

The Regents of the University of California

COMMITTEE ON EDUCATIONAL POLICY

May 20, 1999

The Committee on Educational Policy met on the above date at Covell Commons, Los Angeles campus.

Members present: Regents Atkinson, Bagley, Connerly, Davies, Espinoza, Khachigian, Kozberg, Lansing, Miura, Montoya, and Willmon; Advisory members Pannor, Taylor, and Vining

In attendance: Regents Bustamante, Hopkinson, O. Johnson, S. Johnson, Leach, Lee, Parsky, and Preuss, Faculty Representatives Coleman and Dorr, Associate Secretary Shaw, General Counsel Holst, Treasurer Small, Provost King, Senior Vice President Kennedy, Vice Presidents Broome, Darling, Gomes, Hershman, and Hopper, Chancellors Berdahl, Bishop, Carnesale, Cicerone, Dynes, Greenwood, Orbach, Vanderhoef, and Yang, Laboratory Director Tarter, and Recording Secretary Nietfeld

The meeting convened at 1:35 p.m. with Committee Chair Connerly presiding.

1. UNDERGRADUATE RESEARCH AT THE UNIVERSITY OF CALIFORNIA

Provost King observed that undergraduate research lies at the core of the research university, as it represents a synergistic interaction between faculty, undergraduate students, and graduate students. He introduced the presenters as follows: Mr. Robert Shelton, Vice Provost for Research in the Office of the President; Ms. Judith Smith, Vice Provost for Undergraduate Education at the Los Angeles campus; and Mr. Peter Dale, Vice Provost for Undergraduate Studies at the Davis campus.

Vice Provost Shelton recalled that in its 1998 Report, "Reinventing Undergraduate Education: A Blueprint for America's Research Universities," the Boyer Commission on Educating Undergraduates in the Research University promoted a model of integration among faculty, researchers, graduate, and undergraduate students in the research university. "The research universities," the Commission wrote, "possess unparalleled wealth in intellectual power and resources; their challenge is to make their baccalaureate students sharers of the wealth."

The report goes on to suggest that "...faculty time is best invested in classes in which interaction with students is normal and integral." The University of California has promoted undergraduate research by encouraging a variety of opportunities for undergraduates to interact meaningfully with faculty.

First, faculty bring their scholarship, research, and creative works into the classroom, forging links between research, theory, and practice as part of teaching in every discipline. During 1997-98, campuses continued their efforts to increase interaction between faculty and undergraduate students, especially by offering lower-division seminars and undergraduate research experiences.

An important trend at the University of California has been the increase in support and opportunities available to undergraduate students for research experiences. Campus and federal funds have been earmarked for financial support of undergraduates in research. Research opportunities are available not only from the disciplines and interdisciplinary programs and schools but also from many outside agencies, including the national laboratories, industrial partners, and other universities. The National Science Foundation, for instance, supports undergraduates in research through its Research Experiences for Undergraduates (REU) Program. REU supplemental funds are used to help Principal Investigators hire undergraduates to assist with existing NSF-funded research projects. The Riverside and Santa Cruz campuses are the most innovative users of the REU program; between them, they capture more than half of the almost thirty REU grants awarded to the University of California.

Students are often matched with faculty mentors to guide them through the various phases of their research. Many campuses now organize special conferences for undergraduates to share their research, publish journals specifically for undergraduates to showcase their research, and award prizes for outstanding undergraduate research.

Vice Provost Shelton reported that results from a 1997-98 student expense and resources survey show that 70 percent of UC students surveyed responded that it was very important to them to attend a university that offers them the opportunity to work with a faculty member on a research project. Nearly one-third of all seniors have had the opportunity to work on a research project directly with a faculty member.

Berkeley

Last year, the Berkeley campus opened its centralized Office of Undergraduate Research. The office administers several undergraduate research programs and publicizes research opportunities on campus. It also sponsors workshops and symposia on research.

Through the Undergraduate Research Apprentice Program, undergraduates at Berkeley serve as apprentices to faculty on research projects in the humanities, social sciences, physical and biological sciences, as well as in the professional schools and colleges. Each participating undergraduate files a learning contract that spells out the nature of his or her commitment to the research project. Over the past five years, the number of participating students and faculty has almost doubled, and in 1997-98, 429 students filed 561 learning contracts with 174 faculty.

