James Blake Wilson,** B.S. biology, has had an exciting spring quarter, interviewing with select medical schools. He will enroll at George Washington University Medical School in Washington, D.C. His plans include a public health degree as well as an MBA. A University Honors Program participant, Wilson served as a CAMP-UCR peer mentor, working with freshman biology majors and students interested in the life sciences. Wilson hails from the Los Angeles area, where he participated in *College Bound*, a program for academically motivated African American students, through which he earned college course credit in summer 1993 at Stanford University. He hopes someday to build hospitals for underserved communities.



From left, Hugo Salinas, Maria Martinez, Rosa Alcazar, Gabriel Saldana

Marissa Vasquez (please see page 28) has interviewed for admission to the graduate public health program at Loma Linda University, where she will pursue a specializatioin in occupational health. She is particularly interested in serving rural communities, and providing college information to high school students who are isolated in remote communities.

Diligence & Growth

Bright futures await these UC San Diego undergraduates

science program CAMP ucsd for chemistry & physics majors

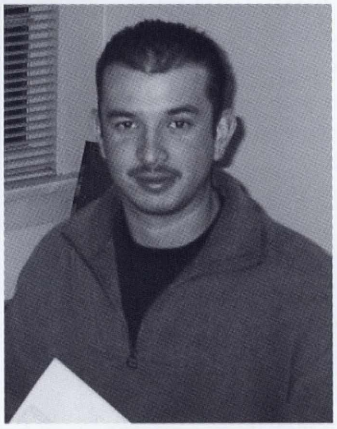
Michelle Stringham is a member of the Golden Key Honor Society and CAMP. She graduated in the top 5% of her high school class in 1995 and is pursuing a B.S. in biochemistry/chemistry. She received Provost's honors and is on the Dean's List. Stringham has served on the John Muir College Judicial Board and the Residents' Council.

MICHELLE STRINGHAM *Biological Sciences*

"As a current participant in the Faculty Mentor Program, I have had my first major exposure to various research projects at the Language Research Center. I am doing a Neuroscience 199 (independent study) under the supervision of Dr. Doris Trauner and her research assistants. I am proud of my contribution to this research project. My work concerns the administration and scoring of the WISC-R (Weschler Intelligence Scale for Children-revised) and the CELF-R (Clinical Evaluator of Language Fundamentals-revised) on a control group and on a group of language impaired children. The data from these tests, in conjunction with other tests (dichotomy, chimeral images) will be used to evaluate information processing capabilities. Recent research suggests that information processing deficits are the underlying cause of specific language impairment. This data will be related to brain structure and function through data obtained from an MRI.

One of my major extra-curricular time commitments is at the UCSD Medical Center in Hillcrest. I volunteer in the

Stringham continues next page



Julio Alonso transfered from Southwestern College, where he earned his A.A. degree. He plans to graduate from UCSD in summer 1999. To unwind he practices Tang Soo Do, in which he holds a first degree black belt. Alonso's career objective is to become a "productive and successful researcher" in the medical field.

JULIO ALONSO *Biochemistry/ Chemistry*

"I am a biochemistry/ chemistry major and the CAMP Peer Counselor at UCSD and I maintain and update the internship and scholarship resources software. As peer counselor I am able to inform students about different internships, scholarships, and upcoming events. It gives me great satisfaction to not only talk to students but to motivate and encourage them.

I am also responsible for outreach on and off campus, including public speaking and newsletter production. Training students on e-mail and Internet use is another of my activities, as well as assisting in the development of course material resources.

As a Ronald E. McNair Program Research Fellow, I am working on colon cancer at the UCSD School of Medicine with Dr. John Carethers. The lab is specifically looking at juvenile polyps in colorectal cancer and the inactivation of receptors TGFB1 RII. If the inactivation leads to cancer then it would give a probable pathway by which cancer proceeds."

Alonso continues next page

Stringham continues from previous page

Central Services department, specifically in the OR instrument workroom. My duties there include preparing items for sterilization, accounting for all instruments in the surgical equipment sets, delivery of items to the operation rooms and other departments, and helping transport patients. I enjoy volunteering in this department and the friendly and capable staff.

My career goals include medical school and then pursuing a career possibly in biomedical research. I am also looking into graduate schools in one of the life science fields."

Alonso continues from previous page

ABSTRACT

MOLECULAR PATHOGENESIS OF COLONIC FAMILIAL JUVENILE POLYPS.

