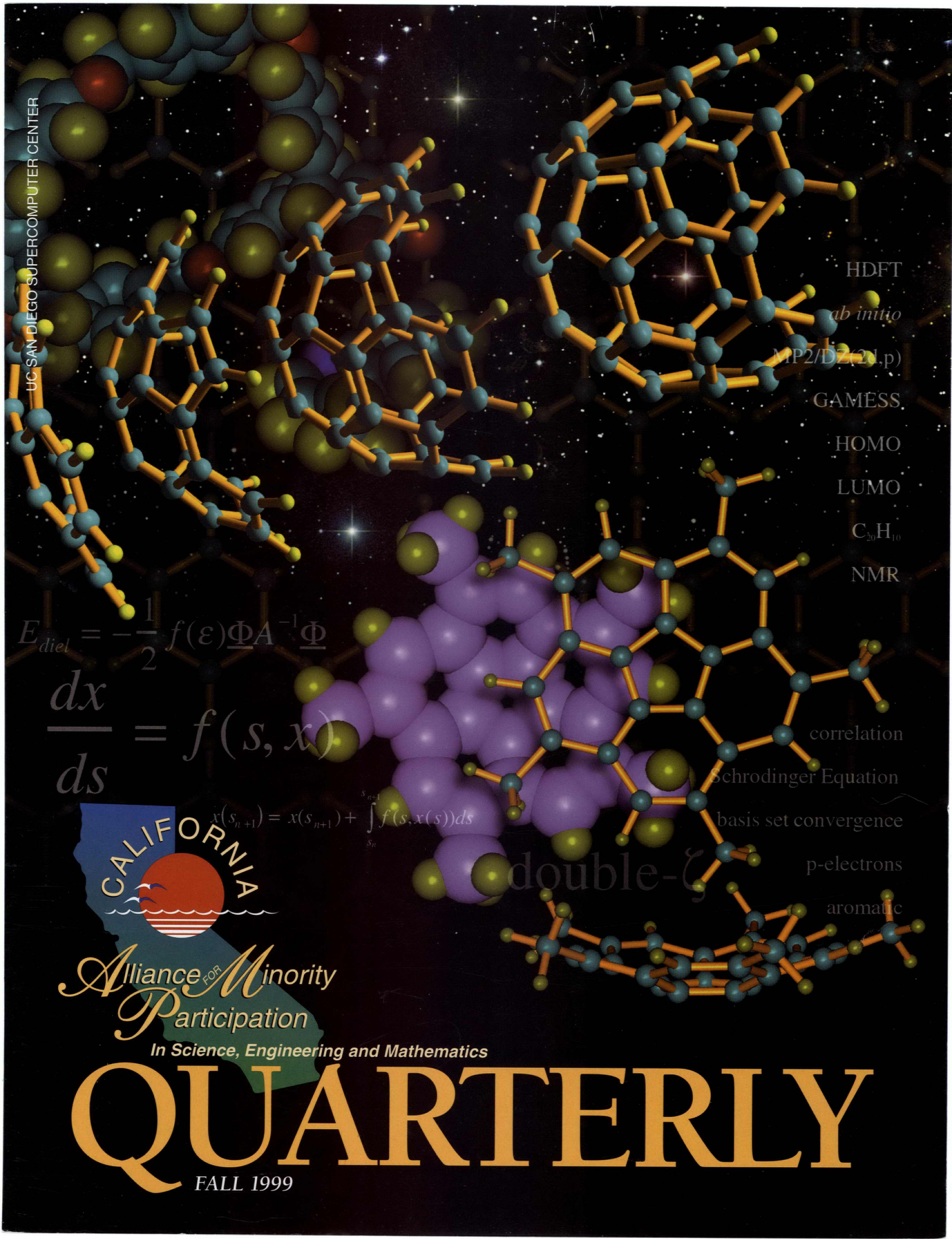
UC SAN DIEGO SUPERCOMPUTER CENTER
HDFT
ab initio
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GAMESS
HOMO
LUMO
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NMR
$E_{diel} = -\frac{1}{2} f(\varepsilon) \underline{\Phi} A^{-1} \underline{\Phi}$
$\frac{dx}{ds} = f(s,x)$
correlation
Schrodinger Equation
$x(s_{n+1}) = x(s_{n+1}) + \int_{s_n}^{s_{n+1}} f(s,x(s))ds$
basis set convergence
double-ζ
p-electrons
aromatic
CALIFORNIA
Alliance FOR Minority Participation
In Science, Engineering and Mathematics
QUARTERLY
FALL 1999

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COVER: Dr. Kim K. Baldridge, principal scientist at the San Diego Supercomputer Center, develops software for visualization in computational chemistry. She is a down-to-earth scientist who creates out-of-this-world 3-D images. Central to her research is QMView, the software she and colleague Jerry Greenberg designed for visual analysis of data sets. Baldridge mentored a CAMP student in summer 1999, whose project is part of our UCSD cover story, beginning on page 18. Cover design by Kim Baldridge and Gail Bamber, San Diego Supercomputer Center.

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The CAMP Quarterly Fall 1999, Volume 8, Number 1

The Quarterly is published three times a year in Fall, Winter and Spring by the California Alliance for Minority Participation Statewide Office.

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

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Please call 949-824-6578 to change your mailing address. Or fax us.

The California Alliance for Minority Participation in Science, Engineering and Mathematics is supported in part through a cooperative agreement between the University of California, Irvine, and the National Science Foundation. CAMP is among 27 Louis Stokes Alliances for Minority Participation. Any opinions, conclusions, or recommendations are those of the author(s) and do not reflect the views of UC, UCI, NSF or other funding organizations.

QUARTERLY

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

FALL 1999 • VOLUME 8 • NUMBER 1

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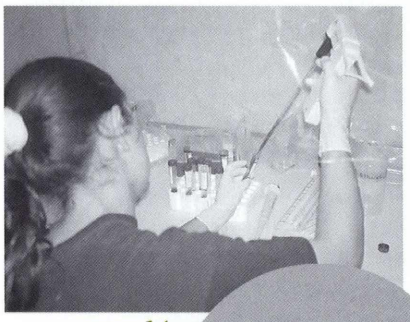

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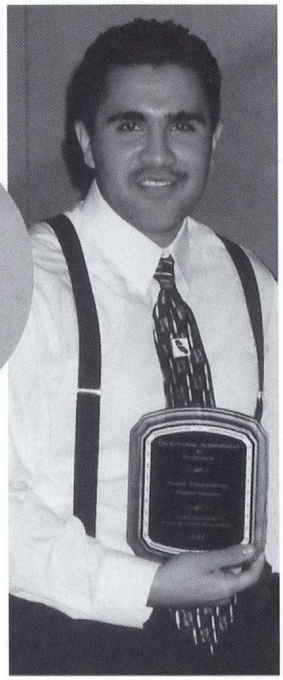

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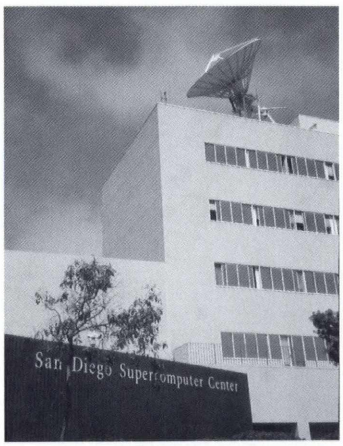

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COLUMNS & DEPARTMENTS

SCIENCE WRITERS SERVE PUBLIC UNDERSTANDING

Still convinced that scientists can't write? **UC Santa Cruz's Science Communication Program** takes this myth to task. Its graduates are writers and editors in high profile periodicals, including NewScientist, Health, Science, and U.S. News and World Report, dedicated to advancing public understanding of science. President of AAAS, M.R.C. Greenwood honored program director John Wilkes at the association's annual meeting for outstanding contributions to public understanding of science. To enter, students must have science degrees and research experience. The program offers two tracks, science writing and science illustration, each admitting ten students annually. With the number of trained scientists-turned-writers, UCSC has become known nationally and internationally for producing science writers and illustrators of the highest caliber. Program alumna also produce reports on technical issues for state legislators.

HONDA AND UC RIVERSIDE COLLABORATE TO REDUCE AIR POLLUTION

UCR IntelliShare is an intelligent shared electric vehicle project that shows promise as an alternative transportation system to ease traffic congestion and reduce air pollution. Fifteen Honda EV Plus cars await UCR faculty, staff, and student employees at three stations on and near campus. A user can quickly and easily obtain a vehicle electronically at an automated kiosk located at each station. The user may return the vehicle to any station where the vehicle then becomes available for another user. In this joint research program between the UCR College of Engineering, Center for Environmental Research and Technology and Honda Motor Company, researchers aim to improve our understanding of the operating details of an intelligent shared vehicle system and how users will react; and provide the campus with a convenient, environmentally-friendly, efficient transportation system.

Honda and UC Riverside create IntelliShare

FROM THE EDITOR

Like any work in progress, the new academic year brings changes on several levels. New faculty directors, new participants, and fresh opportunities for students to exceed their own expectations. UCLA's new regional director Miguel Garcia-Garibay and UCI's Derek Dunn-Rankin are introduced on page 8.

UC students have a strong dedication to purpose, as shown in our features on faculty mentoring. The students are part of the growing trend to engage students early on in research as a platform for graduate school and professional careers. Participants are engaged in many activities, from presenting at the CAMP Statewide Symposium to mentored experiences that prepare them, increasingly, for placement in doctoral programs.

Contributing faculty authors represent the length of the state, from north to south, including professors Brian Kolner, Davis; Bruce Birkett, Berkeley; Donald Smith, Santa Cruz, and Kim Baldridge, San Diego who provides our cover story. We are pleased to share Chancellor Henry T. Yang's perspective in our guest editorial, with a focus on CAMP's place in UC research.

Congratulations to Berkeley, Irvine, and San Diego on receiving awards from NSF for Minority Graduate Education (MGE).

On the national level, the NSF Louis Stokes Alliances for Minority Participation bid farewell and best wishes to Luther Williams, who served as head of the NSF Education and Human Resources Directorate for the past nine years. Williams, together with Roosevelt Calbert, who retires from the Foundation this fall, launched the LSAMP program at 27 sites across the country. We want to extend our appreciation for their support, and look forward to collaborating with MGE which will be offered throughout the University of California.

Marjorie DeMartini

GUEST EDITORIAL
BY HENRY T. YANG
CHANCELLOR, UC SANTA BARBARA

The University of California's Role In Research and Innovation

Since the time that the first person picked up a rock and saw a tool, science and technology have played a determining role in the civilization of humankind.

We have come a long way since then. In our fast-paced modern world, it is easy to forget the extent to which science and technology still shape our culture, our economics, our politics, and our hopes for the future. Open-heart surgery, MRIs, gene therapy, global positioning systems, and bioengineered foods are but a few examples of recent innovations. Likewise, many of the conveniences that we take for granted on a daily basis, such as e-mail, cellular phones, satellite weather forecasting, and microwave cooking, have only come into being within the last few decades.

These scientific breakthroughs and thousands of others have been powerful engines for job creation and the building of a wealth-generating economy. Such advances also make it possible for us to achieve other socially desirable goals, such as the improvement of health care, the revitalization of civil infrastructures, and the protection of our environment.

Hot off the presses is the United States' long-awaited science policy report, *Unlocking Our Future: Toward a New National Science Policy*. This report, which reshapes the science policymaking model formulated by Vannevar Bush in 1945, lays out a vision for the future of scientific research in this country. Perhaps the report's most striking aspect, at least from academia's perspective, is its emphasis on the importance of university research and university/government/industry partnerships.

As the report states, the advancement of technology starts from basic research—long-term, sustained basic research. Important discoveries often come from unexpected avenues; they may involve many years of hard work, not all of it fruitful, before results are achieved. We are driven by our desire for knowledge and for understanding of how our world works. Joshua Lederberg, the 1958 recipient of the Nobel Prize in Medicine, summed up the philosophy behind basic research when he said, "You rarely find the most important things by deliberately looking for them."

Universities are uniquely positioned to conduct such research. Motivated by a passion to understand, rather than a need to turn a profit, faculty, student, and staff researchers are conducting the basic research that underlies some of the most exciting innovations of today—and tomorrow. For example, thirty years ago, our UCSB colleague Professor Walter Kohn discovered the "Density Functional Theory," which simplifies the calculation and prediction of the inner structure of molecules. This theory is now making significant contributions to many frontiers, such as drug manufacturing, new materials, new understanding of interstellar matter, and insight into how chemical reactions affect our ozone layer. For this discovery, he received the 1998 Nobel Prize in Chemistry.

In May of this year, UCSB Professors Michael Mahan, Robert Sinsheimer (Chancellor Emeritus of UC Santa Cruz), David Low, and graduate student Douglas Heithoff discovered a "master switch" that controls the production of many of the weapons that are required for bacterial infection. When they knock out the switch, the bacteria are disabled in their ability to cause disease. This discovery has profound implications for human health worldwide. Possible applications

"I am proud of our talented CAMP students, top-notch faculty, and dedicated staff."

—Henry T. Yang

"CAMP provides an important avenue by which knowledge and skills are passed on to the next generation, using mentorships to help prepare our future mathematicians, scientists, and engineers."

include the vaccination of chickens and cows against *Salmonella* and *E. coli*, and eventually the development of human vaccines and antibiotics for many different kinds of bacterial pathogens.

Discoveries like these reveal the importance of basic research, not just to those of us in academia, but to society at large. As industry becomes more and more knowledge-driven, it also is recognizing the need for sustained basic research, and the benefits of partnering with universities. The new national science policy report discusses the importance of such collaborations, stating that they "provide benefits to the participants and the research enterprise as a whole that could not be realized within the same time frame were the two entities to work in isolation of each other."

University/industry partnerships give companies access to basic as well as applied research, and to valuable human resources. At the same time, such partnerships give university researchers exposure to the frontiers of technology and the needs of industry, while also helping them to leverage both industrial and federal research funds.

We see this on our UC campuses, where more and more such partnerships have emerged and become centers for creative research and exciting new innovations. President Atkinson's visionary leadership in this area, with his Initiative for Industry-UC Cooperative Research (IUCR), has led to the establishment of such exciting collaborative efforts as our Systemwide Digital Media Innovation Program (DiMI), Communications Research Program (CoRe), Biotechnology STAR Project (BioSTAR), Life Sciences Informatics Program (LSI), Semiconductor Manufacturing Alliance for Research and Training (SMART), and more in the future.

The education and research taking place on our campuses are preparing the scientific minds and technical talents of tomorrow—not only scientists and engineers, but also the people who play many other roles in the scientific enterprise that are equally important. The California Alliance for Minority Participation in Science, Engineering, and Mathematics (CAMP) provides an important avenue by which knowledge and skills are passed on to the next generation, using mentorships to help prepare our future mathematicians, scientists, and engineers. CAMP's credo sums it up best when it says, "Scientists and engineers are best developed by other scientists and engineers serving as mentors who exhibit and expect scholarly excellence."

As technology becomes increasingly sophisticated, California's technological leadership and competitiveness depend on a constantly renewing supply of people who can understand and apply the new science, as well as advance it through teaching and basic research. The talent and creativity of our minority students are indispensable to UC's efforts to promote growth in science and engineering. It is so crucial for the diversity of the University to reflect the diversity of the communities it serves. By providing our minority students with inspiration, opportunity, and support, outreach programs like CAMP are helping us to move toward this goal.

I am proud of our talented CAMP students, top-notch faculty, and dedicated staff, including our own distinguished Regional Director, Professor Ken Millett. I am proud of the University of California's leadership role in research and innovation. And I am excited to see what opportunities the future holds for us all.

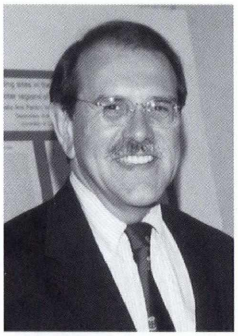
HENRY T. YANG, CHANCELLOR PROFESSOR OF MECHANICAL ENGINEERING, UCSB

Henry T. Yang was named UCSB's fifth Chancellor in 1994. He is a member of the National Academy of Engineering. Dr. Yang has received many awards and honors for his research, teaching, and service, including an honorary doctorate from Purdue University and the Benjamin Garver Lamme gold medal, the highest honor from the American Society of Engineering Education. He has served on scientific advisory boards for the Air Force, Navy, Defense Department, NASA, National Science Foundation, and National Academy of Engineering. Dr. Yang specializes in aerospace structures and materials, transonic aeroelasticity, wind-earthquake structural engineering, and manufacturing. He has authored one book, 160 journal papers, and over a hundred conference papers. Dr. Yang has guided 44 Ph.D. and 17 M.S. theses through completion. He teaches undergraduate courses at UCSB and, with grants from NSF, continues to guide graduate students.

OPINION

Time Magazine Visits UCI

CAMP student interviews put positive spin on analysis of post-209 admission and enrollment



By Juan Francisco Lara, UC Irvine

UCI's Brian McCurtis, a highly competitive computer science major and a CAMP-Toshiba Scholar, is among the first of several undergraduates quoted in a five-page feature in Time Magazine, "When the Field is Level," (July 5, 1999). The special article, the result of a Time site visit to the University of California, Irvine, focuses on outreach, admission and retention post-209. It presents a skewed perspective that sees minorities in science "sliding down from high-ranked schools to lower-ranked ones," clearly a disservice to our fully UC-eligible enrolled students. We know, of course, that the field is not yet level, that pronounced disparities in higher education persist, and that programs like CAMP are more relevant and important than ever.