The President's Undergraduate Fellowship Program also assists undergraduates in pursuing original research or creative work under the supervision of a faculty member. Each student who applies for a fellowship is required to recruit his or her own faculty mentor, who in turn is required to evaluate the merit of the proposed project as part of the application process. In 1997-98 the President's Undergraduate Fellowship Program funded 44 projects out of 51 proposals received.

In addition to these campuswide programs, the College of Engineering's Undergraduate Research Opportunities Program provides an opportunity for undergraduates to participate in research with engineering faculty members. Funded jointly by the Executive Vice Chancellor's Office and the College of Engineering, the program offers a limited number of stipends to undergraduates to assist faculty in their research projects. In 1997-98, 57 undergraduates participated in the program along with faculty from all six departments in the College of Engineering.

Several other undergraduate research programs were new at Berkeley in 1997-98, all privately funded: the Haas Scholars Program, the Miller Scholars Program, the Chevron Undergraduate Research Program Awards, and the Berkeley Physics Undergraduate Research Scholars Program. Each of the programs allowed students who might otherwise have heavy work obligations to take full advantage of the research opportunities on the Berkeley campus and to work closely with faculty mentors and sponsors.

Irvine

At Irvine, the Undergraduate Research Opportunities Program (UROP) encourages undergraduates from all schools and academic disciplines to engage in research and other creative activities. The program helps students and faculty through all phases of the research process, from writing the proposal to conducting the research, analyzing the data, and presenting the results. During the past year, the program awarded more than \$61,000 in grants to undergraduates for faculty-mentored research and creative projects. In addition, 11 students received honorary fellowships for their outstanding research projects, and total proposals received during the year increased by nearly 50 percent.

The extensive research efforts of Irvine's undergraduates and their faculty mentors culminate in an Undergraduate Research Symposium. Last year's symposium included about 250 student presenters and performers from every discipline. At the awards ceremony, the Chancellor's Awards for Excellence in Undergraduate Research were given to both students and faculty.

The Irvine campus also has numerous department or school-based honors and research programs that foster undergraduate research and creative activities. The Excellence in Research Program in the School of Biological Sciences, for example, includes about 1,000 undergraduates per year. This and other programs, such as those sponsored by the School of Engineering and the

Department of Cognitive Sciences, provide opportunities for students to present their research to peers and faculty.

Riverside

The Riverside campus' commitment to undergraduate research dates from its liberal arts origins when a senior thesis was required of all students. In 1997-98 the campus continued to offer research opportunities for undergraduates. A large percentage of undergraduates in the College of Natural and Agricultural Sciences and the College of Engineering, for example, participated in faculty-sponsored research projects. Last year was also the first year undergraduates participated in archaeological fieldwork with faculty from the Department of Anthropology.

The College of Engineering-Center for Environmental Research and Technology (CE-CERT), a research program at UC Riverside, organizes collaborative research with industry and regulatory agencies on environmental problems, with a major focus on air pollution and energy efficiency. CE-CERT is dedicated to the idea that it is essential to bring together a critical mass of scientists and engineers in a comprehensive research effort dedicated to solving air pollution and other environmental problems. It provides appointments for technical and administrative staff, postdoctoral students, graduate students, and undergraduate research assistants. CE-CERT engages in approximately \$5 million per year in sponsored research. Every CE-CERT research project includes funds for the hiring of undergraduates to participate. This creates an average of fifty to sixty paid undergraduate research opportunities per year.

San Diego

The Faculty Mentor Program at the San Diego campus sponsors the main campuswide undergraduate research program. Participating students conduct two quarters of original research under faculty supervision, then present papers at the Faculty Mentor Research Symposium. In 1997-98, 209 students participated in the program and gave papers at the symposium.

The Summer Research Program at San Diego offers full-time research experience to underrepresented students who are interested in careers in research or university teaching. As research assistants, students work on their faculty mentors' projects for at least thirty hours per week during the summer. In turn, they receive free on-campus housing, independent study credit, and a \$2,400 fellowship. At the conclusion of the program, they present their papers at a Summer Research Conference.

UC San Diego also hosts an annual Undergraduate Research Conference. Students who are nominated by faculty present their papers at small, faculty-led round-table discussions. Receiving an invitation is considered a high honor, and conference participants each receive a certificate as a research scholar.

