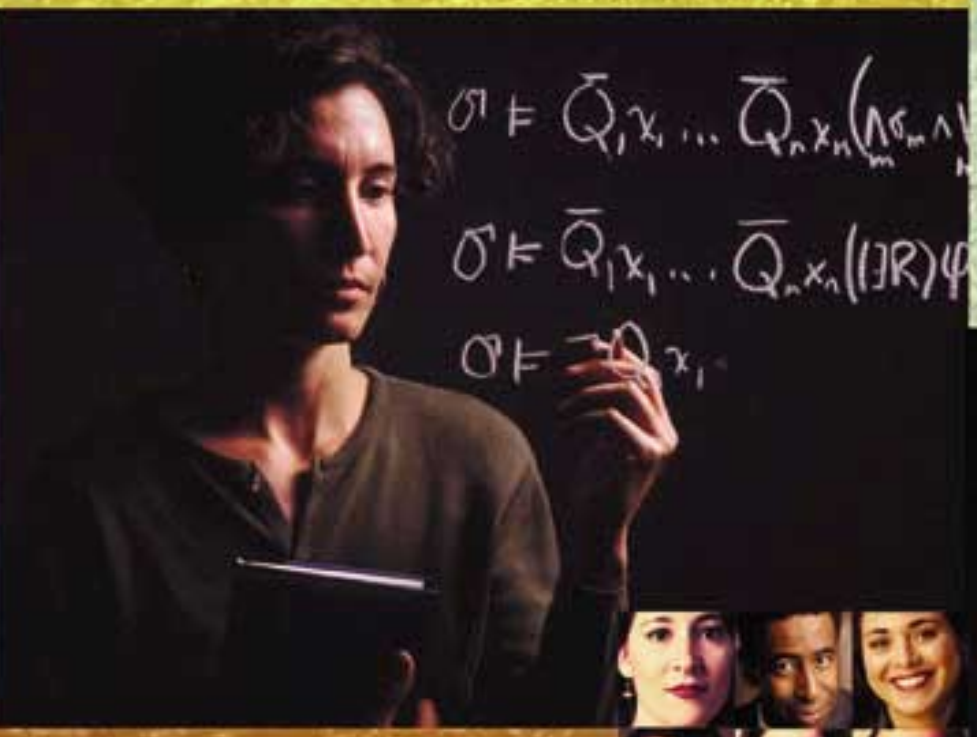
Making Discovery Work

Graduate Education at the University of California



California's future prosperity will require constant innovation and discovery

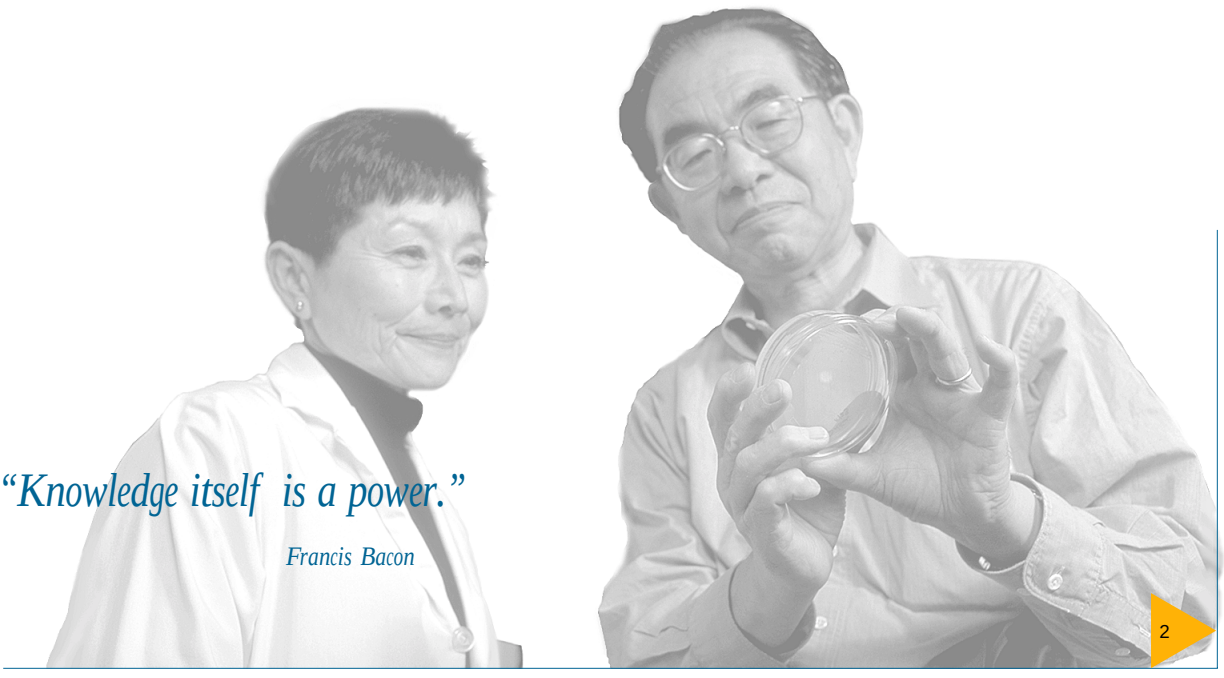
California now competes in a new economy, where research and innovation are essential to economic success. Relatively new knowledge industries like biotechnology or digital technology, to name just two examples, are emerging as key drivers of economic expansion in high-technology states such as California.