McCurtis was one of three computer science students who presented their group project to the CAMP regional directors and the advisory board last year. This counts among the spectrum of activities building his resume and expanding his options. Aisha Kennedy, Detiger Dunams, Genae Jefferson, Karen Fleming and Melissa Marchand—all UCI-CAMP participants, were interviewed as well, attesting that our work makes a difference in real terms. Not only does CAMP ensure enriched undergraduate experiences, but it also prepares students for placement in graduate school.

With UCI as the springboard to national agendas, the feature discusses a mix of issues, from minority student qualifications and competitive eligibility to reasons that affirmative action failed. It also introduces an element of competition and a new term, "cascading," (defined as redistribution of the student body when minorities attend "less selective" campuses)—a term the Time reporter calls "a new fact of life."

From our vantage point, we see it otherwise. Karen Fleming elected to enroll at UCI instead of Cornell because of the personal outreach afforded by CAMP—phone campaigns by continuing students and letters of invitation to the Summer Science Academy and other campus events that give prospective students the flavor of participating in a student-centered program. Genae Jefferson chose UCI for similar reasons. Detiger Dunams enrolled at Irvine rather than another campus in favor of the myriad opportunities facilitated by CAMP. She was just completing the third quarter of her freshman year when the Time reporters caught her between classes and laboratory work.

"I've met the Chancellor," Dunams told them, "and I've already presented my research poster." More than that, Dunams has become a vocal proponent for CAMP and affiliated programs that foster a sense of community among students with shared goals.

Aisha Kennedy had her first taste of research in the lab of Nobel laureate Sherwood Rowland—in her freshman year. What an exhilarating foundation. Only through mentoring, cooperative learning, and shared experiences in the laboratory and in the field do students achieve that kind of bonding and confidence.

Also included in the article were set-pieces on two UCI outreach programs to local schools. The Early Academic Outreach Program's Saturday Mathematics Academy, preparing youngsters for success in algebra, engages CAMP students in one-on-one tutoring in middle school classrooms. Humanities Out There (H.O.T.), a model of creative collaboration, provides literature enrichment and writing development for K-12 students. Its director, Professor Julia Reinhard Lupton, produced HumaniFest, an anthology of student writing that captures the excitement of students discovering new horizons of expression. Participants in these and other focused efforts will comprise part of the coming "tidal wave" for postsecondary education.

It is true that California is seeing an unprecedented demand for higher education—but not from underrepresented groups. Sources project that by 2005 we can anticipate more than two million applicants to our colleges and universities. But we cannot lose sight of the fact that chronic low eligibility persists among African Americans (2.5%), Chicano/Latinos (3.9%), and Native Americans (less than negligible at 0.5%).

We are experiencing an era of rapid social as well as technological change. The pressures will be felt throughout the educational pipeline, and no greater than among the educationally and economically disadvantaged. Current admission policy has directed us to redouble the most effective outreach so that in the coming decades a new generation of students like McCurtis and Kennedy will have a place in UC.

—Juan Francisco Lara, Ph.D., is Assistant Vice Chancellor of Enrollment Services at UCI. He was one of the original architects of the CAMP proposal and has served as statewide executive director and regional director. Lara has led a robust outreach strategy to increase the number of competitively eligible students from disadvantaged backgrounds who enroll in UC.

BOOK REVIEW

IMAGES AND IMAGING SCIENCE

BY BRIAN H. KOLNER
UC DAVIS

Review of "Two-Dimensional Imaging" by Ronald N. Bracewell, Prentice-Hall, 1995, ISBN 0-13-062621-X.

I would argue that of all our five senses, vision is the most important in that it communicates information to the brain at a rate and duration far exceeding that of the other four. It is no wonder, then, that images, their conception, production, manipulation, display and consumption form such an important part of everyday life as we communicate with others and interface with machinery. I would further argue that, as technology improves communications rate and flexibility, "image engineering" will continue to evolve in importance and pervade new aspects of our lives.

Several months ago, I had the good fortune to sit and chat with one of my most inspirational teachers in graduate school, Professor Ronald Bracewell of Stanford University. Professor Bracewell has been thinking about and displaying images for many years in his work in radio astronomy but he has succeeded far beyond this small and esteemed community in bringing a broad understanding of the richness of image science to other disciplines. Many years ago he developed a course in the Electrical Engineering Department at Stanford centered around the Fourier transform and its myriad applications in science and engineering. Judging by the number of people who have taken the course over the years and the fact that his textbook "The Fourier Transform and Its Applications" is now in its revised second edition, I would say that this has been wildly successful.

And so I was delighted to learn during the course of our conversation that he had completed a new textbook based on the material of another wonderful course I also took as a graduate student. This new book "Two-Dimensional Imaging" is, like its Fourier Transform predecessor, bound to become a classic. Even its title is somewhat provocative. You may ask "isn't imaging always two-dimensional?" Well, no, if you'll allow that radar, CAT scans, some types of holographic images, and even simple sculpture are forms of three-dimensional images. The title, like many aspects of the book brings out richness and depth to what, on the surface, appears to be obvious and simple. Therein lies the genius of the author.

Pause for a moment and reflect on the different types of two-dimensional images with which you are familiar and the data that they represent. The half-tone images in the newspaper, the photograph, the display of your computer, the xerographic print from your laser printer, the topographical map from the US Geological Survey, the mercator map projection, the weather isobar maps on the evening news, and so-on. The list seems endless and yet each one of these two-dimensional images has its own set of fascinating rules and techniques that govern their effectiveness and accuracy in conveying information to the viewer. "Two-Dimensional Imaging" is about the science behind these rules and techniques. Although necessarily mathematical, little beyond standard undergraduate calculus should be sufficient. What is striking about the book is how much text there is and how rich that text is in supplementing the formal structure that is presented. Indeed, this is a hallmark of Bracewell's writing and why, in my opinion, he is held in such high esteem.

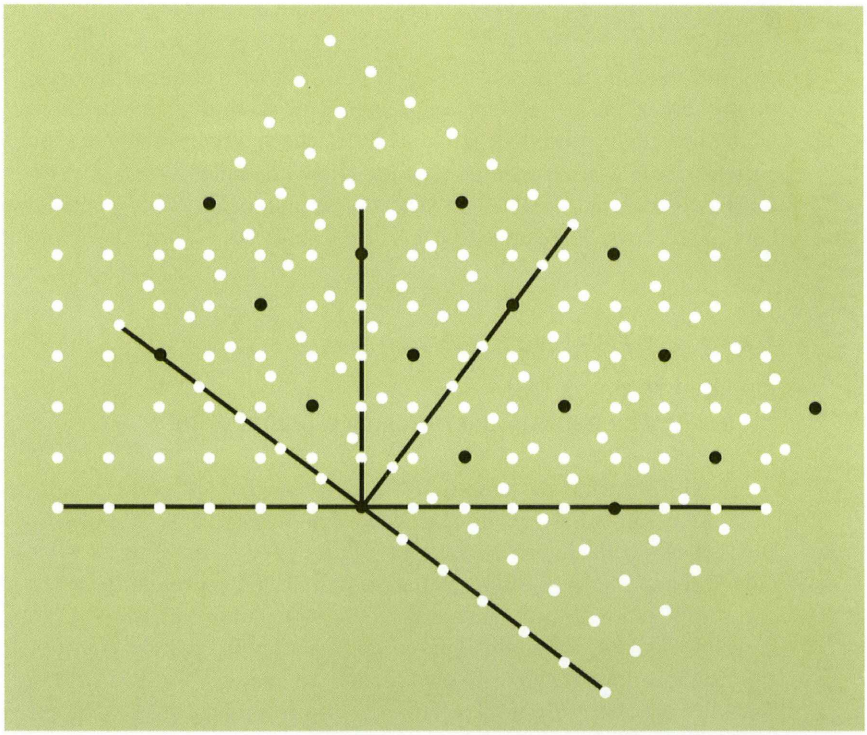
Sitting down with this book and just reading Chapter 2, "The

ImagePlane," gives a superb summary of many different types of image representations and the different classes of manipulations that can be applied in the image plane. We are introduced to the concepts of resolution, dynamic range, density, contours, halftones, shading, light scattering, solid object projections and others. Later, we are introduced to ideas about image manipulation from distortions due to imperfect imaging systems to scale transformations (important to cartographers) and rotations as well as the concepts of image projections which underlie computed tomography. Digital image representation and data compression are also introduced and the author gives ample justification for the technological relevance of this material. The first two chapters of this book, at about 100 pages, could comprise a delightful little monograph in its own right: a survey of image representations and manipulation techniques.

But there is a substantial body of work that must follow to lay down the fundamental tools with which these techniques operate. The middle chapters of the book are devoted to presenting the basic concepts of two-dimensional impulse functions, Fourier transformation, convolution and sampling. These are all essentially analog mathematical operations. These chapters are followed by one on digital operations and then one on the very special aspects of rotational symmetry, which governs most of our optical instruments. From here, the author starts presenting more specific types of instruments and techniques such as antenna beam patterns, photography, the scanning acoustic microscope, diffraction theory of apertures, aperture synthesis and inteferometry.

Following this is a chapter on the fascinating business of image restoration, which is becoming more popular as the power of desktop computers keeps advancing (imagine being able to restore and improve the old family photos right at home). From here we are introduced to the projection-slice theorem and on to computed tomography which is the basis of the modern CAT scanner which produces two-dimensional images of slices of the body from x-ray line scans. The principles of synthetic-aperture radar and its relatives are presented next along with important applications such as aerial topographic surveys and the doppler-radar mapping of the surface of Venus. The final chapter covers the very important and practical consequences of noise in two-dimensional images and discusses the fascinating and beautiful random stereograms. The book concludes with many solutions to chapter problems and a comprehensive index.

While digital image processing has taken over as the logical next step from digital signal processing in the arsenal of electrical engineers, Bracewell has clearly demonstrated the broad range of applicability of the science of two-dimensional imaging. Whether you are a geologist or a marine biologist striving to represent data in new forms, or a radio astronomer making equal-strength contour maps of galaxies, or an energetic young engineer or computer scientist wanting to start a new company in digital image processing, you owe it to yourself to look at this book. I highly recommend it to anyone who has even a passing interest in the hows and whys of image creation, manipulation, or display.



Two patterns, superposed with rotation, contain no spatial frequencies not present in one of the original patterns. Nevertheless, a pattern superposed on itself after rotation through certain special angles produces a crystalline appearance, exhibiting low spatial frequencies to the eye which do not appear in the spectral analysis. From "Two Dimensional Imaging" by R.N. Bracewell, Prentice-Hall, 1995; reproduced with permission.

—Dr. Brian H. Kolner holds a joint appointment in the Departments of Applied Science and Electrical and Computer Engineering at UC Davis. He teaches laser physics, electromagnetics and optics, and pursues research in the field of ultrashort laser pulse generation and measurement. His lab is also developing tools to study very low levels of laser noise and noise in precision clocks and oscillators. Kolner mentors a McNair Scholar and a MORE program participant. See page 30 for update on MORE: Mentorships and Opportunities for Research in Engineering. Kolner participated in the 1999 CAMP Statewide Undergraduate Research Symposium. His response to the event appears on page 12.

NEW FACULTY LEADERSHIP FOR CAMP

Introducing regional directors for UCLA, UCI

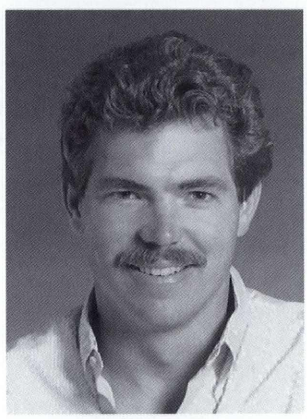
MIGUEL GARCIA-GARIBAY

Regional Director, UCLA
Associate Professor, Chemistry and Biochemistry

Miguel Garcia-Garibay earned his Ph.D. in 1988 at the University of British Columbia, where he worked with John Scheffer. His graduate work was centered on absolute asymmetric synthesis "with reactions where optical activity with very high enantiomeric yields was observed not only with achiral samples but also with racemic crystals." He worked another year in Scheffer's lab as a post-doc, then moved to Columbia University to work with Nick Turro. At Columbia, Garcia-Garibay's work was focused on zeolites and solid state NMR. He and his wife Beatriz (who has a Ph.D. in chemistry) and daughter Ingrid moved to Los Angeles in 1992. At UCLA his work is almost completely dedicated to reactive intermediates and the solid state. His scientific work has been summarized in 49 papers published in reviewed journals, eight book chapters and several papers in press and submitted. He has given 55 invited lectures around the world. Under his supervision, four students have received their doctorates and four have completed their masters. His current research group consists of nine graduate students, two post-docs and two visiting professors. Garcia-Garibay has current NSF Chemistry and Chemistry CAREER grants. Awards include the Dean's Marshal Award, Division of Physical Sciences, UCLA (1997) and the Faculty Development Award (1995).

DEREK DUNN-RANKIN

Regional Director, UCI
Professor, Mechanical and Aerospace Engineering



Derek Dunn-Rankin earned his Ph.D. in 1985 at UC Berkeley, and was a post-doctoral researcher at Lawrence Berkeley Laboratory in the Applied Science Division where his focus was ignition of premixed gases using excimer laser radiation and thermophoretic transport in a heated turbulent boundary layer. He also completed a post-doc at Sandia National Laboratories, in the Combustion Research Division, where he worked on *in situ* optical particle counting and sizing and fundamental processes of pulverized coal and coal/water slurry combustion. Dunn-Rankin arrived at UCI as an assistant professor in 1987. His current research interests include *in situ* particle sizing and counting; transport and deposition of combustion generated particulate; droplet combustion; laser spectroscopy in particle laden flows; control of combustion and I.C. engines; electric field and flame interactions; and spray systems. In 1997 he was a Fulbright Scholar and a visiting scientist at the Imperial College of Science Technology and Medicine, in London. Currently he is co-editor with J.H. Whitelaw, Imperial College for the Academic Press Combustion Treatise Series. Awards include the 1999 Chancellor's Award for Excellence in Undergraduate Research and 1998 Award for Excellence in Undergraduate Teaching. He was also the UCI School of Engineering Outstanding Assistant Professor in 1990-91, and a NSF Presidential Young Investigator. He has supervised six Ph.D. dissertations and 21 master's theses. Among his many invited lectures are those at UCLA; Wright Research Laboratories, Wright-Patterson Air Force Base; the University of Heidelberg; and the Lund Institute of Technology, Lund, Sweden.

QUEST FOR THE BEST:

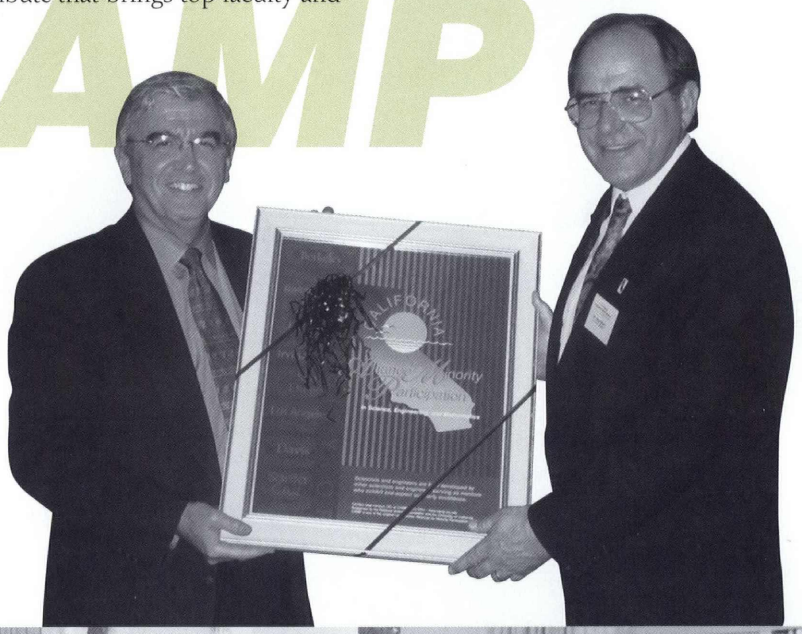
CAMP Statewide Undergraduate Research Symposium

"CAMP precipitates students approaching a faculty for research," Nicolaos Alexopoulos, Dean of the UCI School of Engineering and CAMP P.I. told students at the April 1999 symposium. He added, "Seeing the comfort level of you students interacting with faculty was an inspiration. I never had that as an undergraduate."