The campus sponsors several other programs which provide opportunities for undergraduates to conduct research during the summer, including the Howard Hughes Undergraduate Science

Enrichment Program, the Scripps Undergraduate Research Fellowship, and the Minority Biomedical Research Support Program.

Santa Barbara

The Santa Barbara campus estimates that one out of every five upper-division students participated in research-related activities in 1997-98. Participation can take many forms, such as independent study with faculty supervision, internship with a research unit on campus or in industry, or employment on a faculty research grant. Each of the three colleges has its own mechanisms for sponsoring undergraduate research. The College of Letters and Science, for example, sponsors an annual colloquium on undergraduate research, provides an annual award to one faculty member and to one graduating senior who has a distinguished record in undergraduate research, and supplies travel grants to students to present their work at professional meetings. In addition, in 1997-98, Special Programs in Undergraduate Research provided funding for 58 undergraduates to work on a research or creative project under the guidance of a faculty member. The Faculty Research Assistance Program supported approximately fifty students. The Howard Hughes Medical Institute provided a summer stipend and laboratory expenses for twenty seniors for one full year. The UCSB Achievement Programs supported research activities for 23 students and provided academic workshops for 213 students.

The College of Engineering also supports summer and year-round undergraduate research internships. In 1997-98, three of the College's multidisciplinary research centers supported 45 students with grant funds. Grant funding from individual faculty supported another 27 students. Students are required to submit written reports on their work and, in some cases, receive the opportunity to co-author papers in scientific or technical journals or present papers at professional meetings.

The College of Creative Studies offers advanced independent research which provides formal recognition for research projects undertaken by science students working closely with faculty mentors.

Santa Cruz

The Santa Cruz campus has always had a commitment to integrating research into the undergraduate experience. Since its inception, it has had a senior graduation requirement that most students fulfill by some research project. Many courses also stress research activities.

To recognize the importance of research in undergraduate education and to foster close faculty-student interactions, the Natural Sciences and Engineering divisions organized the first annual undergraduate research symposium in 1998. Students from these two divisions presented their research in poster sessions, and the deans and chancellor gave awards to outstanding

presentations. This event was so successful that it will be expanded during 1999 to recognize student research and achievement across the campus.

In the Department of Computer Sciences, undergraduate students are using graphics to analyze uncertainty and other aspects of meteorologic, oceanographic, and other large data sets. These students, funded through the National Science Foundation's Research Experiences for Undergraduates Program, worked primarily on a project on "uncertainty visualization," usually together with a graduate student.

Organized and Multicampus Research Units

The term "organized research" refers to research carried out on broad, interrelated topics by faculty members under the auspices of specialized interdisciplinary entities called Organized Research Units (ORUs). ORUs that span two or more campuses are known as Multicampus Research Units (MRUs). ORUs and MRUs range from clusters of faculty on different campuses who share research interests and who meet on a regular basis to share research findings, to large, permanent institutes with specialized facilities and professional and administrative staff.

A 1997-98 survey of ORUs and MRUs indicated that close to 2,000 undergraduates systemwide participated in research via ORUs and MRUs, with some 1,500 of them contributing directly to research and 500 providing support to researchers. These figures are based on a 50 percent survey response rate.

In 1992, the Institute of Governmental Affairs (IGA), an Organized Research Unit on the Davis campus, established the Undergraduate Research Fellows Program in response to a Universitywide effort to provide undergraduates with greater research experience as an integral part of their education. This unique program gives students the opportunity to collaborate with a faculty member on an advanced research project for one quarter or more. Students have been involved in all aspects of the research enterprise including presenting at national conferences and co-authoring with faculty in top journals. In 1994, the Institute on Global Conflict and Cooperation, an MRU, joined the IGA as a co-sponsor, significantly expanding the number of available fellowships and increasing the stipends. Approximately thirty students are now awarded \$750 stipends each academic year. To date, faculty and students from the departments of economics, political science, sociology, history, psychology, agricultural economics, anthropology, music, and applied behavioral sciences have participated in this program. Through such research, students gain practical work experience, learn about career options, and are given a preview of graduate study in their disciplines.

The White Mountain Research Station (WMRS), an MRU located in Bishop, California, conducts high-altitude research in a range of fields, from physiology and zoology to botany, geology, hydrology, and atmospheric science. WMRS runs two intercampus "supercourses" in biology and

geology designed to provide undergraduates with hands-on lecture, field, and laboratory experiences. The supercourses comprise four courses and include four units of independent research.