JC Alonso, BM Lopez, AF Zigman, WS Jo, HD Appleman, CR Boland, and JM Carethers. University of California, San Diego.

Familial juvenile polyposis syndrome (JPS) is an autosomal dominant disorder characterized by the presence of multiple juvenile polyps throughout the colon. Patients with JPS have up to a fourfold risk for adenocarcinoma of the colon compared to the general population. Recently, we have discovered the presence of microsatellite instability in the normal-appearing surface or cystic epithelium of some polyps, a surrogate marker for inactivation of the DNA mismatch repair (MMR) system. These findings indicate that histologically normal tissue may harbor microsatellite alterations, and suggest that inactivation of the DNA MMR system may contribute to the elevated risk of these polyps to develop adenocarcinoma. We will determine whether other genetic sequences, particularly those contributing to the pathogenesis of microsatellite-unstable colorectal cancer, might be responsible for the pathogenesis of familial juvenile polyps.

"Michelle Stringham and Julio Alonso have impressed me with their diligence and growth. For both, I see exceptionally bright futures. I want to acknowledge their accomplishments in reaching this level and in aspiring to the next (and the next and the next)."

—Sarah Richards-Gross, CAMP Coordinator, UCSD

VIRUSES continues from pg 32

impossible task. However, if we consider the strategy of persistence of parasitic agents as a very selected or fit relationship, we can offer a solution to this dilemma. Viral like parasites may themselves be inventing the new identities that allow host evolution. Consider for example the evolution of bacterial systems of antiviral immunity. This is principally the restriction modification system found in most bacteria in which one modification enzyme chemically alters the DNA while another restriction enzyme will degrade unmodified 'foreign' DNA. How was this system invented as it requires the simultaneous creation of two independent enzyme activities? We now know that there exist parasitic and persisting plasmids of *E. Coli,* that code for both restriction and modification enzymes.

Together, these two genes compel the infected bacteria to persistently maintain the plasmid. If this parasitic plasmid is lost from the host bacteria, the remaining restriction activity will degrade the now unmodified bacterial DNA and destroy the bacteria. In a sense, this parasitic plasmid provides both a genetic poison and the antidote that forces persistence. However, once the bacterial host is persistently infected with such a parasitic plasmid, it has acquired a new molecular genetic system of DNA identification and will be immune to the infection of other viruses or genomic parasites that are not similarly modified. Thus a persistent infection can provide a critical adaptive function (immunity) to the host. It seems likely to me that if we look carefully, we will see the footprints of persistent viruses that were involved in the invention of the amazingly adaptive immune system of vertebrates.

It therefore appears that **virus and virus-like systems may be contributing** in a most profound way **to the evolution of their host.** An early view from Salvador Luria had envisioned a similar conclusion. When considering the issue of how a virus might contribute to the host, he wrote "... may we not feel that in the virus, in their merging with the cellular genome and their re-emerging from them, we observe the units and process which, in the course of evolution, have created the successful genetic patterns that underlie all living cells?" Thus we may wish to reconsider the architecture of the tree of life. Rather than thinking of it as a tree with the usual structure of unconnected tips from a common branch, perhaps a structure more reminiscent of that done by Mexican artisans rendering of the 'arbol de la vida' in which horizontal elements, bearing images of both life and death, are connecting the tips may better account for the contributions of viral agents to host evolution.

BUILDING ACADEMIC MORALE

CAMP Program coordinators provide motivation and heart, as well as opportunities for student development

"My career interests have always been centered around teaching and counseling students." —Teresa Cofield

TERESA COFIELD: RIVERSIDE

"What gives me the most satisfaction is working directly with students."

Cofield has a B.S. degree in mathematics with an emphasis in economics, and has completed a year of graduate studies at Penn State. With this background, she plans and implements the CAMP program at Riverside, as well as provides academic counseling to participants. During the academic year, she organizes a series of workshops and seminars that include faculty participation, and coordinates peer tutoring. Her short term goal is to increase participation in conferences and teacher preparation activities. During the summer, she assists with the core of CAMP at Riverside, the five-week bridge program in math and chemistry for entering freshmen and the eight-week residential summer research program for upper division students. Cofield brings insights and understanding to CAMP students based on her personal experiences. During her year at Penn State, she was a graduate teaching assistant and served as a program counselor for the Pennsylvania Space Grant Consortium, a NASA funded program for high school students. Family commitments have necessitated her taking time out from her studies. UCR students benefit not only from her motivation, but also from her pragmatic tried-and-true guidance. At UCR, she has been a recipient of staff incentive awards for her work in CAMP and in peer counseling. During her undergraduate career at UCR, she was a Grad/Track Program research intern. Her long term goal is to complete a Ph.D. in economics, to teach at the university level, and to mentor undergraduates. She says, "My career interests have always been centered around teaching and counseling students."