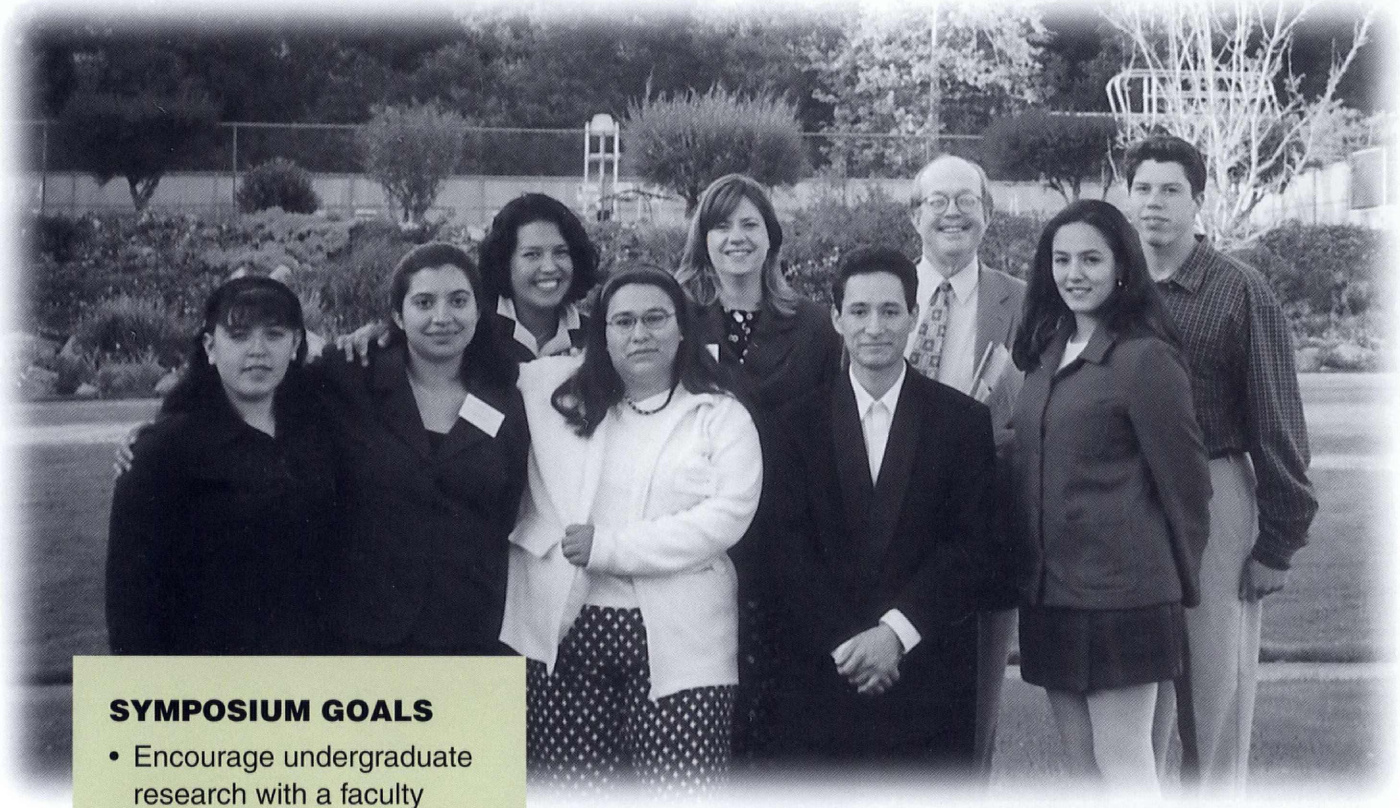
The CAMP Statewide Undergraduate Research Symposium brought faculty, students and program staff from the University of California campuses for a student-focused symposium held at the retreat center, La Casa de Maria. The site, nestled in the coastal foothills of Santa Barbara, was a unique setting for students. For some it was much too quiet with not nearly enough diversion, but for others, it was a rare opportunity to commune with nature.

Chancellor Henry T. Yang welcomed students to the first annual symposium and told them that they were enjoying the most ideal climate in the world—an attribute that brings top faculty and students to UC Santa Barbara. He encouraged them to consider UCSB as an excellent option for graduate education.

UC faculty evaluated 55 present-



Symposium participants from several campuses pause to relax after poster session. Several won honors for their presentations in oral and poster sessions, including Omar Zuniga of UCR (far right) who is shown with his award on Contents page. Students conducted themselves professionally in every aspect of the symposium. Top photo, Nicolaos Alexopoulos, CAMP P.I., and Kenneth Millett, UC Santa Barbara Regional Director, show off the CAMP poster.



UC San Diego students were joined by CAMP Coordinator Sarah Richards-Gross, center back row, and Assistant Vice Chancellor Loren Thompson, to her right, for a walk around the grounds of La Casa de Maria. Students offered suggestions for the next statewide symposium, which they will help to plan and host at UCSD in April 2000.

SYMPOSIUM GOALS

- Encourage undergraduate research with a faculty member
- Develop written and oral communication skills
- Provide a UC Systemwide forum for faculty and students
- Foster interest in graduate school, particularly for the Ph.D.
- Set national standards for undergraduate research presentations

"I am consistently amazed and delighted to see how competently these students conduct their research and how professionally they present their results."

—Dr. Keith Oddson, Associate Dean, College of Engineering, UC Riverside

ers in three main categories for oral and poster sessions: engineering and computer science, life sciences, and physical sciences. Based on content, organization, effectiveness and delivery, awards were made for Exceptional Achievement in Research, Distinction in Research, and High Merit in Research.

"You have experienced some of the best of what the University has to offer," Vice Chancellor Manuel N. Gómez told the students, "and I know that you will continue to honor these experiences as you move forward in life."

Keynote speaker, Professor Kathy Foltz, UC Santa Barbara, told the story of Dr. Katsuma Dan, a legend in her field of fertilization biology. During World War II, Dan plead to save the Mikasi Marine Laboratory through the sign he had left for U.S. troops. She said, "What we have in common as both scientists and as human beings can often be more powerful than ways in which we differ." Foltz thanked students for "proving to me and to all of us that the future is still very, very bright."

The graduate information workshop featured three outstanding panelists who shared insights into packaging the graduate application through the avenues for ensuring persistence and success. Dr. David McDonald, UC San Diego, and Dr. Catherine Lyon and Hank McCoullum from Penn State, provided candid insights and recommendations for a successful and smooth application process. They offered graduate school application fee waivers to CAMP students, and urged them to take

RESEARCH RECOGNITION

ENGINEERING/COMPUTER SCIENCE

SAMANTHA C. OZUNA
Chemical Engineering, Environmental, Biochemical Engineering, Berkeley
Mentor: Jay D. Keasling, Ph.D.
Bioremediation of Cadmium by Genetically Engineered *E. coli*
Exceptional Achievement in Research Oral

JESSI E. JOHNSON
Electrical Engineering, Electromagnetics, Davis
Mentor: Brian N. Kolner, Ph.D.
In Use of a Whispering Gallery Mode Resonator in an Electro-Optic Time Lens
Distinction in Research Oral

ANDRÉS NAVA AND AARON M. SOTO
Information & Computer Science, Software Engineering, Irvine
Mentor: Debra Richardson, Ph.D.
Costs and Benefits of Applying a Formal Method to a Software Requirements Specification During Requirements Analysis
High Merit in Research Oral

FEDERICO PEREZ
Chemical Engineering, Biochemical Engineering, Irvine
Mentor: Steven C. George, Ph.D.
Effect of Breathing Conditions on the Measurement of the Diffusing Capacity of Nitric Oxide
Exceptional Achievement in Research Poster

GELBERG H. RODRÍGUEZ
Civil Engineering, Berkeley
Mentor: Jim Garett, Project Manager
Manufacturing Floor Recoating Project
Distinction in Research Poster

ERNESTO F. VERA
Electrical Engineering, Control Systems, Los Angeles
Mentors: A.V. Balakrishnan, Ph.D., and Oscar S. Alvarez-Salazar, Graduate Student
Real Time Digital Signal Processing Using Modular Control Patch
High Merit in Research Poster

Recognition continues next page

UCSB Professor Kathy Foltz, left, gave an inspirational keynote address. San Diego participants, right, arrived well prepared and full of optimism.

UCI students enjoy the fruits of their labor. They made a strong showing in the life sciences category, thanks to many contact hours with faculty mentors and CAMP staff who helped them polish their content and delivery.

responsibility for the quality of their letters of recommendation by providing faculty with a statement of purpose and a resume.

UC Santa Barbara undergraduates led a tour of the campus on Sunday morning. Despite a few bumps that accompany any event like this ("no night life!" "no vending machines!") it was seen as a successful first symposium for CAMP participants to present their work and fellowship with their peers and faculty in their disciplines.

"Define your own success. Get involved. Cherish and mentor children and young people. Respect elders. Stand up for human rights. Make a difference."

–Dr. Kathy Foltz, keynote speaker

PHYSICAL SCIENCES

LORRAINE E. SADLER
Engineering & Physics, High Energy Particle Physics, Berkeley
Mentor: Young-Kee Kim, Ph.D.
Cross Section Measurement of $Z \rightarrow \nu\bar{\nu}+\gamma$
Exceptional Achievement in Research Oral

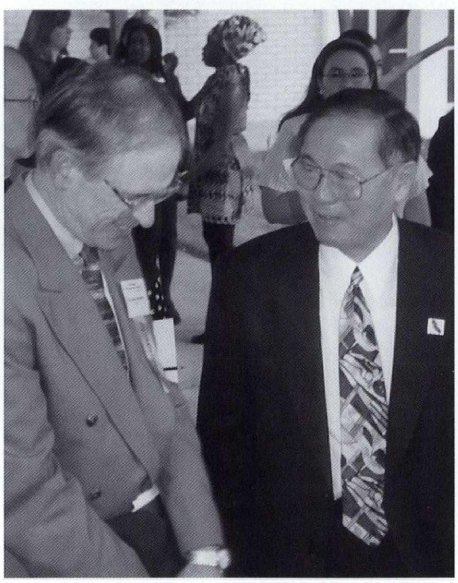
MARIA DELEON
Mathematics, Davis
Mentor: William P. Thurston, Ph.D.
Holes in the Penrose Tilings
Distinction in Research Oral

IAN J. OROZCO
Biochemistry & Anthropology, Los Angeles
Mentor: Harold G. Martinson, Ph.D.
Determining When Termination of RNAPII Begins in Higher Eukaryotes
High Merit in Research Oral

OMAR E. ZUNIGA
Mathematics, Riverside
Mentor: Carlos J. Moreno, Ph.D., Bernand M. Baruch College, CUNY
Using Farey Fractions to Analyze the Complexity of Calculating the Greatest Common Divisor
Exceptional Achievement in Research Poster

LAKRECIA B. SANDERS
Mathematics, Pure Mathematics, Riverside
Mentor: James Curry, Ph.D., University of Colorado, Boulder
Wavelets in Computer Graphics
Distinction in Research Poster

ELIZABETH N. WILCUT
Physics, Berkeley
Mentor: Simon Cherry, Ph.D., UCLA
Positron Emission Tomography
High Merit in Research Poster



James Shackelford, engineering professor and associate dean at Davis, and Henry Yang, chancellor at Santa Barbara, exchange views on mutual interests—students and engineering education.

LIFE SCIENCES

GERMAN A. CORTEZ
Biological Sciences & Chemistry, Biochemistry, Irvine
Mentor: Robert D. Simoni, Ph.D., Stanford University
The Role of Transmembrane Span 6 in the Cholesterol Regulated Degradation of 3-Hydroxy-3-methylglutaryl Coenzyme A Reductase
Exceptional Achievement in Research Oral

MAURICIO E. VARGAS
Neuroscience & Cybernetics, Computer Science, Los Angeles
Mentor: Michael S. Levine, Ph.D.
Murine Models of Huntington's Disease: Glutamate Receptor Agonist-Induced Cell Swelling in Neostrial Neurons
Distinction in Research Oral

MICHAEL PALMER
Biological Sciences & Biochemistry, San Diego
Mentor: Randolph D. Christen, M.D., UCSD Cancer Center
Modulation of Drug Sensitivity in Hormone Independent Prostate Cancer Cells
High Merit in Research Oral

DORA C. CASTAÑEDA
Biological Sciences, Irvine
Mentor: Frances Leslie, Ph.D.
Expression Nicotinic Receptor Subunit mRNA within Dopaminergic Cells of the Substantia Nigra (SN) and Ventral Tegmental Area (VTA)
Exceptional Achievement in Research Poster

DETIGER DUNAMS
Biological Sciences & Spanish, Plant Evolution & Molecular Biology, Irvine
Mentor: Luis Mota-Bravo, Ph.D.
Genetic Relationships of the Genus *Theobroma*
Distinction in Research Poster

OLUMIDE M. AKINGBEMI
Biological Sciences, Genetics, Irvine
Mentor: Luis Mota-Bravo, Ph.D.
Phylogenetic Relationships of Cactaceae
High Merit in Research Poster

"I thoroughly enjoyed the symposium and hope that CAMP will conduct another in the future. There is a real benefit for the students to get this kind of experience early in their careers. I applaud you."

–Brian H. Kolner, Ph.D., Professor, Departments of Applied Science and Electrical and Computer Engineering, UC Davis

The proceedings are available from the CAMP Statewide Office. Symposium 2000 will be hosted by UC San Diego, April 7-9, 2000 (see right.)

Save the Date!

CAMP STATEWIDE 2000

UNDERGRADUATE RESEARCH SYMPOSIUM

April 7-9, 2000 • University of California, San Diego

ABSTRACTS & APPLICATIONS DUE FEB. 11

OBTAIN DETAILS FROM YOUR LOCAL UC CAMP OFFICE.

EVENTS

Friday, April 7: registration, lab visits, campus tours, reception
Saturday, April 8: concurrent technical talks, dinner, beach party
Sunday, April 9: poster sessions, workshops, awards lunch

FEATURES

Special Guests
Faculty Chats by Discipline
Graduate School Recruiters
Personal Statement Workshop
Refining Presentation Skills Workshop

TOURS

San Diego Supercomputer Center
Scripps Oceanographic Institute Stephen Birch Aquarium
Biomedical Research Buildings
The Stuart Collection of Commissioned Sculpture

Math & Computer Science • Biology & Life Sciences
Physical Sciences • Engineering

UCSD HOSTS

Vice Chancellor Joseph Watson
Asst. Vice Chancellor Loren Thompson
CAMP Coordinator Sarah Richards-Gross

CAMP PARTICIPANTS!

CALL FOR ABSTRACTS

The undergraduate symposium is a professional development opportunity for new and seasoned presenters.

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Toxic Metals Research

CAMP intern studies seabirds for effects of environmental contaminants on immune function

BY DONALD R. SMITH AND MYRA FINKELSTEIN
UC SANTA CRUZ

"Mentoring is a type of apprenticeship, a powerful form of learning."

As a relatively new junior faculty, I am strongly committed to further developing and maintaining a vigorous research program centered around investigating both fundamental and applied aspects of metal toxicology in biological systems. Post-docs, graduate students, and undergraduates in my lab work as a team on various projects. Although most of my research has centered around the toxic metal lead (Pb), those studies have been quite varied in their approach to understanding the physiologic and biochemical mechanisms of renal and neurotoxicity; the important pathways of human exposures (especially children exposed to household sources); and the efficacy of public health interventions and therapeutic treatments to alleviate exposures and toxicity.

Specifically, this work includes studies on the effects of Pb on protein kinase C (PKC), an important second messenger protein in our cells. This effect may be an important aspect of the underlying reasons that Pb is such a powerful neurotoxicant, affecting cognitive function of children (and laboratory animals) at very low exposures. Interestingly, the more recent data in lab animals and human studies indicates that even low Pb exposures alters the cognitive functioning of the brain in subtle but very important ways. There are numerous potential biochemical processes underlying these effects, such as the functioning of PKC, that may be altered by Pb. Our work in a infant rodent model has shown that Pb at low exposures—similar to what inner city children may experience—significantly alters PKC. Moreover, this effect appeared more pronounced when the animals were presented to a novel, learning environment, as opposed to the situation where they

had time to acclimate to their environment. In other words, the effect was most pronounced during episodes of apparent active learning—a finding that others have also observed.

Our work on investigating the efficacy of household interventions for reducing lead exposures to resident children is underway. Funded by HUD, this study should be important, because we—Roberto Gwiazda and I—are applying stable lead isotope methods to identify specific sources of lead exposure to the resident lead-poisoned child. We hope to then be able to evaluate how efficacious the public health interventions are at reducing lead exposure, since we will be able to use the isotope method to know which sources are actually responsible.

Currently, household interventions, including lead abatement, to reduce childhood lead exposure are at best only moderately effective. This may be because current methods are unable to identify known sources of lead exposure, so a 'shotgun' approach must be used in de-leading a house—not particularly successful in reducing lead poisoning. Notably, our research will also enable us to elucidate the importance of the child's skeleton as an internal source of lead that may be released back into the blood. This process may serve to actually reduce the 'apparent' benefit in de-leading the home, since the skeleton may continue to serve as an important source of lead exposure to the blood, even after the external (household) sources are reduced.

A very large part of our research addresses the benefit of therapeutic treatments for reducing levels of body lead. We have focused mainly on the clinical chelating agent succimer (Chemet), which is widely used in treating children and adults for lead poisoning. We have spent the past five years studying many aspects of succimer action, such as the tissues that benefit most or least from succimer chelation, and the kinetic aspects of chelation treatment. This work has involved human studies as well as animal models.