The California Space Institute (CalSpace), an MRU housed at UC San Diego, is home to EarthKam, a NASA-funded mission control project that enables thousands of middle school students to see earth from an astronaut's perspective by giving them the opportunity to take pictures of the planet from space. EarthKam provides a valuable experience for a group of undergraduate students who operate the program and ensure that the middle school's camera commands are properly executed. Although primarily staffed and run by undergraduates, EarthKam depends on the leadership of several faculty advisors who offer their expertise to the project, as well as engineers at Johnson Space Center and the Jet Propulsion Laboratory.

The Institute of Urban and Regional Development serves faculty and students at UC Berkeley conducting research into processes of urban and regional growth and decline and the effects of governing policies on the patterns and processes of development. Since 1996, the Institute has employed several undergraduate researchers through the Cal-on-Campus Pre-Professional Internship Program.

The Institute of Transportation Studies-Davis (ITS), an MRU, organizes and promotes multidisciplinary research on complex transportation problems, especially those related to congestion and environmental and energy issues. ITS is deeply committed to undergraduate research and education and offers five to ten fellowships per year to undergraduates. This year, two students worked on ITS' smart car-sharing project. They conducted literature reviews of experiences with car sharing around the world, worked with Honda to design and install state-of-the-art communications and data collection technologies on 12 vehicles, and participated in designing and administering focus groups and surveys.

Vice Provost Shelton ended his presentation by recalling that the Boyer Commission report concludes with the observation that undergraduates need to benefit from the unique opportunities and resources available in research universities. The report continues:

“The research universities need to be able to give to their students a dimension of experience and capability they cannot get in any other setting, a research experience that is genuine and meaningful. They should turn out graduates who are well on the way to being mature scholars, articulate and adept in the techniques and methods of their chosen fields, ready for the challenges of professional life or advanced graduate studies. Research universities have unique capabilities and resources; it is incumbent upon them to equip their graduates to undertake uniquely productive roles.”

The University of California has anticipated this important need and provided an ever-widening network of opportunities for undergraduates to participate fully and directly in the life of a research university. This is the same commitment that is extended to the University's faculty and graduate students.

Davis

Vice Provost Dale reported that the Davis campus has for many years encouraged its undergraduate students to participate in faculty-guided research projects. A survey of undergraduate students conducted ten years ago indicated that 13 percent had had the experience of conducting research with a faculty member “often” or “very often.” Seven years later, that figure had risen to 22 percent. The campus encourages undergraduate research through a number of programs. This year, the Davis Honors Challenge offered 180 lower-division students the opportunity to participate in 15 separate seminars based on 15 research problems on which they worked as teams.

The campus annually sponsors a research conference for undergraduates doing research under the guidance of faculty members. The conference is designed to acquaint students with the process of presenting research in a scholarly manner and to encourage them in careers in research and college teaching. In 1997-98, 145 students participated in the conference, up from 129 in 1996.

UC Davis also publishes a number of undergraduate student journals. While student journals are not formal educational offerings, the process of submitting manuscripts and preparing them for publication involves a *de facto* tutorial relationship between students and faculty. In 1997-98 Davis published its first issue of *Explorations, An Undergraduate Research Journal*. Three of the essays selected for publication in the inaugural issue came from Davis’ annual competition for the Chancellor’s Prize for Excellence in Undergraduate Research; the fourth was chosen from dozens of other submissions sent in by undergraduates in response to a general call for papers. Other journals designed for undergraduate publication at Davis are *Prized Writing* and the *McNair Scholars Journal*.

In addition to its undergraduate research conference and student journals, the Davis campus provides a number of research experiences for undergraduates across a wide variety of fields. In 1997-98, for example, 3,688 undergraduates completed research-based internships in agricultural and environmental sciences, education and graduate placement, engineering and physical sciences, health and biological sciences, and liberal arts.

A number of other specialized programs at UC Davis also encourage faculty involvement in the education of small groups of undergraduates. The President’s Undergraduate Fellowship and the Institute of Transportation Studies Undergraduate Summer Fellowship, for example, provide funds for undergraduate students to pursue research activities under the supervision of a faculty member. The Natural Reserve System Student Research Grants provide funding for and access to UC Natural Reserve sites located throughout the state. The Bodega Marine Laboratory offers three programs in the spring quarter for undergraduate students consisting of five weeks of intensive course work and five weeks of intensive research with faculty, an undergraduate colloquium with visiting scholars, and a six-week summer research program. The Mentorship for Undergraduate

Researchers in Agriculture, Letters and Science places eligible upper-division students in research opportunities with faculty members. The UC Davis Washington Center provides internships in the nation's capitol, many of which involve independent research projects. In 1997-98, 107 students participated in the program.