MARY GONZALEZ-HOWARD: LOS ANGELES

"I rigorously promote academic success and the overall student academic health and morale."

Gonzalez-Howard manages all aspects of the National Institute of Health/Minority Scientist Development and CAMP Research Program, CARE Mentor Program, CARE Summer Scholars Program, and the Howard Hughes Honors Undergraduate Research Program, including assisting with budget and annual reports. She assists faculty and students in seeking supplemental funding from private, federal and state sources, and meets with a diverse student population individually and in-groups to assess needs and provides academic counseling. "I give special attention to advising

students on all aspects of the graduate school application process," Gonzalez-Howard says. Promoting cooperation is also a priority, and she maintains communication and close coordination with tutorial, honors and counseling programs as well as academic departments. Development of the CARE homepage on the World Wide Web also comprises her territory. Before coming to CARE and CAMP in 1995, Gonzalez-Howard worked in the UCLA Cardiomyopathy Clinic and served as program assistant for University Extension's business and management courses. Her experience at UCLA has also included such student-centered service as orientation counselor and campus tour guide. She knows the UCLA campus inside and out and enjoys sharing its history and all aspects of the campus environment. A Bruin "through-and-through," Gonzalez-Howard was a management assistant in the UCLA Store Bearwear Department for four years as an undergraduate. She earned a B.S. degree in physiological science from UCLA in 1994. She is the first in her family to graduate from college.

"I see a great part of my role as being a resource for our students. Someone that they can feel comfortable communicating their needs, concerns, dreams, and goals." —Marlene Robinson

MARLENE ROBINSON: SANTA CRUZ

"What I enjoy most is being the liaison between our students and our faculty or administrators."

In her position with the Dean's Office, Division of Natural Sciences, Robinson serves as a liaison between students and various student programs, faculty and the campus community. This is a new field for her, coming as she does from the more fiscally related aspects of university business, but she is enjoying the expanded contact with faculty and students in an array of settings, including attendance at conferences such as the national AMP conference held in New Mexico last summer. Student interaction opens new horizons and challenges to Robinson. "As the new coordinator, my immediate goal is to continue to strengthen our bridges with the various campus student services as well as our existing divisional student programs. In doing so, I hope to assist in creating a path for our science undergraduates that clearly defines the resources available to aid them in reaching their academic goals. In addition, I would like to increase our efforts to expose our students to the many opportunities in science and engineering research. Whether it is through an academic year or summer internship with a faculty mentor or through industry, these experiences help to optimize their educational experience."

Previous positions at UCSC have prepared her well for managing the various aspects of CAMP. She has worked in the Natural Sciences Business Office, where she monitored federal, state and gift research grants for faculty researchers; in the Student Organization Advising and Resources office; and at Porter College, where she was assistant to the Provost. She also worked at UC Davis, providing financial and administrative assistance in the dean's office at the School of Medicine and the School of Engineering.

"This job has been one of the most rewarding activities in my life. I have been able to help others work toward their personal and professional goals. It is my hope that it will continue to grow, improve and provide valuable services to students for many generations." —Mary Gonzalez-Howard