The role of undergraduate researchers in our lab

We routinely host from three to five undergraduate students in our lab. I feel strongly, and these feelings have been substantiated by my observations, that the opportunity for undergraduates to conduct research in an active laboratory is the defining experience in their undergraduate education. I personally have found it very rewarding to see undergraduates enter our lab as eager but naive students, and leave as more mature and focused individuals. Mentoring is a type of apprenticeship, a powerful form of learning. We put a lot of effort into exposing students to all aspects of our research, placing on them very high expectations that they both perform, and fully understand all that they are personally involved in within our lab. Although it often takes a lot of attention, we are adamant about requiring that students fully understand what they are doing and why, including all the details, assays, and instruments they use. This approach often takes longer, but it hopefully ensures that students are not just 'turning the crank' and doing as they are asked. It is also consistent with the important concept of 'understanding precedes action'.

We often take an approach of integrating undergraduate students into the larger, on-going studies being conducted within our lab. Typically, we create a project that will generate data that we are interested in, and that will complement or extend the primary studies we are

Top: Myra Finkelstein obtains a blood sample from a Greater Scaup. Blood was used to validate laboratory assays that measure immune function. Above: biologists Bradford Keitt and Mike Litzow take a wing measurement from an American Coot. Pauline Lampa is recording the data. Facing page: taking culmen (beak) measurements of an American Coot. Standard morphological measurements (culmen, tarsus, wing, weight) were collected on each bird to help assess the bird's overall health, while blood was collected to evaluate immune function and contaminant levels.

conducting. In this way, we have a vested interest in the outcomes of those undergraduate research projects and thus are inclined to demand a high level of performance and the highest level of scientific rigor.

CAMP Intern Pauline Lampa

Over the past three years, we have hosted five CAMP undergraduate students (two in the summer of 1996, two in the summer of 1997, and one in summer 1998). All of the students have been exceptional individuals who benefited greatly from the research experience. In addition, we have hosted a MARC student, as well as several other undergraduates per year. For this article, instead of recounting the research projects of all the CAMP students to come through our lab, I will focus on the most recent intern, Pauline Lampa.

Pauline came to us as a CAMP student in summer 1998. Based on her interests in physiology, she began working with Myra Finkelstein (a Ph.D. graduate student in my lab) on the effects of environmental contaminants on immune function in seabirds. While Myra was busy developing and adapting immune function assays that could be used on blood samples from wild birds, Pauline was given the project to adapt white blood cell staining and counting techniques, so that collected blood samples could be characterized for counts of the different kinds of white blood cells.

Since several studies have shown that while blood cell counts can be altered in cases of elevated contaminant exposure, we hope this project will lead to a methodology and data that will complement the immune system assays that Myra is working on. For this study, Pauline worked throughout her CAMP internship, and has continued to the present (over a year total). Pauline first helped develop suitable blood cell separation methods for seabird blood, and has more recently been evaluating a number of different cell stains that will enable her to differentiate and count the various white blood cells in blood samples collected from wild seabirds.

Pauline Lampa making slide smears on blood collected from American Coots. Typically, 5-7 smears were prepared from each sample, in addition to determinations of blood hematocrit and white blood cell counts.

Pauline's Research Interests

The effects of contaminants on seabird immune function is a very interesting and compelling research question. More broadly, substantial attention has focused recently on better understanding the sublethal effects of contaminants on immune system function in wild populations. While toxicology has historically focused on the measurement of acute effects, including mortality and morbidity, it is now recognized that more significant impacts at the population level may be occurring due to subtle but significant effects of contaminants on important physiological systems, such as the central nervous system and the immune system. Both of these systems are extremely complex in their functioning, and thus are often particularly susceptible to toxic effects. However, it was not well recognized until recently that even subtle effects could generate dire consequences. In the case of the immune system, even subtle alterations in immuno competency of an organism may alter the ability of that organism to resist pathogens. As everyone knows, when the immune system is compromised, there is often increased incidence of sickness and disease. However, for wild animals such as seabirds, who also experience a variety of other environmental stressors including food and habitat shortages, competition for food and habitat, stress of migration, etc., the added immunostress due to contaminant exposures could be enough to 'push them over the edge', leading to increased incidence of disease, morbidity, and mortality.

Studies By Others in Marine Mammals

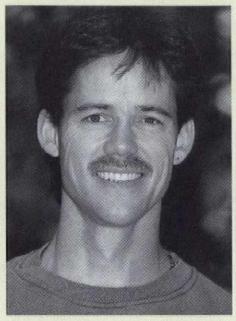
There have been some interesting studies done lately in marine mammals that substantiate this concern. Those studies have reported viral outbreaks in several species, including about 20,000 harbor seals (in 1988), several hundred gray seals, Baikal seals, and even several thousand striped dolphins (in 1990-1991). In many of these cases, contaminant exposures were considered probable cofactors, in which the additional stress of immunotoxic chemicals may have

facilitated the emergence of otherwise non-problematic viruses. Specific contaminants known to effect immune function include the toxic metals mercury and lead, and organic compounds such as PCBs, PAHs, and TCDD (dioxin), among many others.

Extending research to manganese

Thus, in a nutshell, our research has covered nearly the entire gamut of Pb toxicity, from biochemical mechanisms to clinical treatments. More recently, we have become interested in the biochemical mechanisms of manganese (Mn) neurotoxicity. The story with Mn is quite interesting, since unlike Pb, Mn is an essential element. However, elevated exposures to Mn, as seen with miners, can lead to neurotoxicity in the form of 'manganism', a syndrome with symptoms similar to Parkinson's Disease. In fact, epidemiological evidence suggests elevated past exposures to several metals—Pb and Mn, among others—as well as elevated exposures to some pesticides are risk factors for adult onset Parkinson's Disease. Interestingly, the underlying causes of manganism are similar in some ways to the underlying manifestations of Parkinson's Disease, though the causes are not known. This similarity seems to be centered around the depletion of the neurotransmitter dopamine in specific regions of the brain (the nigro-striatal pathway) that controls fine motor movement. It substantiates a possible role of elevated Mn exposure in the acceleration and onset of Parkinson's.

As a result, we have begun investigating the effects of Mn exposure (either as divalent Mn(II) or trivalent Mn(III)) on the acceleration and onset of Parkinson's Disease in a rodent model. This work is particularly timely, since petroleum producers in the U.S. are considering adding Mn to gasoline as an anti-knock component—could be the Pb story all over again! This and ongoing work by others may help elucidate the possible risks for neurotoxicity associated with increased chronic respiratory exposure to Mn from auto exhausts.



FACULTY BIO

Donald R. Smith

Assistant Professor,
Biology and Environmental Toxicology
University of California, Santa Cruz

- UC Santa Cruz, Ph.D. (Biology), 1991
- Moss Landing Marine Laboratory, MA (Marine Biology), 1985
- Research Associate, Department of Laboratory Medicine, School of Medicine, UC, San Francisco, 1993-1996
- National Institute of Environmental Health Sciences Postdoctoral Fellow, Program in Toxicology, University of Maryland, Baltimore, MD, 1991-1993
- Member of Society of Toxicology and Neurobehavioral and Teratology Society
- Recipient of William Beye Heald Ph.D. Dissertation Research Award, 1990
- Young Investigator Award

CURRENT RESEARCH FUNDING:

- National Institutes of Health; Department of Housing and Urban Development
- UC Toxic Substances Research and Teaching Program

PUBLICATIONS:

- Over 26 publications since 1990, 25 of which are specifically on lead, including stable isotope tracer studies of environmental lead, human lead exposure and metabolism, and therapeutic treatments for lead intoxication
- More than 32 published abstracts since 1993

IMPORTANT RESEARCHERS IN SMITH'S LAB IN RECENT YEARS:

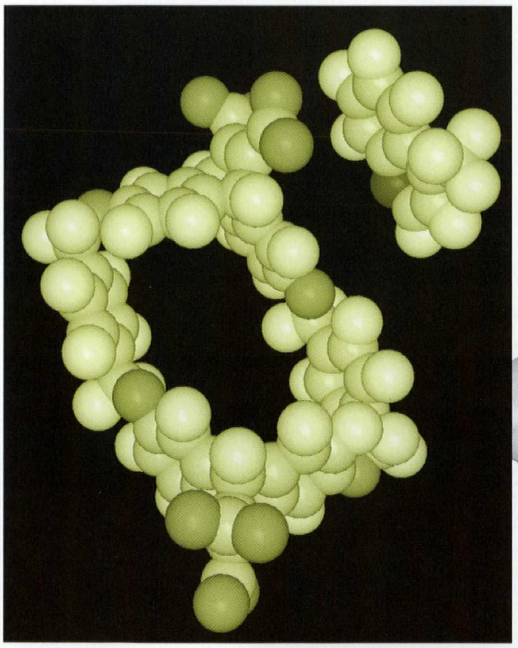
- Dr. Roberto Gwiazda, Postdoctoral fellow: the benefit of public health interventions to reduce household lead exposures to resident children, and the role of manganese exposure on the acceleration and onset of Parkinson's Disease.
- Dr. John Cremin, Postdoctoral fellow: studies to establish the efficacy of therapeutic chelation treatments for reducing body burdens of lead, with particular interest in reductions in brain lead levels; and the biochemical mechanisms underlying lead neurotoxicity.
- Myra Finkelstein, Graduate (Ph.D.) student in Ocean Sciences and Environmental Toxicology: effects of environmental contaminants on immune function in seabirds, with the idea of using various immune function parameters as biological markers of sublethal toxicity in seabirds.
- Stephen Reaney, Graduate (Ph.D.) student in Chemistry and Environmental Toxicology: methods for studying manganese oxidation state in biological systems, including our rodent model of manganese exposure and Parkinson's Disease.

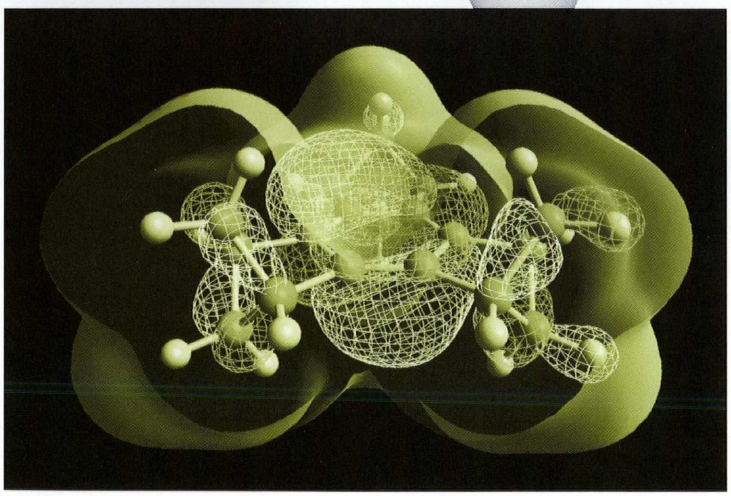
It also provides new and exciting opportunities for CAMP interns, developing their laboratory and investigative skills in compelling areas.

'K'OMPUTATIONAL

San Diego Supercomputer Center offers challenging environment for CAMP summer intern

BY KIM K. BALDRIDGE
Principal Scientist, San Diego Supercomputer Center
Associate Adjunct Professor, UC San Diego





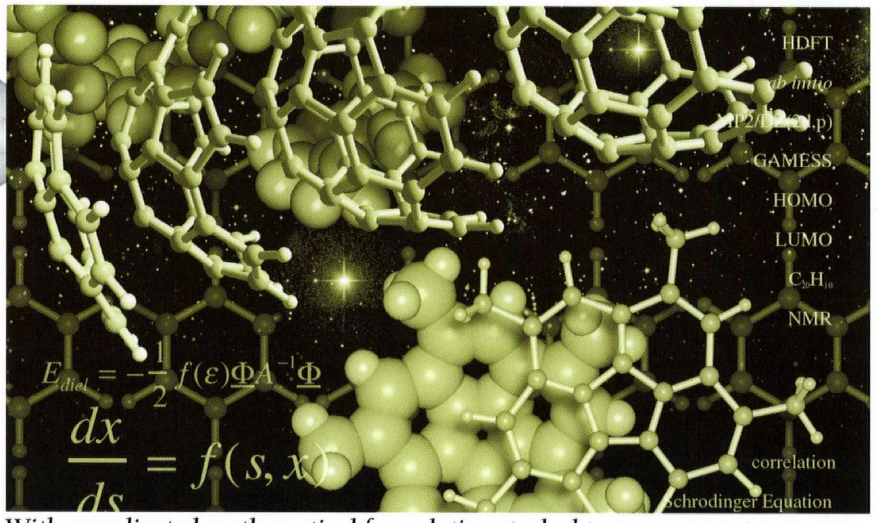
Since the beginning of time people have been trying to visualize molecules. Chemical calculations that predict structures, energetics, and other properties of experimentally known or unknown molecules provide a fundamental resource for chemical research today. The basis of these calculations lies in an area of theoretical chemistry called molecular quantum mechanics. This science relates molecular properties to the motion and interaction of electrons and nuclei. Since the chemical properties of atoms and molecules are determined by their electronic structure, it is necessary to understand the nature of the motions and energies of the electrons and nuclei.

The understanding of molecular systems at this detailed level requires high level mathematical formulations that govern and allow prediction of molecular structure and properties. The ultimate goal of these calculations is the application to problems of general chemical/experimental interest such as a) the determination of reaction mechanisms, b) the study of the details of molecular forces and their role in structure determination,

'K'EMISTRY

and c) the calculation of detailed potential energy surfaces and dynamics for reaction processes. Elucidations in these areas in turn lead to advancements in areas such as materials chemistry, electronics, environmental chemistry, and medicinal chemistry.

media, from tinker toy models to high level, accurate quantum mechanical modeling. We're doing quantum mechanics on the supercomputer to help our understanding of, for example, biological problems. Computational chemistry has emerged over the past twenty



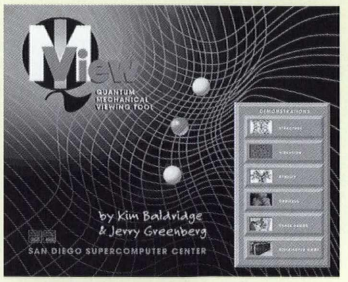
With complicated mathematical formulations tasked to supercomputers, we can study beautiful exisiting as well as new materials and biochemical structures, with novel and important functional properties.

I've been at SDSC for ten years, and early on noticed the scarcity of computational chemistry in our undergraduate science curriculum. It's a given that you have to have both theory and experiment for successful teaching/learning to take place. Together with SDSC chemist Jerry Greenberg, we have collaborated to increase the availability of tools with which to compute and subsequently visualize complex molecular systems. These tools greatly enhance the understanding of such chemical processes, and are currently being incorporated into the classroom both as UCSD and at the Center. Internships allow us to readily obtain student input and bring them into the work.

We're involved in all sorts of

years as a successful subdiscipline of chemistry that supplements traditional laboratory experiments as well as extends and validates theoretical methods. At its most fundamental computational chemistry applies the basic equations of quantum mechanics to chemical systems, known as *ab initio* quantum chemistry.

Successes in large scale chemical computer modeling came in the 1950s, with the increase in available computer platforms and chemical software. Today, we have advanced to using much more complex hardware and software algorithms, combined with advance visualization techniques. This is Dr. Greenberg and Dr. Mike Bailey's (another of our collaborators at SDSC) areas of expertise. We rely on their innovative



QMView is designed to facilitate the visualization and interpretation of quantum mechanical data. Capabilities include display of chemical structure, animation of quantum mechanically determined vibrational modes, and depiction of electronic properties and three-dimensional molecular orbitals. QMView has a user-friendly interface that allows users to interactively manipulate many features of the molecular structure and/or property, including positioning and structure representation, via mouse-activated dialog boxes. Although the interface allows input from results of any of the popularly used quantum mechanical software, Baldridge and colleague Jerry Greenberg have focused on GAMESS, a widely distributed quantum chemistry code, of which Baldridge is also a co-author. QMView was designed with the special feature of working in distributed mode with GAMESS, the latter running on a supercomputer, the former running on a Silicon Graphics platform. To learn more, see ***Kim's 'K'omputational 'K'emistry Software 'K'orner,*** *http://www.sdsc.edu/~kimb*

techniques of computer-aided design and computer graphics to achieve this.

It was a perfect time for my CAMP student intern, Melissa Heagerty, to come. Melissa is a biochemistry major who has done a lot of independent work. As a Ravell College student, she is on an interdisciplinary track, taking humanities along with science, as well as coursework in art and social science. She is skilled in the arts and the theater, which provides additional levels of interest for both of us. Melissa says her involvement in the arts and humanities has made her a better scientist—and it's true. The project I've given her is to figure out under what circumstances a smaller 'guest' molecule will fit into bigger 'host' molecule, using several types of molecular models. Our goal is to understand both the electronic as well as the steric factors involved in this process. I literally gave the project to her and with very little assistance, she was able to deduce much more about the complex process. She tells me, "You have to use your chemical intuition." That's something she does quite well.