Ms. Jeanne Abalos, a junior majoring in neurobiology, reported that when she began working in a laboratory she recognized the importance of hands-on experience in an academic environment, which allows students to see why certain steps must be taken to obtain the desired results. She explained that she began working with Professor Williams, her faculty mentor, in her freshman year through the Biology Undergraduate Scholars Program (BUSP). BUSP offers students access to research, workshops, and classes in a community of like-minded colleagues. Ms. Abalos reported that, working in the laboratory with her faculty mentor, she focuses on a relatively rare hereditary disease which results from a defect in the transport of cystine, an essential chemical in the body which, in excess, can cause kidney stones. They have demonstrated that at least two transport mechanisms for handling cystine exist in the kidney. One is defective in the disease, and the other is an unaffected transport system. This was first confirmed through the research which she is performing with Professor Williams. The discovery is a step toward treatment of the disease. Ms. Abalos noted that working in the laboratory had helped her to develop practical skills, interact with faculty and students, and had provided the opportunity to present her research at various functions. Taking what she learns in class and applying it in the laboratory is a key to productive learning.

Mr. Scott Hawley, Professor of Genetics at Davis, reported that several years ago he wrote an editorial for the *Sacramento Bee* which discussed the importance of undergraduate research. In response, the newspaper received many letters to the editor which criticized his position as being elitist. Those writing felt that the faculty should concentrate their efforts on teaching large numbers of students rather than a few. Professor Scott believed that while the faculty could teach such things as measurement and techniques in a large laboratory setting, they could not teach students the wonder of research. At Davis, resources have been channeled into undergraduate research such that, in the Division of Biological Sciences, 70 percent of undergraduates have done research.

Los Angeles

Vice Provost Smith reported that each year more than 3,500 students at UCLA are engaged in research at all levels of the undergraduate experience. There is an array of programs coordinated by two Undergraduate Research Centers, including the Student Research Program for lower-division students, Independent Research Study, and Senior Honors Thesis. Research experiences culminate with completed projects, publications, and presentations at regional and national conferences. The Student Research Program (SRP) is designed to provide undergraduate students with opportunities to work one-on-one with leading faculty on research projects. Such involvement is designed to improve the quality of undergraduate education and increase the potential for

students' academic success. By expanding research opportunities for undergraduates, SRP hopes to broaden the talents and to increase the knowledge of the professional and academic leaders of the future. The largest program of its type in the nation, SRP was founded in 1985 and now serves almost 2,000 students each year.

Vice Provost Smith gave as an example of UCLA faculty involvement in research that of Ms. Cathy Clarke, an Assistant Professor of Biochemistry. Over the past four years she has worked with 25 undergraduate students in the laboratory, and nine have been co-authors on refereed papers. Many of these undergraduate students go on to graduate school. At UCLA undergraduate research encompasses all fields of study, and faculty from the College of Letters and Science and all professional schools serve as mentors.

In 1997, UCLA was one of ten universities to be awarded the National Science Foundation's Recognition Award for the Integration of Research and Education and was granted \$500,000. The National Science Foundation praised UCLA for its ongoing leadership activities and the University's commitment to developing programs that lead to further introduction and integration of research and education.

Financial support is important because most students must work twenty to thirty hours per week; thus, support for undergraduate research is a top priority. The campus receives endowments from individuals, from private companies, and from foundations, and grants from federal agencies. The support that the campus receives from the National Science Foundation, the National Institutes of Health, and the Department of Education is critical because this money funds CARE, the Center for Academic Research Excellence. This center is geared to help low-income students, first-generation students, and students who have been traditionally underserved in science. The campus has recently set the goal of raising \$8 million over the next four years to support undergraduate research scholars, which will result in full fee support for about one hundred research scholars per year.