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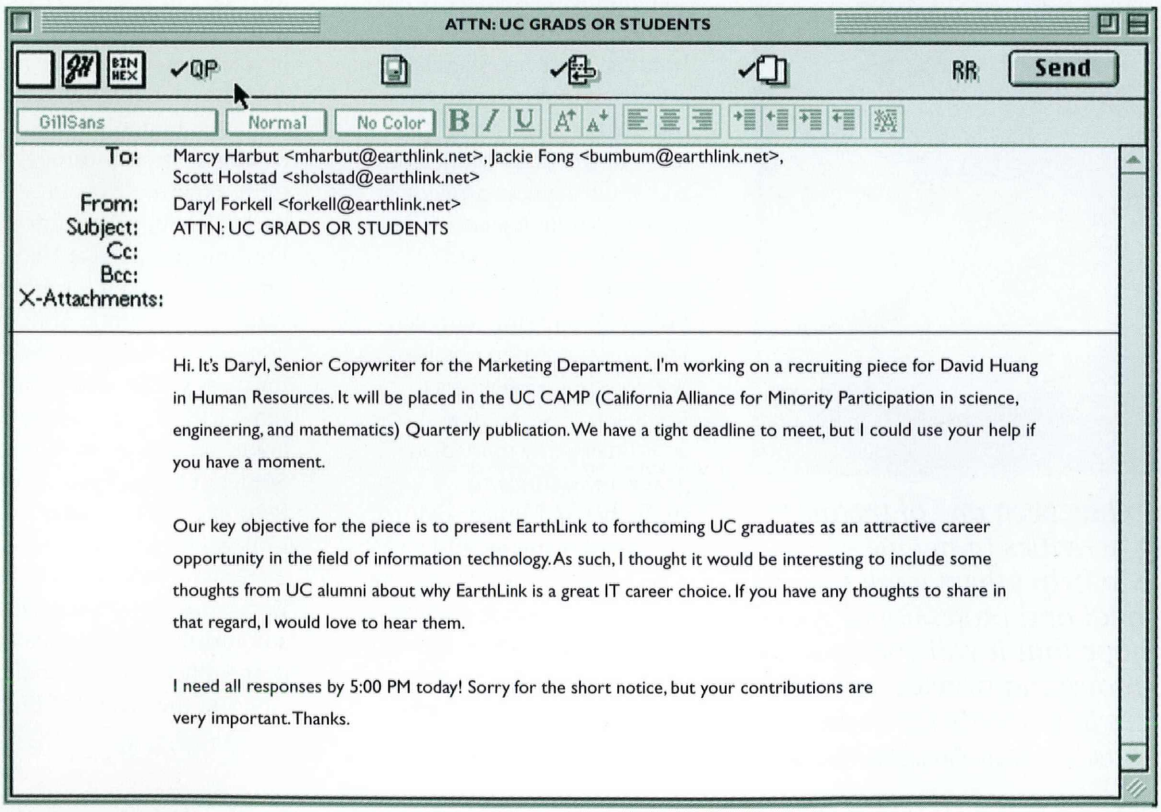

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To: Daryl Forkell <forkell@earthlink.net>

From: Marcy Harbut <mharbut@earthlink.net>
Subject: Re: ATTN: UC GRADS OR STUDENTS
Cc:
Bcc:
X-Attachments:

As an employer, I believe EarthLink gives new college graduates the best of both worlds: the close-knit community of a young and hungry start-up along with all the amenities of a real company, such as paid vacation time, company-sponsored events, and most important, staff development programs. In particular, EarthLink's Information Technology division invests heavily on employee training. The company makes sure to provide numerous educational resources and opportunities to its employees as a way to promote their technical and professional growth. EarthLink is growing at a tremendous rate as a company, and its employees directly benefit from that growth—not only in terms of experience and knowledge, but also financially, thanks to healthy stock option packages and annual bonuses. I've worked at several companies before coming to EarthLink, and never before have I felt like I was truly part of something as dynamic and worthwhile, and with so much potential.

Marcy Harbut
UC Riverside

RE: ATTN: UC GRADS OR STUDENTS

To: Daryl Forkell <forkell@earthlink.net>

From: Scott Holstad <sholstad@earthlink.net>
Subject: Re: ATTN: UC GRADS OR STUDENTS
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Scott Holstad
UC Los Angeles

RE: ATTN: UC GRADS OR STUDENTS

To: Daryl Forkell <forkell@earthlink.net>

From: Jackie Fong <bumbum@earthlink.net>
Subject: Re: ATTN: UC GRADS OR STUDENTS
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Jackie Fong
UC Davis