Melissa has an amazing breadth of interdisciplinary interests, and completed an exchange program at King's College in London last year. That makes the mentoring relationship that much more interesting for me—to hear about her experiences and to know that we share many things in common, not the least of which is travel to foreign places. She relates her experiences in England, and I relate my recent sabbatical in Israel. Having an undergraduate take on a project and work successfully is energizing. Melissa took this particular project, which she describes in the adjoining pages of this feature, and ran with it. Working with young people keeps me in sync with why I loved mathematics and chemistry in the first place—the sense of discovery that awaits each day. And it supports one of my professional interests—encouraging women to excel in science and also to become contributing scientists in their own right. These goals are also served by the Maria Goeppert-Mayer Symposium which I started five years ago to recognize the advancements women make to science, mathematics, and engineering. Some day Melissa and others will be on the agenda, speaking about their own research and teaching experiences. That thought keeps me looking forward to innovation in my own field of computational chemistry as well as to my next CAMP intern.

SUMMER 2000 "SUPERCOMPUTER" INTERNSHIP

The National Partnership for Advanced Computational Infrastructure (NPACI) will fund nine research internships for CAMP students in Summer 2000. The internships are part of the NPACI mission to ensure access for underrepresented students to the emerging computational science infrastructure, especially in the areas of science, mathematics, engineering and technology. The collaboration between CAMP and NPACI will identify talented students who will benefit from working with researchers at the San Diego Supercomputer Center and other sites. Mentors will be chosen for their abilities to select interesting, appropriate projects for the students. Interns will be sought based on CAMP eligibility requirements. Funding is from the National Science Foundation. Applicants should contact San Diego CAMP coordinator Sarah Richards-Gross, srichard@ucsd.edu

The San Diego Supercomputer Center (SCSC), a national laboratory for computational sciences and engineering, is sponsored by NSF, other agencies, the State and University of California, and private organizations; is affiliated with the University of California, San Diego; and is administered by General Atomics. For more information, see http://www.sdsc.edu Computational research at SDSC advances theory and complements laboratory experiments.

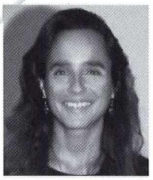
MARIA GOEPPERT-MAYER SYMPOSIUM ON CHEMISTRY

Hosted by UC San Diego and the San Diego Supercomputer Center

This symposium commemorates Maria Goeppert-Mayer's role as a leading scholar and her unflagging pursuit of excellence in science. The one-day, fifth annual symposium will be held March 7, 2000. It is a professional development opportunity for CAMP participants. Students interested in attending should contact their local UC CAMP coordinator.

CAMP FACULTY MENTOR PROFILE

KIM BALDRIDGE



Kim Baldridge grew up in a small town in North Dakota. The general message throughout her K-12 education was that women didn't go into chemistry. But she excelled in math and science and had supportive parents. She unloaded trucks for four years to pay for her undergraduate education, and received double bachelors degrees in chemistry and math. Baldridge went on to earn a master's in math and a Ph.D. in theoretical chemistry.

As a theoretical chemist, her job is to design new mathematical methods to use for chemical applications. She follows two paths. One is the study of the details of structure and properties of many types of molecules. The second is more complicated: Baldridge and her colleagues try to understand the reaction process. In the last 10 years or so, this field has changed from simply getting the tools to handle this process, to predicting the rates of transaction, consideration of solvation effects, and performing the compilation with parallel techniques.

As a computational chemist, Baldridge can do things that are not always possible using experimental techniques, via mathematical techniques. While it is not always possible to produce a molecule experimentally, many insights can be gained from computational modeling. But Baldridge is not interested in merely studying what already exists. She is interested in the possibility of designing new materials. To do this, she uses supercomputers. The output of the chemical equations is so numerically intense, visualization is often the only way to comprehend the answers.

Baldridge recently returned from a six-month sabbatical in Israel, on a Fulbright scholarship. Baldridge chose the Weizmann Institute near Tel Aviv to collaborate with associate Jan Martin in the area of molecular spectroscopy. This is the primary way chemists identify the structure and 'fingerprint' of compounds, and allows the study of computational methods for magnetic resonance spectros copy. Today's high performance computers have made it possible to compute the spectral signatures of household chemicals, pharmaceuticals, and environmental toxins.

To recognize and promote scientific achievement by women, she founded the annual Maria Goeppert-Mayer Symposium on Chemistry highlighting women in science. It is named after a prominent scientist, Goeppert-Mayer, who won the Nobel Prize in physics in 1963 at UC San Diego.

Baldridge co-teaches UCSD chemistry courses, providing overviews of computational methods and

CAMP STUDENT INTERN PROFILE

MELISSA HEAGERTY

- Hometown: *San Jose, CA*
- Major: *Biochemistry; Minor in Theater*
- Degree: *B.S. Biochemistry/Chemistry, June 2000*
- Campus Life: *Revelle Residence Life Intern; Revelle College Council, Financial Controller; Revelle Emerging Leaders Program*
- Work Study: *Scripps Institution of Oceanography Library, Interlibrary Loan, 1997-98*
- Enrichment: *Education Abroad Program 1998-99, University of London, King's College, exchange program with full load of second year chemistry courses*
- Service: *Los Niños, Tijuana; Habitat for Humanity*
- Career Goal: *research and/or medicine. "If I become a doctor, I want to be like Patch Adams."*
- Success Slogan: *Work hard, play hard.*
- Comments: *"I'm learning so much—understanding where electron density lies. I didn't know this kind of research existed, and I thank Sarah [Richards-Gross] at CAMP for sending me the application.*

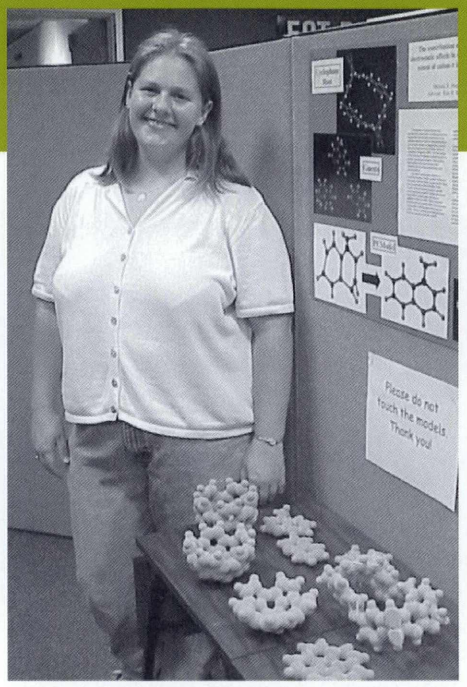
The contribution of steric and electrostatic effects in determining the extent of cation-pi interactions

MELISSA R. HEAGERTY

Chemists have known for some time that the interaction of a cation with a pi system is energetically favorable. The electron density on either face of an aromatic system such as a benzene ring forms a partial negative charge. The sp2 hybridized carbons are more electronegative than the hydrogens along the outside of the ring, so the edge carries a partial positive charge. Thus, it is believed that the partial negative benzene faces will interact favorably with a cation. This logically leads us to the question of how much these interactions are worth in terms of free energy or binding constants.

Research in this area (McCurdy 1992) has claimed that in reactions with a cyclophane host, the transition state between the quinoline substrate and the methylquinolinium product has a binding constant that is greater than the substrate by two to three orders of magnitude. It is the belief of this lab that the results of this experiment did not effectively account for the solvation, electrostatic, and steric effects involved if the guest binds to the host. This error may have lead to an increase in the magnitude of the binding constant and therefore an

Baldridge and Heagerty continue on next page



UCSD biochemistry major Melissa Heagerty with the 3-D molecular models she built. She presented her poster at the 1999 UCSD campuswide summer research symposium.

Baldridge continues:
computational organic chemistry. She also does outreach to high school students, and is developing an on-line tutorial package that delivers chemistry learning media via the web.

KIM K. BALDRIDGE CURRICULUM VITAE

- B.Sc., Mathematics; B.Sc., Chemistry, Minot State University, Minot, ND
- M.A., Mathematics, North Dakota State University, Fargo, ND, 1985
- Ph.D., North Dakota State University, Fargo, ND, 1988 (Aromaticity; theoretical reaction paths and dynamics; Post-Doctoral, Wesleyan University, Middletown, CT, 1989 (Theoretical reaction dynamics and molecular dynamics)
- Current Position: Principal Scientist, San Diego Supercomputer Center
- Associate Adjunct Professor, Dept. of Chemistry, UCSD

AWARDS
- Joint NATO award, UCSD Chem. Dept. (Jay S. Siegel) and University of Milano, Italy, Chemistry Department (Franco Cozzi), 1994-96
- Visiting Professorship for Women Award, NSF, 1995-96
- DOD Software Initiative Grant, 1996
- Grand Challenge Supercomputer Award, 1997-98
- Research Opportunities for Women Award, NSF
- Fulbright Award, 1997-98

Heagerty continues:
observed increase in the significance of cation-pi interactions. Therefore, our goal is to obtain a more precise account of the effect of cation-pi interactions by accounting for these effects. The following experiment uses computational and visualization techniques to better understand the effects of sterics and electrostatics on the guest molecule in order to better approximate cation-pi interactions. The binding of this guest to the host mimics biological reactions such as those seen in acetylcholine and its esterase (Caldwell 1995); however it does not replicate any known reaction.

In order to understand the steric effects involved in this reaction it is necessary to have good models. We built a 3-D tactile model so that we could gain a better understanding of the volume of the cavity. In order to make this model, it is necessary to generate 3-D computer models. First, we constructed the host and guest molecules using PCModel which is a builder application. This gives us x, y, z coordinate files. These were then converted into a more universal format (.pdb) which is used by the Protein Data Bank. Next, we add a surface to the molecules using GRASP. And finally, we turn the surface into triangular (.tri) files which give the coordinates for the entire surface. These files are then fed into the C-CORE machine which produces the 3-D tactile model.

We can run the .pdb files in other applications including QMView and Insight & Discover. While these programs provide information about bond angles, electrostatics, polarity, hydrophobicity, and minimum energy with respect to the conformation of the molecule, they are not as accurate at calculations for partial charges and orbital energy. We use quantum mechanical programs such as GAMESS and COSGMS to determine the optimal geometry, orbital energy, polarity, partial charges, and solvation effects. This helps us to understand the kinetics and thermodynamics of reactions between host and guest and the differences between reactions with different but similar guests.

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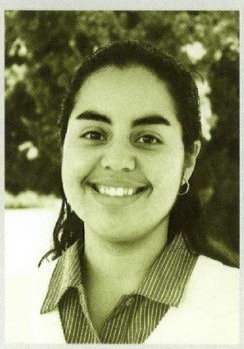
UC SANTA BARBARA PAIR CHOOSE APPLIED MATHEMATICS

Two share common interests, tutoring in Math Achievement Program, supported by CAMP



GLADIS AISPURO

MAJOR:
Mechanical Engineering
CAREER GOAL:
Robotics
SUCCESS SLOGAN:
Continue to make Mom proud

"Besides the friendliness, the best thing about being a student at UCSB is the faculty. They are very willing to help. One is Kenneth Millett, a mathematician. I met Professor Millett during the Summer Institute in Math and Science, and took calculus the first two quarters with him. He recruited me and a friend to tutor because we both had done well in his classes and were ourselves going to the Math Achievement Program workshops. Another advantage of the summer institute was getting acquainted with the campus. The friends I have made have become my family away from home. When I graduate from Santa Barbara, I'll miss having everyone I know living within one square mile. I'm co-chair of the student group, *Los Ingenieros,* affiliated with the Society of Hispanic Professional Engineers (SHPE) and the Mexican American Engineers and Scientist (MAES). *Los Ingenieros* won the 1999 student organization of the year award by the Office of Student Life—a great honor for us. We have always felt that we were a good organization and now we have won campus recognition. I continue to be a math tutor and really enjoy it. My area of emphasis is dynamics in controls. A design class, ME 97, peaked my interest in robotics. You choose a project from among many topics. I was involved with Robot Wars. I like, for example, in the entertainment industry how dinosaurs come to life through applied engineering. Someday I would like to work on a project like that."

A graduate of Livingston High School, Livingston, CA (near Delhi), Aispuro will be the first in her family to earn a college degree. She credits "cool math teachers" for her interest in engineering during her junior year in high school, when she "didn't know the full meaning of being an engineer," but the seed was planted.

CARLA BILLINGS

MAJOR:
Mathematics Science
CAREER GOAL:
Systems analysis/market research
SUCCESS SLOGAN:
Patience leads to perseverance

"I was a computer science major for three years before turning to math science. My major introduction to programming languages was highly influenced by the computer science class I took. I realized that it wasn't programming I liked but the mathematical reasoning used in the code I produced. So with a little investigation I found out about the B.S. program in mathematics science, which deals with applied mathematics—just what I was looking for. My programming knowledge (I know seven languages) gave me a big advantage when it came to programming projects. I am thankful that there is an overlap between the two areas. I took a few math classes and Professor Millett noticed that I did well in them and soon I was offered a job as a peer facilitator. The students I worked with for the first four quarters were really responsive. I was very fortunate. Teaching my own sections in the Math Achievement Program has prepared me well for the life of a typical graduate student. I have to have a firm understanding of the material in order to correctly approach a problem. During my senior year, I focused solely on coursework and a strong gpa. I took a break from participating in student organizations, such as the National Society of Black Engineers, in which I was active for two years. I'm interested in a career that combines computer science, particularly systems analysis, with perhaps market research, applying my minor in statistics."

Billings is a tutor and peer facilitator for the Math Achievement Program. She taught her own section of Math 5C during 1998-99. A graduate of St. Bernard's High School in Playa del Rey, she is giving graduate school serious consideration. Billings will complete her B.S. degree this Fall.

Writing Course Turns ENGINEERS into Authors

UCI's Engineering 190W Course a Conduit to Publication

BY JOE FORAKER, UC IRVINE

Good engineering requires good communications skills. In my position as writing instructor at UCI, I call upon the years I did public relations and communications at TRW, a high space age technology company, and 16 years of editorial work at Time, Inc.. Students in my upper division writing course learn the basics of clear writing even for highly technical material. If you can communicate your ideas succinctly, logically, and in such a manner that people outside your field of expertise can at least grasp the concepts, you're well on your way to being a professional in demand.

People who specialize in technical areas have a responsibility to themselves, their co-workers, and their professions to be prepared to handle communications tasks effectively. Competent communicators quickly stand out in a group. This talent is highly valued, as is frequently revealed in searches for employee candidates, "...must have outstanding communications skills." After you have developed an awareness of how to fulfill your future communication responsibilities, classwork focuses on several specific skills that help students become an effective presenter of technical information.

I've been teaching this course for nine years. I tell students that as communicators of technical and professional data, they must be able to meet numerous requirements. They must be fact-minded and also able to present information clearly, accurately, and precisely to audiences who have varying degrees of understanding. Engineering students particularly should know how to use different techniques and formats, such as multi-media software like PowerPoint, for presenting information, including reports and proposals. Once they put all this in perspective, and once they are in front of the classroom addressing their peers, they lose their inhibitions.

SELECTED TOPICS

- food irradiation
- concrete corrosion
- wastewater treatment
- movie special effects
- Hubble space telescope
- lie detectors
- gravity & the human body
- 21st century space flight
- automotive engine design
- supercomputers
- biological engineering
- computer animation

Required texts are *Introduction to Technical Writing: Processes & Practice* by Lois Johnson Rew, St. Martin's Press and *The Elements of Style* by William Strunk, Jr. and E.B. White, Macmillan. The students develop a research paper on an assigned topic and during week 10 of the quarter, give oral presentations. The level of sophistication that students achieve is remarkable.

In E190W, Technical Communications in a Professional World, students discover "the wonders" of *California Engineer.* The journal is the UC-wide undergraduate engineering publication that has won first place for student scientific journals in the nation. Some past

AIRBORNE LASER program

BY LYNHER RAMIREZ

United States defense technology must improve in order to sustain and eventually surpass the level of combat weapons utilized by hostile forces. More than twenty countries now have over ten thousand theater ballistic weapons in their arsenals. Ballistic missiles are those propelled by a brief boost of power supplied by rockets and travel in an arched trajectory, using momentum from gravity to hit their target.

As demonstrated in the Persian Gulf War, there was a limited capacity to protect the US and allied forces from theater ballistic missiles. An increased threat of theater ballistic missiles is highly probable if no credible defense exists against them, so the need for a viable defense system is apparent. Today, researchers are investigating the possibility of expanding missile defense systems using laser technology. Laser technology, at present, is used in various facets of life, from manufacturing to medicine. The qualities of a laser make it a highly useful tool in many applications.

DEFINITION OF A LASER

Not many people know that the word laser is actually an acronym. LASER stands for light amplification by stimulated emission of radiation. Commonly, when people think of lasers, the image of a professor using a laser pointer, or maybe a science fiction movie using lasers as powerful weapons, comes to mind. The movie depiction of laser weaponry may not be so far off.

LASER THEORY

Einstein proposed a process concerning stimulated emission of light in 1917. It was not until 1958, over 40 years after Einstein's initial theory, that lasers were constructed.

> MOST LASERS ARE CONSTRUCTED OF THREE IMPORTANT ELEMENTS: A GAIN MEDIUM, A PUMPING SOURCE, AND A RESONANT CAVITY.

Two American physicists, Arthur Schawlow and Charles Hard Townes, submitted a patent application for the working principles of lasers in 1958. The patent was granted, but was later challenged by another American physicist Gordon Gould. In 1977, the US Patent Office court acknowledged one of Gould's claims over the operating system of the laser.