Vice Provost Smith explained that the campus celebrates undergraduate research in many ways, including the Science Poster Day. Over one hundred science students presented posters and posted abstracts on the new undergraduate research website. Eight students received Dean's Awards based on their research descriptions and their answers to questions posed during the poster session. The Science Poster Day was so successful that it is now planned as an annual event. The campus also sponsors two journals, one that focuses on creative writing and another that focuses on research in science. The undergraduate research website gives information about current programs and also features students and faculty who have worked together as teams.

With funding from the NSF, in February 2000 the campus will sponsor an all-UC conference on undergraduate research. The purpose of the conference will be to identify issues that focus on student research, such as how it should be evaluated and what role it should play in the teaching

load for faculty. Another issue is whether or not the opportunity to engage in research should be offered to all undergraduate students.

Vice Provost Smith reported that this year two UCLA students participated in a nationwide poster day in Washington, D.C. She suggested that the University might wish to consider a similar function in Sacramento, because student research, and research in general, is not always well understood by the Legislature.

Ms. Kristine Ha, who will graduate in June with a double major in Microbiology/Molecular Genetics and English Literature, explained that she had decided to pursue an honors thesis in English literature due to the personal relationships which she had developed with her professors in a small classroom setting, and she presented anecdotal evidence to illustrate one of these relationships.

Mr. Alex Balazs, a fourth-year Molecular Biology and Genetics major who will enroll in the Ph.D. program at Harvard University in the fall, noted that he had learned theory and basic laboratory experience in the many biology classes he had taken at UCLA. He reported that he had learned more from two years of research with Professor Morrison than he had from four years of classes.

His research had been supported by the CARE program described by Vice Provost Smith. Mr. Balazs believed that more programs which encourage students to participate in research would improve undergraduate education in general.

Regent-designate Pannor, speaking as a participant in undergraduate research at the Berkeley campus, stressed the importance of research programs because undergraduate students make up the majority of students at the University. She strongly supported making such programs available to all undergraduate students.

In response to a question from Regent Montoya, Vice Provost Smith responded that twice as many science students participate in undergraduate research than do those in the arts and humanities. The administration is working with the faculty to identify more research opportunities in the social sciences. In response to a further question from Regent Montoya regarding Regents Scholars, Ms. Smith agreed that such students would be good candidates to participate in research as a result of their high academic ability. A large number of students are interested in research; the challenge is to find the right faculty members with whom they can work.

President Atkinson supported Vice Provost Smith's suggestion regarding a poster day in Sacramento.

2. **REPORT ON THE INDUSTRY-UNIVERSITY COOPERATIVE RESEARCH PROGRAM**

President Atkinson observed that since World War II the federal government has organized research such that private industry is responsible for research and development activities, while universities are the driving force behind basic research. On the other hand, cooperative research between the two segments is able to move ideas quickly into the public sector, and the Industry-University Cooperative Research Program is based upon this model.

Ms. Suzanne Huttner, director of the program, introduced her fellow presenters: Mr. Tapan Monroe, consulting corporate economist at Pacific Gas and Electric Company and Distinguished Professor for Asian Economies at the University of San Francisco; Mr. Andrew Cromarty of COMPAC Corporation; and Ms. JoAnn Kuchera-Morin, Director of the Digital Media Innovation Program and Professor of Music at the Santa Barbara campus.

Director Huttner recalled that the Industry-University Cooperative Research Program was founded in 1996, a time of change in California's economy as well as a time of robust growth in research activity at the University. The program is envisioned as a three-way partnership between the University, California businesses, and the State of California. The program's primary goal is to accelerate the transfer of research advances that are developed at the University, because their use in businesses in California will lead to the growth of the state's economy in a more sustained way over time. The program is also designed to develop a new set of indicators to assist in better understanding the role of the University's basic research in economic growth and development. Overall, the primary purpose of the program is to position University research so that it will continue to strengthen the California economy.

The Industry-University Cooperative Research Program uses matching grants for funding, with the University providing funding to faculty who submit research proposals together with a letter of commitment from a California company stating that it will provide matching support. The program supports only research judged to be "outstanding" to "excellent" on a national comparison in fields of research that have been identified as important to the economy and to the University. The original plan was to fund \$40 million annually in new research, with \$5 million from the University, \$15 million from the State of California, and \$20 million in matching contributions from California businesses. In 1996-97, the State provided \$5 million in funding, and the University immediately launched the BioStar program. Within four months, more than \$9 million in cash contributions from industry had been committed to the proposals that were submitted. In the Governor's 1997-98 budget, funding for the program was made permanent, and two additional programs were established, one in digital media and one in semi-conductor manufacturing.