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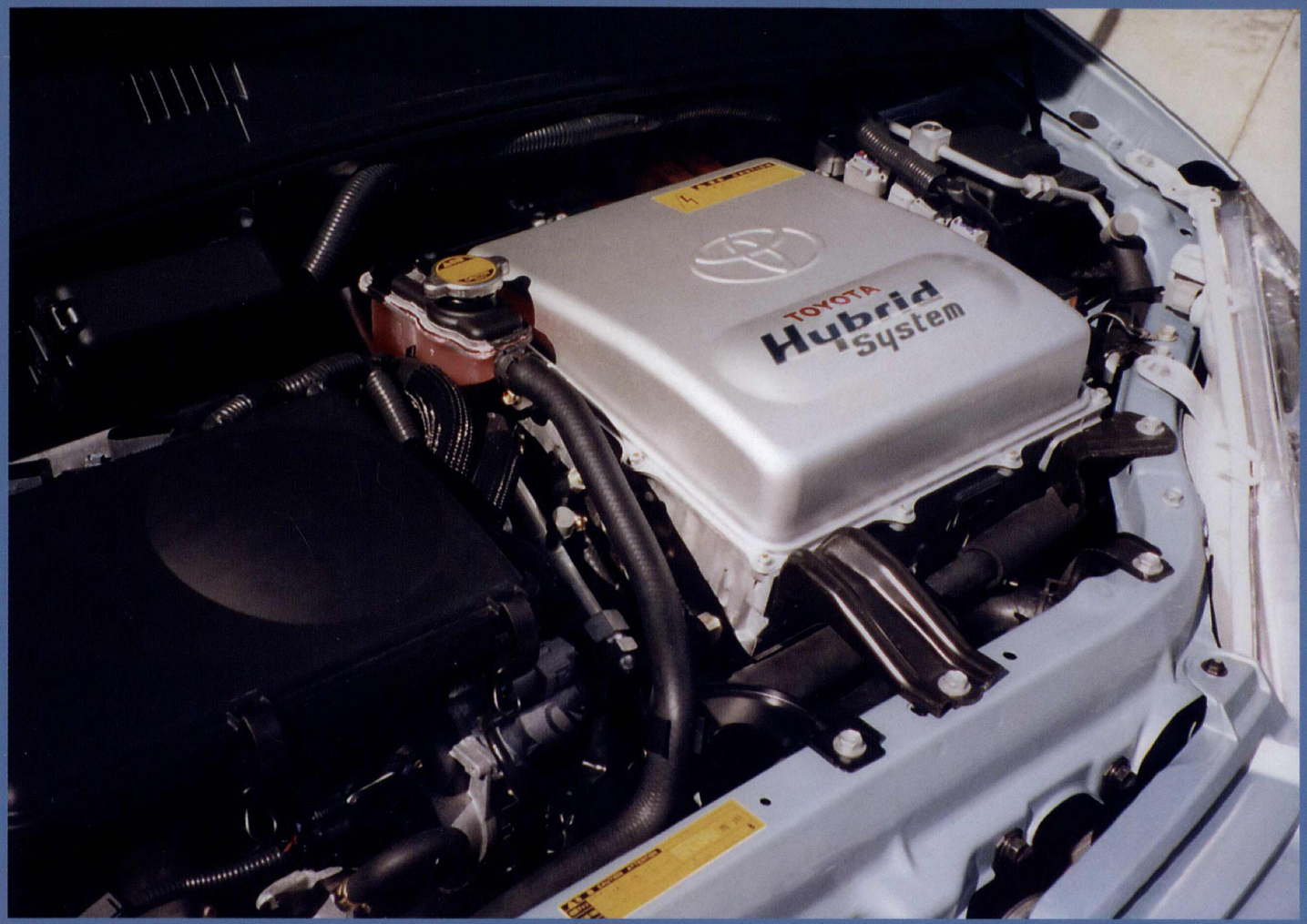

PHOTO: M. DEMARTINO WITH PERMISSION FROM TOYOTA

The only one of its kind in the United States, this hybrid electric vehicle utilizes advanced power generation technology. Toyota Motor Sales, USA, of Torrance, CA, a research and development partner, displayed the vehicle at UCI's Engineering Gateway Plaza during the National Fuel Cell Research Center dedication, February 25, 1998. Dr. Jack Brouwer, principal development engineer, UCI School of Engineering, says that the Hybrid System vehicle will be offered for sale to the American public in two years. The research and development for the hybrid is being done in Japan, where the vehicle is being marketed for the first time this year. Advanced power generation technology is the predecessor to fuel cell powered vehicles, which Toyota is currently developing. Please see related feature, page 12.

CALIFORNIA Alliance FOR Minority Participation
In Science, Engineering and Mathematics

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