The principle concerning laser light is not difficult to understand. Light is composed of particles called photons. When an electron of an atom drops from a higher energy state to a lower one, it is called emission. A natural transition is called a spontaneous emission while a forced transition is stimulated emission. The light amplification is achieved as photons move back and forth between two parallel mirrors, triggering much more stimulated emissions.

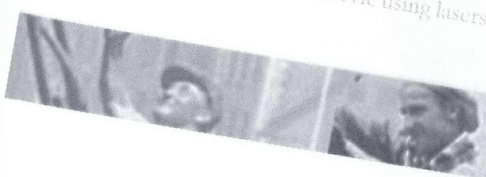
Ideal laser light is formed when groups of photons are all at the same frequency, termed monochromatic, and all photons are in the same phase, or coherent. These two properties of laser light are the difference between the light beam produced by a laser pointer and the light beam of a flashlight. The waves of laser light, being coherent and monochromatic, form an intense, highly directional, pure color beam. This is unlike the waves of light of a flashlight that have various wavelengths, which cause the light beam to spread out.

TYPES OF LASERS

Most lasers are constructed of three important elements: a gain media, a pumping source, and a resonant cavity. The laser medium and pumping source determines the specific type of laser. The first type of laser constructed was a solid-state laser pumped by irradiating a ruby crystal. Solid-state lasers have the highest power output. One mirror in the ruby laser is one hundred percent reflecting and the other mirror is only ninety-five percent reflecting, which allows for a coherent light beam to propagate out of the laser cavity. The color of the beam depends on the specific wavelength produced by the laser.

"In France, they force feed geese to enlarge their livers for the wonderful paté. Like geese, I've been force-feeding you all quarter. I hope you don't have much of a bellyache."

—JOE FORAKER, UCI WRITING INSTRUCTOR



issues have been entirely taken up by UCI undergraduate authors. Topics range from fuel cells to space stations to digital video disks and aerogels. Students have a number of criteria to follow for their papers, but one of the most distinctive is their use of an appropriate quote from a recognized expert in their chosen topic. For example, mechanical engineering major Tar Nusso used this quote from Richard P. Feynman on nano-storage: "...All of the information that man has carefully accumulated in all the books in the world can be written in...a cube of material 1/200 of an inch wide..."

A number of students are CAMP participants. Chemical engineering major Lynher Ramirez published "Airborne Lasers" in California Engineer. She is a CAMP-TOSHIBA Scholar, and her work reflects a commitment to excellence. Like Ramirez, E190W students exceed their own expectations—and I've come to expect the unexpected from them. Their use of multimedia for their presentations, their newly-acquired public speaking skills, and their creative application of the literature all contribute to quality end products: a paper suitable for submission for publication and an oral presentation with outstanding technological support.

In Spring 1999, I taught three sections of 20 students, which meant that I had to give feedback to the paper drafts as well as to the presentations—delivered in marathon-like succession in Week 10. Those sessions get their adrenaline flowing, and they put into practice many of the skills we discussed all quarter. In fact, I told them this year that I had force fed them like the French do their specialty geese—to get extraordinary results. The students always meet or exceed my expectations. Recently, four new papers have been accepted for *California Engineer,* which publishes four times a year. The papers are varied and compelling, including "Digital Cameras: A Farewell to Film," "E-Commerce: Selling on the Web," "Recreating the Wetlands," and "MP3."

Some examples of inspiring writing may be

"A big advantage of working with bright students is that they catch on quickly."

—JOE FORAKER

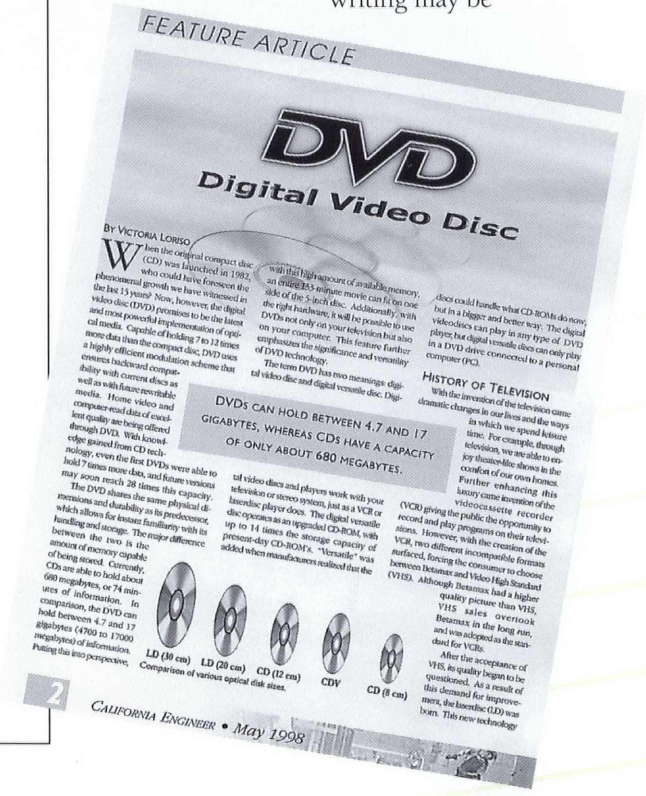
COURSE GOALS

By the end of the quarter you will be able to:

- Demonstrate the importance of good writing and speaking skills in technical areas;
- Examine the critical importance of the audience in technical communications;
- Analyze the key elements that provide a basis for the discussion and analysis of technical writing;
- Access technical communication behaviors in the student's own organization;
- Demonstrate editing and evaluation skills;
- Identify and explain the components of technical reports and methods and sources of audience response;
- Make effective decisions about report format, style, and organization as a result of audience response;
- Prepare and assemble all the necessary parts of formal and informal reports in appropriate formats;
- Orally present a technical topic with effective visual aids and articulate delivery;
- Evaluate written and oral communication skills (including your own), and develop a strategy for continued growth in both skill areas;
- Recognize unethical written and oral communication.

COURSE REQUIREMENTS

- Final Paper: Create and develop comprehensive research report (14-18 pages) on approved topic that will utilize acquired communication skills. Written presentation will be guided by extensive checklist.
- Final Oral: Plan, prepare, and deliver timed oral presentation (6-8 minutes) that correlates closely with final research report. Multimedia presentations are encouraged.


FEATURE ARTICLE

DVD

Digital Video Disc

By Victoria Lorigo

When the original compact disc (CD) was launched in 1982, who could have foreseen the phenomenal growth we have witnessed in the last 15 years? Now, however, the digital video disc (DVD) promises to be the latest and most powerful implementation of optical media. Capable of holding 7 to 12 times more data than the compact disc, DVD uses a highly efficient modulation scheme that ensures backward compatibility with current discs as well as with future rewritable media. Home video and computer-read data of excellent quality are being offered through DVD. With knowledge gained from CD technology, even the first DVDs were able to hold 7 times more data, and future versions may soon reach 28 times this capacity. The DVD shares the same physical dimensions and durability as its predecessor, which allows for instant familiarity with its handling and storage. The major difference between the two is the amount of memory capable of being stored. Currently, CDs are able to hold about 680 megabytes, or 74 minutes of information. In comparison, the DVD can hold between 4.7 and 17 gigabytes (4700 to 17000 megabytes) of information. Putting this into perspective, with the high amount of available memory, an entire 133-minute movie can fit on one side of the 5-inch disc. Additionally, with the right hardware, it will be possible to use DVDs not only on your television but also on your computer. This feature further emphasizes the significance and versatility of DVD technology.

The term DVD has two meanings: digital video disc and digital versatile disc. Digital video discs and players work with your television or stereo system, just as a VCR or laserdisc player does. The digital versatile disc operates as an upgraded CD-ROM, with up to 14 times the storage capacity of present-day CD-ROMs. "Versatile" was added when manufacturers realized that the discs could handle what CD-ROMs do now, but in a bigger and better way. The digital videodiscs can play in any type of DVD player, but digital versatile discs can only play in a DVD drive connected to a personal computer (PC).

DVDs CAN HOLD BETWEEN 4.7 AND 17 GIGABYTES, WHEREAS CDs HAVE A CAPACITY OF ONLY ABOUT 680 MEGABYTES.

LD (30 cm) LD (20 cm) CD (12 cm) CDV CD (8 cm)

Comparison of various optical disk sizes.

HISTORY OF TELEVISION

With the invention of the television came dramatic changes in our lives and the ways in which we spend leisure time. For example, through television, we are able to enjoy theater-like shows in the comfort of our own homes. Further enhancing this luxury came invention of the videocassette recorder (VCR) giving the public the opportunity to record and play programs on their television sets. However, with the creation of the VCR, two different incompatible formats surfaced, forcing the consumer to choose between Betamax and Video High Standard (VHS). Although Betamax had a higher quality picture than VHS, VHS sales overtook Betamax in the long run, and was adopted as the standard for VCRs.

After the acceptance of VHS, its quality began to be questioned. As a result of this demand for improvement, the laserdisc (LD) was born. This new technology

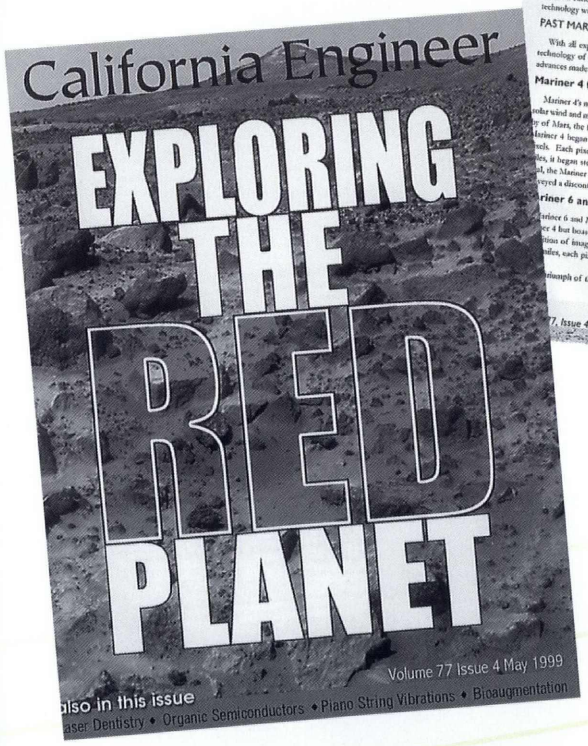
2

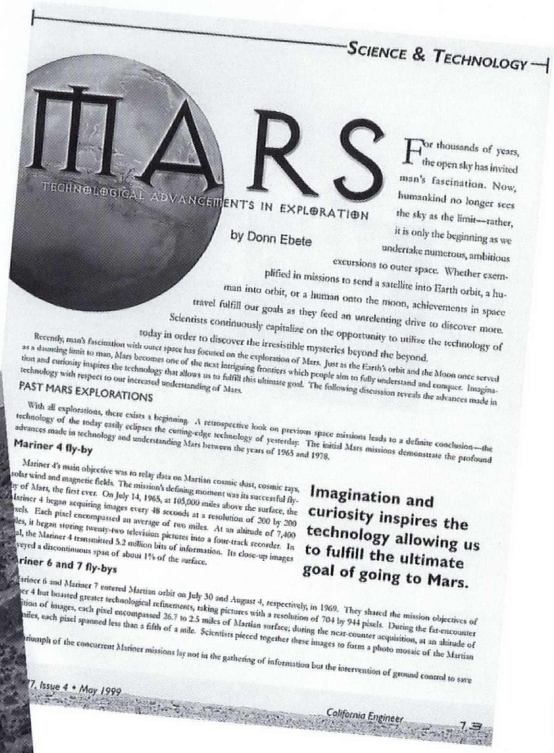
California Engineer • May 1998

found especially in the May 1999 issue cover feature article, "Exploring the Red Planet," by UCI's Donn Ebete, a civil engineering major. For his opening, Donn wrote:

"For thousands of years, the open sky has invited man's fascination. Now, humankind no longer sees the sky as the limit—rather, it is only the beginning as we undertake numerous, ambitious excursions to outer space. Whether exemplified in missions to send a satellite into Earth orbit, a human into orbit, or a human onto the moon, achievements in space travel fulfill our goals as they feed an unrelenting drive to discover more. Scientists continuously capitalize on the opportunity to utilize the technology of today in order to discover the irresistible mysteries beyond the beyond.

Recently, man's fascination with outer space has focused on the exploration of Mars. Just as the Earth's orbit and the Moon once served as a daunting limit to man, Mars becomes one of the next intriguing frontiers which people aim to fully understand and conquer. Imagination and curiosity inspire the technology that allows us to fulfill this ultimate goal."




SCIENCE & TECHNOLOGY

MARS

TECHNOLOGICAL ADVANCEMENTS IN EXPLORATION

by Donn Ebete

For thousands of years, the open sky has invited man's fascination. Now, humankind no longer sees the sky as the limit—rather, it is only the beginning as we undertake numerous, ambitious excursions to outer space. Whether exemplified in missions to send a satellite into Earth orbit, a human into orbit, or a human onto the moon, achievements in space travel fulfill our goals as they feed an unrelenting drive to discover more. Scientists continuously capitalize on the opportunity to utilize the technology of today in order to discover the irresistible mysteries beyond the beyond.

Recently, man's fascination with outer space has focused on the exploration of Mars. Just as the Earth's orbit and the Moon once served as a daunting limit to man, Mars becomes one of the next intriguing frontiers which people aim to fully understand and conquer. Imagination and curiosity inspires the technology that allows us to fulfill this ultimate goal. The following discussion reveals the advances made in technology with respect to our increased understanding of Mars.

PAST MARS EXPLORATIONS

With all explorations, there exists a beginning. A retrospective look on previous space missions leads to a definite conclusion—the technology of the today easily eclipses the cutting-edge technology of yesterday. The initial Mars missions demonstrate the profound advances made in technology and understanding Mars between the years of 1965 and 1978.

Mariner 4 fly-by

Mariner 4's main objective was to relay data on Martian cosmic dust, cosmic rays, solar wind and magnetic fields. The mission's defining moment was its successful fly-by of Mars, the first ever. On July 14, 1965, at 105,000 miles above the surface, the Mariner 4 began acquiring images every 48 seconds at a resolution of 200 by 200 pixels. Each pixel encompassed an average of two miles. At an altitude of 7,400 miles, it began storing twenty-two television pictures into a four-track recorder. In total, the Mariner 4 transmitted 5.2 million bits of information. Its close-up images conveyed a discontinuous span of about 1% of the surface.

Imagination and curiosity inspires the technology allowing us to fulfill the ultimate goal of going to Mars.

Mariner 6 and 7 fly-bys

Mariner 6 and Mariner 7 entered Martian orbit on July 30 and August 4, respectively, in 1969. They shared the mission objectives of Mariner 4 but boasted greater technological refinements, taking pictures with a resolution of 704 by 944 pixels. During the fat-encounter acquisition of images, each pixel encompassed 26.7 to 2.5 miles of Martian surface; during the near-encounter acquisition, at an altitude of 2,000 miles, each pixel spanned less than a fifth of a mile. Scientists pieced together these images to form a photo mosaic of the Martian surface.

The triumph of the concurrent Mariner missions lay not in the gathering of information but the intervention of ground control to save

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California Engineer 7

Seeing their writing in print is tremendously rewarding for students, and as their instructor, it makes the long hours of preparation that more worthwhile. Far more than building confidence and professionalism, being published—and having had to present the material in a finely-tuned presentation—gives students an edge when they interview for jobs. Former students tell me that the experience prepared them to be competitive. Often companies will require the final candidates to give a 20-minute presentation. It's the "proof" companies are looking for when they state the necessity for communications skills. Do I get tired of listening to fledgling engineers present their chosen research topic? Never! They make me feel young and they inspire me.

"Before taking this class, I was shy and couldn't speak in front of the class. After my presentation in this course, I learned that I could do it."

—SIO FU

"Cal Engineer is 77 years old or more. These past two years, it has risen from the ashes. UCI students have been consistently strong submitters."

–JEFF YEE, EDITOR, CALIFORNIA ENGINEER, UC BERKELEY

—Joe Foraker loves to teach. He also loves to grow roses. He designed and developed—and frequently is the sole tender of—the Chancellors' Rose Garden at UCI, with 365 varieties of roses. Foraker's students are regularly published in California Engineer, the journal of the UC engineering colleges and the only UC-wide undergraduate engineering magazine. UCI engineering alum Scott Fable, now a Berkeley graduate student, served as business manager and editor-in-chief for two years, attracting financial support and putting California Engineer back on the map.

Thanks to California Engineer *for permission to use their covers and inside pages to illustrate this feature.*

MUTUALISM = LEV

CAMP EXPANDS UC PR

SANTA CRUZ

ACE is the place

ACE Honors Program gives students an edge

By Nancy Cox-Konopelski

The Division of Natural Sciences developed the ACademic Excellence (ACE) Honors Program to give underrepresented students an edge. It began in 1986 with pilot mathematics study groups and expanded the following year to include intensive study sections in precalculus, calculus and general chemistry.