In the past fiscal year, with the above three programs in operation, the Industry-University Cooperative Research Program received more than \$40 million in proposals from faculty. Industry has consistently responded by providing more matching funds than were requested. All of the programs emphasize multi-disciplinary research and are intended to break down barriers between disciplines at the University in order to forge new territories in science and engineering. This also creates the foundation for new industries and new markets. All of the programs emphasize new

educational opportunities, and any proposal that includes funding for students is given priority. The programs use rigorous peer review and consider the scientific and technical merits, as well as the relevance of the program that is being proposed. Ms. Huttner emphasized that all of the programs require new contributions by sponsors. Priority is also given to projects that are supported by small businesses because those companies are most important to the future of the California economy. Last year 89 companies participated in the three programs; 57 percent were small businesses, and 36 percent had fifty or fewer employees. Forty percent of the companies that participated last year were making their first contributions to University of California research. At the University, 134 faculty were involved, with one-third of them at the rank of assistant professor. The program helps these young faculty members develop an early track record that will make them more competitive for federal funding. It is also helping to develop a culture among faculty who understand the relevance of their research to society and the appropriateness of transferring their research results to the commercial sector. These research contributions are broad, spanning the full spectrum of needs in the state, including health care, agriculture, the environment, and technology bottlenecks. Over time the State has expanded its investment in the program, such that in the current fiscal year, 1998-99, an additional \$7 million was provided. This funding allowed expansion of the program into the areas of communications and information sciences for the life sciences. In addition to these five programs, in the current year the existing MICRO program, which was established in 1981, was brought into the Industry-University Cooperative Research Program. The Regents' Budget for 1999-2000 included a request for an additional \$5 million for the program, which will permit its further expansion.

Mr. Monroe noted the strength of California's economy, the growth of which has been underestimated by forecasters for the past four years. Productivity gains have been significant, resulting in low inflation and low interest rates. Mr. Monroe gave an overview of the state's economic history, observing that the present knowledge- and information-based economic trend is perhaps the most significant event. The University of California plays a major role in this information-based society. He pointed out that one of the strengths of the State of California is its ability to reinvent itself in response to changing circumstances. For example, five of the top internet-connected counties in the nation are located in California. With respect to education, the San Francisco Bay Area and the Los Angeles basin are the top two regions in the state for graduate education in science, mathematics, and engineering. The research and development performed at universities are critical to the economic vitality of the future. Regions such as the Bay Area, Boston, and Seattle in many ways determine the economic future of the nation. Mr. Monroe believed that it was critical for research universities to eliminate the boundaries between them and industry as the economy moves into the 21st century.

Mr. Cromarty discussed the digital media industry, noting that as recently as five years ago the industry was limited to CD ROMs. It has expanded rapidly such that most of the information on the internet, including distance learning, is based upon digital media. Nearly one-third of the companies that comprise the digital media industry are located in California, and one of every four

jobs in the San Francisco Bay Area is in or directly related to the digital media industry. On average, workers in the industry earn 65 percent more than the average worker in the same region.

With respect to the future of the industry, he noted that nearly half of all venture capital is invested in the Silicon Valley. The digital media industry cooperates in three ways with the University, first through joint or industry-sponsored research. Secondly, the industry hires a large number of UC graduates. Finally, there is a robust internship program throughout the Silicon Valley that trains UC graduate students during the summer. This encourages them to stay in California and contribute to the state's economy. The benefits to industry from this collaboration include a flow of new ideas as well as the dissemination of new ideas into society. Mr. Cromarty concluded by noting the importance of the Industry-University Cooperative Research Program to this collaboration because it allows researchers from industry to identify UC faculty with whom they can work.

Professor Kuchera-Morin explained that the Digital Media Innovation Program, or DiMI, is facilitating partnerships between faculty, graduate students, undergraduate students and industry from many different fields, focusing on novel content as a driver of innovative technologies. The opportunities and needs for research partnerships that advance the frontiers of digital media are both immediate and substantial. Musicians, artists, and geographers, for example, are joining with engineers and scientists to advance their fields.

Regent Preuss believed that the Industry-University Cooperative Research Program would play a significant role in fulfilling the University's mission to the state.

The meeting adjourned at 2:45 p.m.

Attest:

Associate Secretary