I came on board in 1988 as a section leader for general chemistry. Based on the success of these sections, the Division of Natural Sciences agreed to expand the chemistry component of the program to include organic chemistry, at which point I became the ACE chemistry coordinator. I worked closely with faculty to ensure student success in both general and organic chemistry courses. ACE grew to include biology coordinator Ginger Trumpbour and mathematics coordinator Ray Lapuz. Both are in close communication with their respective faculty to cement a broad foundation for students with math and science-intensive majors.

In 1997 I became the program director, allowing me the opportunity to affect the retention and graduation of all of the ACE students, not just those in chemistry. During the 1997-98 academic year, ACE served approximately 250 different students who enrolled in one or more discussion section in precalculus or calculus, general or organic chemistry, general biology or genetics, or calculus based physics. CAMP supports a vital component—our peer mentors. Each quarter CAMP provides stipends for ten to twelve of these trained, knowledgeable student staff members.

ACE seeks a diverse mix of students who will contribute to a strong learning team. Membership comes from all social and economic backgrounds, with a wide range of academic preparation. All share a commitment to achieve their personal best. Students are selected based on a combination of factors, including, but not limited to, academic record and goals, disadvantage, and dedication. Student

ACE is dedicated to increasing the number of highly-qualified underrepresented science students graduating with natural science degrees. The program does that by providing a setting in which students are given a healthy balance of support and challenges to achieve their personal best.

[Mutualism: mutual, beneficial association]

ERAGE OGRAMS

performance is monitored, and students receive advising on majors, course planning, and career pathways. Over the past 12 years, we have seen approximately 2,000 students benefit from ACE.

We measure success in several ways. One is student performance data. ACE students earn about 5% more As and Bs in their courses than students at large. Another is students' participation in undergraduate research. Since 1992, 123 CAMP research stipends have been awarded to UCSC undergraduates working with faculty in the Division of Natural Sciences and the School of Engineering. Seventy percent of those stipends have been awarded to current or former ACE Honors students.

Since 1990, when it was conceivable that ACE students could first matriculate into the National Institutes of Health Minority Access to Research Careers (MARC) and Minority Biomedical Research Support (MBRS) Programs, 56% of the 135 fellowships have been awarded to ACE Honors students.

The final measure of the success of our program, the goal of which is to mentor students to the baccalaureate, is to look at graduation data. Of those ACE students who could have graduated by now, 62% have done so compared to the national (six-year) average of 56% (for Division I schools in 1991-92, *The Chronicle of Higher Education, November 20, 1998*). Seventy-five percent of the ACE graduates have earned their degree in majors within the Division of Natural Sciences. Nationally, the African American six-year graduation rate in 1991-92 was 40%, whereas that rate for African American ACE students is 63%. The national graduation rate for Chicano/Latino students that year was 45% compared to a rate of 63% for Chicano and 59% for Latino ACE students.

The ACE Honors Program is unique because it is co-curricular rather than extra-curricular. Neither remedial nor for credit, an ACE section usually replaces a regularly scheduled discussion section for the course and provides a setting in which students master the material while developing critical thinking

MEET ACE TUTOR: JACQUELINE EPPS

Fourth year participant in ACE and a program tutor, Epps began with math, expanded to chemistry, and then to organic chemistry. She has been both a CAMP mentor and co-leader for pre-calculus, calculus, and the general chemistry series.

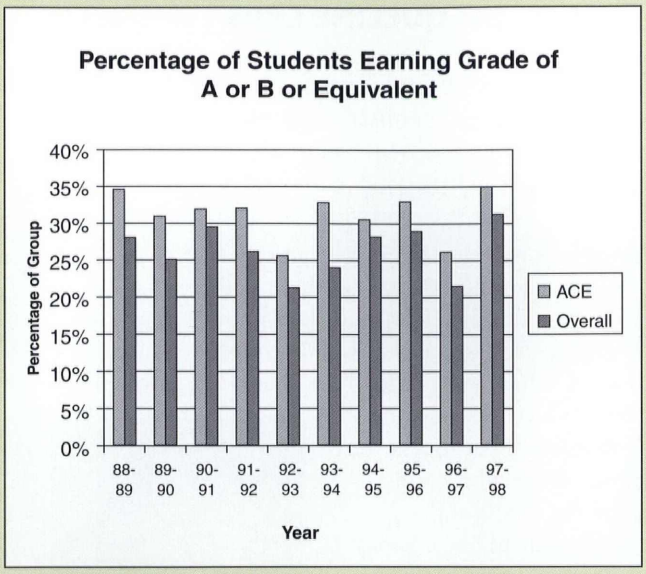
"My education at UC Santa Cruz continues to be one of the best learning experiences that I will ever have. ACE has played an enormous part in my success. It is an integral part of my life, for the social as well as the academic aspects. My gpa is around a 3.6, which I attribute to the work ethic instilled in me by the program. It has taught me how to work collaboratively and to bring out the best in whatever I do. The staff is caring and concerned about my efforts and achievements. I think of them like a family.

"ACE teaches you how to achieve and maintain self-motivation. And if you should fall short there is always someone, a peer or staff member, who can help you replenish your supply. One time organic chemistry wasn't going so well. It was the second midterm and I had studied so hard for it. I left the test feeling that my best wasn't good enough. I dropped by a program staff member's office, who happened to be my section leader for the class. She convinced me that I could do it and that it wasn't the end of the world. This is the type of support that makes my experience unique at UCSC and that helps to shape my decisions about future pursuits.

"The best aspect of being a Santa Cruz student is having the closeness that I do with so many people. This includes peers, staff members, and recently, faculty. I have found that at UCSC in general, people show genuine concern for your well-being and success.

Jacqueline "Jackie" Epps completed a summer fellowship at UCSF in the laboratory of Dr. Leslie Benet, Biopharmaceutical Chemistry Department, School of Pharmacy. Based on her assignment, she wrote a proposal and an abstract and delivered an oral and a poster presentation. She did "a ton of mass spectrometry," important to her preparation for graduate school.

"Initially, I had wanted to be a biology major. I didn't take a biology class until my junior year—only to discover that by this time I loved chemistry. I also explored being a math or economics major. However, after a rigorous year of trial and triumph in organic chemistry, I decided that chemistry would be my way of life."



ACE students are more likely to receive grades of A or B than the average student in a course. Experience shows that our students graduate and excel. . . . We measure success based on student retention, achievement, and graduation.

and problem-solving skills. Focus is on introductory courses and the critical transition points when students enter the intensified rigors of university science coursework. The program does not offer sections for upper division courses because the collaborative skills learned in the introductory sections transcend course number. Students communicate their understanding of the material by teaching each other. They recognize their peers not only as classmates from whom to copy the notes, but also as friends with whom they share a common goal. They begin to integrate into a broader scholarly community and thus emulate the values and mores of professional scientists whether in industry or academe.

ACE discussion sections serve no more than sixteen students in a collaborative workshop setting that meets twice a week for two hours. Students engage in guided development and practice of problem-solving skills using supplemental materials. A professional section leader with an academic background in the subject matter prepares the supplemental problem sets and facilitates these workshops. The section leader regularly confers with the professor of the course. An undergraduate co-leader who has excelled in the course and has been part of the program assists, bringing the student to teacher ratio to 8:1. It is this small group setting that is crucial to our success. Students get to know and trust each other, an essential aspect of community. Outside of section, students are assigned a CAMP peer mentor who works with them to assess and strengthen study techniques and conceptual understanding.

Seasoned participants are encouraged to become co-leaders and peer mentors. One of these is Jacqueline Epps, a junior chemistry major who served both as co-leader and CAMP mentor for general chemistry during 1998-99. Since she had applied and was accepted to UC San Francisco's 1999 Summer Undergraduate Research Program as well as UCSC's MARC Program, she was in a unique position to encourage her first year chemistry students to consider undergraduate research in their academic plans. Her summer program was challenging and inspiring. Now, back at Santa Cruz as a MARC fellow, she is continuing her course-work while undertaking her senior research in Professor Barry Bowman's biochemistry laboratory. She plans to pursue graduate work in pharmacology.

Our staff, whether student or professional, actively encourages student participation in research and internship programs. Several of these interns presented their summer research projects at the CAMP Statewide Undergraduate Research Symposium last April. The collective experience and wisdom these undergraduate researchers bring to the program is invaluable.

A supportive environment precipitates success. Students striving to give their personal best to their studies discover that ACE is a place to learn, develop, and share the habits, attitudes, and skills that lead to academic success and preparation for graduate studies.

We are located in a readily accessible, student-friendly space in the UCSC Jack Baskin Engineering Building (formerly Applied Sciences), next door to the Multicultural Engineering and MESA Programs. This offers further opportunity for programmatic cooperation and resource leveraging. Cooperation and leveraging are indeed skills we endeavor to teach our students. If collaborative learning serves as the cornerstone of our program, then personal responsibility creates the rest of the foundation. Students who own their education have the confidence to leverage their success as undergraduates to achieve their career goals.

Our mission is to graduate more underrepresented students with mathematics and science degrees, offering opportunities that allow students to realize that mission. Our challenge, therefore, is to provide a culture and community that nurtures them and optimizes their potential. We are equal to the task.

"Over the past 12 years, we have seen approximately 2,000 students benefit from ACE." —Nancy Cox-Konopelski

To learn more about the ACE Honors Program, visit http://natsci.ucsc.edu/acad/ace/ or contact Nancy Cox-Konopelski, ACE Honors Program Director by e-mail nancyck@cats.ucsc.edu.

DAVIS

MORE moves forward

New criterion and foundation support from Intel, Dow Chemical

By Ryan D. Mitchell

Mentorships and Opportunities for Research in Engineering (MORE) is a program in the UC Davis College of Engineering that seeks to increase the participation of all undergraduate engineering students in faculty/graduate student research. MORE is the brainchild of Dr. Zuhair Munir, a leading educator and materials scientist who led the initiative to establish the program in 1987. He has served the College as Associate Dean for Graduate Studies since 1980.

"I observed the lack of diversity among engineering graduate students and concluded that a program was needed to hook undergraduates on the challenges and satisfactions of research at an early stage in their education," Munir said.

Exposure to the dynamics of research not only enhances professional opportunities, but may also be critical for encouraging some students to consider an advanced degree that may broaden their career choices. The program has grown to be inclusive of all Davis undergraduate engineering majors.

Selected on the basis of upper-division standing and minimum gpa of 2.75, MORE students are expected to participate in the program at least three academic quarters, which may include the intensive summer program. In addition to laboratory experience, students attend a seminar series focused on issues relevant to both graduate school and transition to industry and broader society.

In addition to CAMP-NSF funds, private foundations provide stipends. Intel, a long-time educational partner, gave $32,580 in direct student support during 1998-99, and some of these funds went to CAMP students. During the school year, students receive $840 per quarter, and $3,000 during the

Of the 12 (current or past) MORE students graduating in 1999, nine are enrolling in graduate school this fall. Five are CAMP students: Jafar Faghih (above in the lab), Javier Garay, Kofi Inkabi, Jessi Johnson, and Daniel Leigh-Martinez.

intensive summer program.

Intel supported two outstanding CAMP students in 1998-99: Jafar Faghih and Daeron Lockett.

Faghih, a June 1999 Davis graduate, was a civil and materials science engineering major. He conducted research under Dr. Munir on methodologies for synthesizing various ceramic composites that have important structural applications. This fall, he is enrolled in the UCLA graduate program in civil engineering.

Lockett, an electrical engineering major in his senior year, has been mentored by Dr. Scott Collins, Department of Electrical and Computer Engineering, focusing his research on silicon-wafer circuit design. Upon completing his B.S. degree, Lockett hopes to continue on to graduate school.

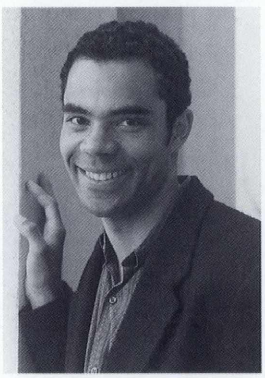
Intel Foundation funds also support nine additional MORE researchers for 1999-2000.

Another important contributor is Dow Chemical Company Foundation, consistently giving $500 - $1,000 the past few years in support of our annual banquet that brings together the student researchers, faculty mentors, advisory board members, and special guests. In addition to sustaining infrastructure, these funds allow us to cover advertising for recruitment. Dr. Randy Yoshisato from the Dow Chemical Company in Pittsburg, CA has been a long time MORE Advisory Board member and ambassador of Dow's commitment to education.

The success of MORE is best determined by the number of students who pursue an advanced engineering degree. Since its inception in 1987, MORE has supported the involvement of 197 students in faculty/graduate student research activities. Of the 162 students who have graduated, 56 had immediate plans to pursue either a master's or doctoral degree in engineering. This number represents 35% of all graduates. With the addition of the new MORE admittance criterion in Summer 1998, a strict gpa requirement (minimum 2.75), I am hopeful that this number will increase. In the past, a number of students were only marginally qualified for graduate study despite the enriching activities we offered. The implementation of stricter criterion will enhance the pool of students that are most likely to receive maximal benefit from our activities, which includes increasing the numbers of students entering well-respected graduate programs.

The merit to these ideas has already been seen in the first class of new program alumni. Of the 12 (current or past) MORE students graduating in 1999, nine are enrolling in graduate school this fall. Five are CAMP students: Jafar Faghih, Javier Garay, Kofi Inkabi, Jessi Johnson, and Daniel Leigh-Martinez. We have 10 CAMP students in the 1999-2000 academic year program, six of whom have begun their MORE experience summer 1999.

CAMP COORDINATOR UPDATE



Dr. Ryan Mitchell is currently teaching fall sememster Chemistry 1A at Sacramento City College. The course covers topics such as atomic and molecular structure, chemical bonding, nomenclature, stoicheometry, thermochemistry and the nature of solids, liquids, and gases. During the summer, Mitchell had an opportunity to teach the laboratory component of the course. The lectures were taught by Dr. Paul Steed, a long time contributor to CAMP at Davis. Steed has served for many years as a chemistry workshop facilitator for MESA students in the CAMP-funded Workshops for Excellence Program.

Mitchell is currently teaching a section of Chemistry 1A lecture and the accompanying discussion sections.

"Teaching at Sacramento City College is enjoyable. It allows me to interact with a large cohort of a diverse pool of students that CAMP will in turn support. These students are a critical cohort for ensuring a diverse pipeline of qualified students seeking an advanced education in math, science, and engineering."

Mitchell assisted with the Summer Research Opportunities Program research symposium at Pennsylvania State University (where he earned his undergraduate degree). He moderated an oral presentation session and provided feedback to students in poster presentations—applying the same standards he employed for presenters at the 1999 CAMP Statewide Symposium. Mitchell has been with CAMP since 1995.

"I observed the lack of diversity among engineering graduate students and concluded that a program was needed to hook undergraduates on the challenges and satisfactions of research . . ."

—Zuhair Munir, Ph.D., College of Engineering, UC Davis

BERKELEY

PSP strengthens coalition

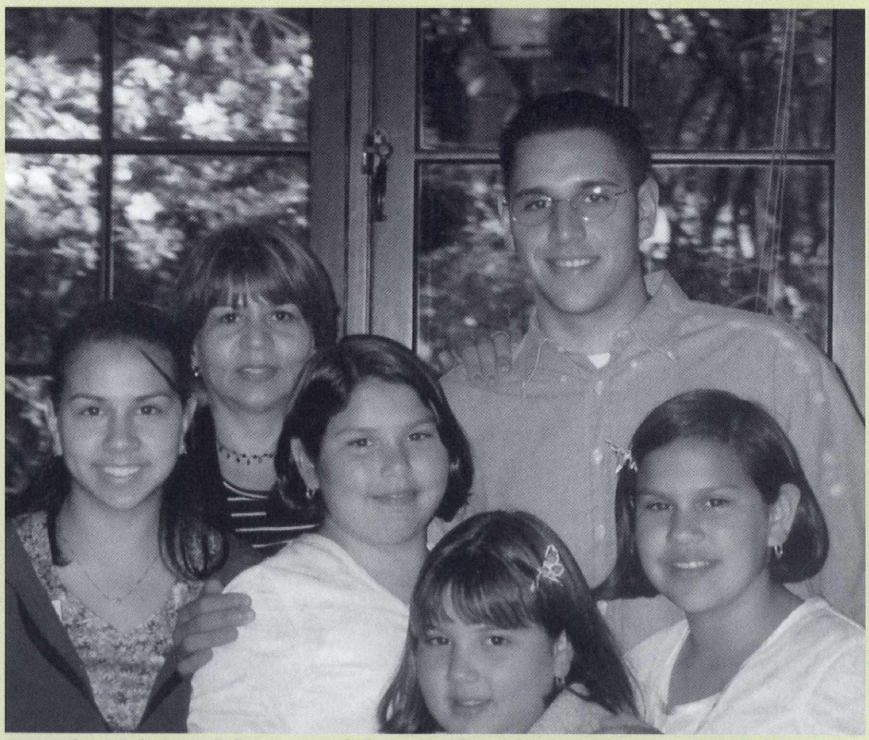
Physics Scholars Program partners to promote learning

By Bruce B. Birkett

With support from CAMP-NSF, students in the Physics Scholars Program (PSP) actively participate in a community of scholars as both teachers and learners. Through problem-solving workshops and "intensive discussion sections," where students study in pairs or groups to solve honors-level problems, participants gain a sense of community with others who share an interest in the physical sciences. All aspects of the program are designed to promote the success of intellectually motivated undergraduates. Primarily, we work with students historically underrepresented in physics, and prepare them for graduate study and/or professional careers. Serving as faculty director for PSP is a very rewarding aspect of teaching at Berkeley.

We recruit the most highly qualified graduate student instructors and tutors in the Physics Department to work with participants. Instructors are trained to use the most effective educational techniques to foster students' conceptual understanding and collaborative learning. PSP provides participants with research opportunities, some with stipends, and other professional development activities such as career preparation colloquia, exposure to careers in physics in academia and industry, and academic and financial support for students' presentations at professional conferences. The program welcomes all students interested in the physical sciences (physics, astrophysics, astronomy, geology, geophysics, and physical science) as well as those whose intended fields of study require the Physics 7 series (including biophysics, chemical engineering, chemistry, engineering, and environmental sciences).

To leverage our efforts at Berkeley, we formed the Coalition for Excellence and Diversity in Mathematics, Science, and Engineering. This Coalition is a partnership of colleges, departments and programs that have joined together to engage historically underrepresented students in the joys and excitement of science, mathematics and engineering and to help them excel in these fields. Among many benefits is the opportunity for research, such as through the Chevron Scholars, addressed later in this article. Our long-term goal in the Coalition is to increase the diversity of professionals in science, mathematics and engineering, build a workforce that better reflects contemporary society, and strengthen the nation's intellectual and economic potential. In addition



Timothy Melano celebrates with his proud mother and sisters after his oral presentation on "Passive vs. Active Suspension Quarter-Car Models" at the 1999 Chevron Undergraduate Research Program Research Symposium.

"We are trying to leverage resources."
—Professor Bruce B. Birkett, PSP Faculty Advisor

to the Physics Scholars Program, Coalition membership includes:

Biology Scholars Program, Howard Hughes Medical Institute: peer teaching and association with mentors and role models are key community-building aspects. Participants become "system-smart" through timely access to information and contact with culturally sensitive faculty, staff, graduate and advanced standing undergraduate students. The goal is to increase the participation of Berkeley undergraduates from historically underrepresented groups in the biomedical sciences. It is designed to provide women and students of color with a way to secure access to resources. Founded in 1992, the biology scholars community currently includes more than 200 active members.

College of Chemistry Scholars Program, College of Chemistry: provides a rich intellectual community life that affirms students' diversity, intellectual interests, and professional goals. The College has designated a resource and study center to which participants have exclusive access. The program was established in Fall 1991 to promote and advance the educational and career opportunities of students from groups historically underrepresented in the fields of chemistry and chemical engineering. The retention component has served more than 211 students since its inception.

Ronald E. McNair Scholars Program, Academic Achievement Division, Office of Undergraduate Affairs: Students benefit from a close relationship with a faculty mentor and are immersed into the challenges, excitement, and rigor that signify research at Berkeley. Students engage in weekly seminars on research techniques and advanced methodology skills, research writing, computer resources, and time management. In the summer, students present their research findings in a national symposium. The goal is for 50% of the scholars to apply and be admitted to at least one graduate program leading to doctoral study, with a full financial aid package. The McNair Scholars Program, now in its fifth year, is for low-income, first-generation college and underrepresented students from all disciplines. Each year 31 students are selected to pursue rigorous and substantive research.

Charles Tunstall Multicultural Engineering Program, The College of Engineering, Center for Underrepresented Engineering Students: MEP faculty have reengineered the entire process through which students experience undergraduate education at Berkeley to foster a supportive environment in the College of Engineering for underrepresented students. Program innovations range from early identification and recruitment in high school to a week-long community-building "academic boot-camp" for admitted students just prior to the fall term. An extensive department-based network of graduate students, staff and faculty provide academic support for engineering students in mathematics, physics, chemistry, and engineering courses. MEP prepares students to enter graduate school in engineering by providing a strong undergraduate education and research internships on campus and in industry. Founded a decade ago, the MEP community includes about 300 students with 75 new students each year.

Professional Development Program, The Academic Senate Special Scholarship Committee: PDP is centered around calculus or pre-calculus, with all students taking "intensive discussion sections" in these classes. These official sections of mathematics department-offered courses are led by specially trained graduate student instructors. Students are provided opportunities to work collaboratively in small groups on honors-level problems. Tutoring, advising, and seminars round out the student community at PDP, which promotes the success of those who are underrepresented in mathematics and science in the university. Working jointly with the Mathematics Department, PDP trains mathematics graduate student instructors who teach calculus to underrepresented students. Instructors try out new teaching techniques using innovative curriculum materials, traditional small study group techniques and custom designed computer lab modules. From six to ten graduate students teach calculus to about 125 undergraduates each year.

Student Learning Center, The Office of Undergraduate Affairs, Chávez Student Center: supports the campus's diverse undergraduate community. The center provides math and science drop-in tutoring areas in which students discuss class topics as well as receive direct assistance from one of more than 125 student tutors. It also serves students in statistics, economics, study strategies, business administration, writing and composition, and the social sciences. Through one of the 40+ math/science study groups and adjunct courses, students are given the opportunity to join smaller, more focused communities centered around their individual classes. These groups and courses are almost exclusively student led, and serve as a vehicle for students to discuss their class material in a facilitated small group environment. The Center is one of the primary sources of undergraduate tutor training at Cal.

Whatever program students connect with, shared information and resources among the Coalition are a great advantage for the students. For example, Chevron supported the Chevron Scholars in 1998-99, drawing participants from several member programs of the Coalition: Timothy Melano, Viviana Acevedo-Bolton, Devana Cohen, Dionna Harris, and Danny Ooi. The five undergraduates presented their year-long research projects at a symposium last May held at the Faculty Club.

Graduating senior Dionna Harris, physics, took the beginning physics sequence with Dr. Andrew Elby, who wrote the books for the physics scholars sections. "He made it intuitive," Harris says. Her research was on the development of carbon nanotubereinforced composites.

Harris told the audience, "Being a Chevron Scholar was a great experience. To have funding for a year changes the department's perception of you." A May '99 graduate, Harris is enrolled in graduate school this fall at Cal Poly San Luis Obispo. She is pursuing the Engineering Management Program and in two years will have earned both an MBA and a masters in engineering. With her energy, she will be great working with students.

Timothy Melano, a third year mechanical engineering major, brought his family to see his hard work. He presented a design of passive suspension for which he developed mathematical models.

Other topics presented include "The effects of transient acetate loading on enhanced biological phosphorus removal of wastewater," "Rheology of liquid crystal polymers: HPC," and "Studies of structural and catalytic roles of aspartate transcarbamoylase in *E. coli*."

My colleague, Dr. Michele DeCoteau, MEP Director, said, "The Chevron Scholars are already doing work at the graduate level." A materials scientist herself, DeCoteau affirmed, "The presenters really knew their material." Simply put, it sums up our collective goals.

From every aspect of the collaborations within the Coalition, including new opportunities like the Chevron internships, students are the focus and the reason for our efforts. Visit our web page: www.aad.berkeley.edu/coalition/

UC BERKELEY FACULTY ADVISOR PROFILE

BRUCE B. BIRKETT

- Ph.D., Physics, University of California, Berkeley, 1994
  Outstanding Graduate Student Instructor Award, 1989
- A.B., Physics, University of California, Berkeley, 1988
  Highest Honors in Physics, Highest Distinction in General Scholarship, Phi Beta Kappa

SPECIAL INTEREST:

- Teaching, Curriculum, Undergraduate Development
- Birkett is a Fellow, NSF Program in Science, Mathematics, Engineering, and Technology Education, UCB (1998-present). He develops and coordinates intensive discussion section (IDS) format for introductory physics and mathematics programs, and improves professional development programs for graduate student instructors.

ADVISING:

- Faculty Advisor, Physics Scholars Program, Department of Physics
- Faculty Director, Chevron Research/Scholarship Program
- Member, Coalition for Excellence and Diversity in Science, Mathematics, and Engineering
- Member, Lawrence Hall of Science Advisory Board

PROFESSIONAL ACTIVITIES (SELECTED):

- Panelist, AAC&U Annual Meeting, Session on reform of SMET education, 1999
- Team Leader, UCB, AAHE Conference on Institutional Change, 1998
- Presentation, UC Systemwide Meeting of Physics Departments, IDS Approach to Physics, 1997
- Team Leader, UCB, NSF/NRC Shaping the Future: Revitalizing Undergraduate Education Conference, 1996
- Participant, NSF Proposal review, Course and Curriculum Development Program, 1996

TEXTBOOK DEVELOPMENT:

- Author, with Andrew Elby, *Learning Physics.* John Wiley & Sons (Publication 2005).
- Contributing author, *Physics for Scientists and Engineers,* by Douglas Giancoli, Prentice-Hall publishers (1998).
- Member, early development team for *The New Physics,* by Eric Mazur, Prentice-Hall Publishers (1995-97).

PROFESSIONAL ASSOCIATIONS:

- American Association of Physics Teachers
- American Educational Research Association
- American Physical Society

Birkett was the senior collaborator for *Improving Gateway Courses in Mathematics, Physics, and Chemistry.* He coordinated the successful application to NSF "Institutionwide Incentive Award" program.

Excellence

SCIENCE PRIZES AWARDED

UCI, UCSC faculty select outstanding student recipients

At UCI and UCSC, three undergraduates have been named to receive the inaugural awards created in honor of their distinguished faculty. At Irvine, Juan L. Bravo received the 1999 Francisco J. Ayala Science Prize and Erick R. Miranda received the 1999 Luis P. Villarreal Science Prize. At Santa Cruz, Rebecca Vega won the prize named in honor of Frank Talamantes, who, along with Professors Ayala and Villarreal, are recipients of the SACNAS Distinguished Scientist Award. The faculty's national recognition precipitated the subsequent honor of the CAMP science prizes for undergraduates. Students must be nominated by a faculty member. They must have a strong academic record, engage in research, and demonstrate potential for graduate school.

UCI's Ayala is a renowned evolutionary biologist who consistently supports CAMP events and serves on the statewide advisory board. Villarreal, a molecular biologist, helped to design the UCI CAMP summer science academy curriculum. His specialization is the study of viruses. UCSC's Talamantes, an endocrinologist, has for more than 25 years served as a paradigm for excellence in science education.

Faculty at both campuses praised the student recipients.

"I have little doubt that Juan [Bravo] will get into a top-notch graduate program and will have an outstanding graduate career," UCI Professor Thomas L. Poulos stated in his letter supporting the nomination. He said, "When Juan enters graduate school, he will be well trained in a number of techniques that will enable him to make advances quickly."

Bravo will complete his B.S. degree in June 2000.

"Erick [Miranda] is a truly outstanding student and a university citizen," said Dr. Michael E. Selsted, Professor and Vice Chair of the Department of Pathology, UCI College of Medicine. "Erick has already been recognized as a Regent's Scholar, a Chancellor's Scholar, and as a Dean's Honor Roll member for seven quarters. . . . I cannot imagine anyone being more deserving of the Villarreal Science Prize."

Miranda completed his B.S. degree in June 1999.

"Rebecca Vega is our star. She is attending graduate school at Stanford this fall. She is a dedicated, hard-working student who excelled in her research," Russell Flegal said on behalf of the UCSC biology department. Vega did her senior thesis with Giacomo Bernardi.

CAMP Statewide Office worked with the two campuses to design the criteria and selection process.

***UCI's Erick Miranda and Juan Bravo celebrate with Dr. Francisco Ayala who serves on the CAMP Statewide Advisory Board. Excerpts from Ayala's lecture, "Biological Evolution and Ethical Behavior," appeared in the Fall 1997* Quarterly. *He was recently profiled in the* Los Angeles Times.**

1999-2000 Academic Year
Special Events Calendar

September 1999

1 UCLA CARE POSTER PRESENTATIONS
UC Los Angeles, 159 MBI

22 UCI CAMP SUMMER SCHOLARS SYMPOSIUM
UC Irvine Social Sciences Lecture Hall

22-26 MAES NATIONAL LEADERSHIP CONFERENCE
Seattle, Washington - www.tamu.edu/maes

October 1999

1 UCSC CAMP UNDERGRADUATE RESEARCH SYMPOSIUM
UC Santa Cruz, Earth Marine Science Building

6-9 ACS WESTERN CONFERENCE
Ontario, California - www.acs.org

7-10 SACNAS CONFERENCE
Portland, Oregon - www.sacnas.org

15 CAMP REGIONAL DIRECTORS' MEETING
UC Berkeley

November 1999

7-13 ACS NATIONAL CHEMISTRY WEEK
www.acs.org/ncw

18-20 AISES CONFERENCE
Minneapolis, Minnesota - www.aises.org

January 2000

19 CAMP ADVISORY BOARD MEETING
UC Irvine

20-23 MAES NATIONAL SYMPOSIUM & CAREER FAIR
San Antonio, Texas - www.tamu.edu/maes

February 2000

17-22 AAAS CONFERENCE
Washington, D.C. - www.aaas. org

20-26 NATIONAL ENGINEERS WEEK
www.eweek.org

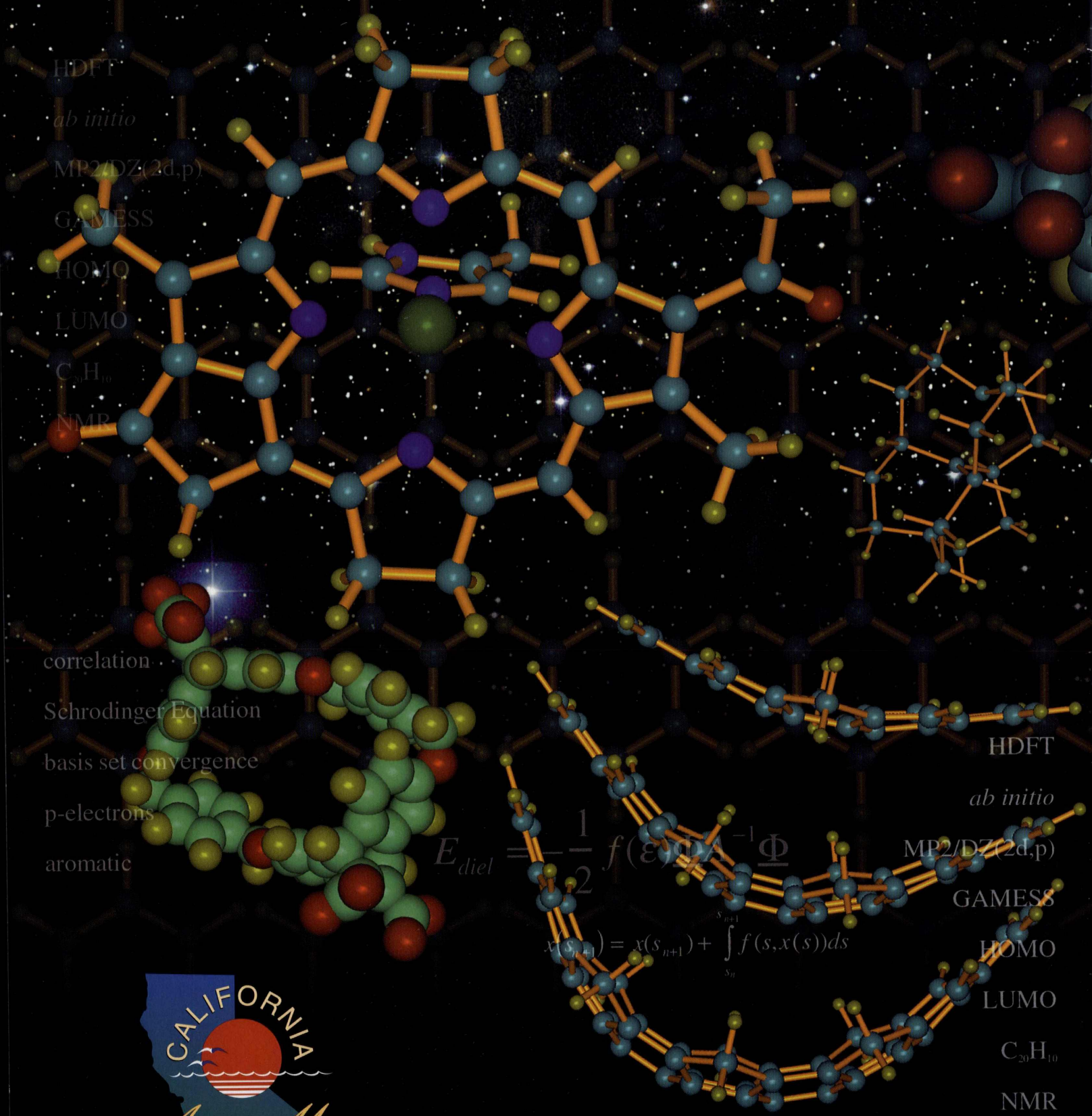
March 2000

7 MARIA GOEPPERT-MAYER SYMPOSIUM
UC San Diego, San Diego Supercomputer Center

22-26 NSBE CONFERENCE
Charlotte, North Carolina - www.nsbe.org

April 2000

7-9 CAMP STATEWIDE UNDERGRADUATE SYMPOSIUM
UC San Diego



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