The new economy is global. Information and capital move from San Diego to Shanghai at the stroke of a computer key; a software company in Sacramento may find itself competing with rivals in Boston – or Calcutta. More and more, economic success demands a sophisticated understanding of other cultures. This is particularly true for California, which sees much of its economic future in Latin America and the Pacific Rim.

The emergence of the knowledge industries and the intertwining of national economies have made a highly educated workforce imperative. California and the nation must have more scientists, engineers, artists, and entrepreneurs who can create, invent, and reach solutions to increasingly complex problems.

Technology and economics, of course, are not the only reasons why today's world demands advanced education. The need is much broader. A humane and just society that is able to move toward solving its problems must have a citizenry that *knows how to think*. Crime, pollution, urbanization, the challenge of equalizing opportunity in a state that is daily becoming more ethnically diverse – all of those issues demand thinkers and problem-solvers who are the products of advanced education.

For all of the above reasons, graduate education is an increasingly important key to economic and societal success. And graduate education at the University of California, the nation's premier public university, provides one of our best and most cost-effective methods of producing the educated citizens today's world demands.



"Knowledge itself is a power."

Francis Bacon

Cover photographs: Ben Ailes

UC's graduate programs spark new discoveries every day

UC graduate alumni have an unparalleled record of achievement

Here is a closer look at the scope of UC's graduate programs and their contributions to the state, the nation, and the world.

Because UC attracts the brightest and most creative individuals to its graduate programs and offers them an unparalleled education, many of these graduates have had major impacts on the nation and world – creating much of California's biotechnology and computer industries, developing research breakthroughs that have led to major medical advances, shaping ideas about our world and culture, creating the economic and social infrastructure of our communities, and assuming political leadership in California and the nation.

- Among the CEOs who received graduate degrees from UC are the chairmen of Lockheed, Transamerica, and Intel; other holders of UC graduate degrees are motion picture director and producer Francis Ford Coppola, author and economist John Kenneth Galbraith, and Ralph Bunche, Jr., United Nations undersecretary who in 1950 became the first African-American to win the Nobel Peace Prize.
- At least 10 UC Ph.D.'s have been awarded Nobel Prizes in chemistry, economics, and physics, recognizing achievements that have brought the greatest benefit to humanity.
- California's biotechnology industry would not have happened without UC researchers, including graduate students. Many of California's biotech companies resulted from collaboration between such researchers and private-sector entrepreneurs, or were started by alumni of UC graduate programs. According to the UC Biotechnology Program, 85 percent of California biotech companies employ UC alumni with graduate degrees, often in key scientific or decision-making roles.
- California's colleges and universities depend on UC Ph.D.'s to teach their students; one out of five UC and California State University faculty members has a UC doctoral degree, and they have come from programs on every UC campus.
- Many political leaders who have shaped the state's and the nation's policies have been educated in UC graduate and professional programs – among them former California Governor Pete Wilson (J.D.), Legislative Analyst Elizabeth Hill (M.P.P., public policy) and State Superintendent of Public Instruction Delaine Eastin (M.A., political science) along with many key U.S. Congress members and state legislators. UC has also educated individuals who have gone on to top political positions in other nations, including Canada, Costa Rica, Indonesia, Kenya and Taiwan.

The University of California and its affiliated national laboratories produce more research leading to patented inventions than any other public or private research university.

Source: National Science Foundation

- Through their presence in the community, large numbers of UC-trained architects, educators, lawyers, and business people, among others, have shaped their environments in ways strongly influenced by their UC educations. This shaping is literally true for graduates of UC Berkeley's College of Environmental Design, who have had an enormous impact on California's environment, including buildings, wetlands and parks. As one example, UC Berkeley graduates have founded 80 percent of the architecture firms in the San Francisco Bay Area.

The work of UC graduate students and alumni benefits people in California and around the world every day, making our lives safer, longer, and more enjoyable in ways that most of us don't realize. When you move through the Internet, plug in a hair dryer, drive on a freeway, or sit down at the dinner table, you are benefiting from inventions and processes that have resulted over the years from advanced research and innovation by faculty and graduate students at the University of California.

Graduate Education at UC

Fall 1998 Enrollment

Undergraduate	133,230
Graduate (non-Health Sciences)	28,865
Health Sciences Graduate*	7,350
Total	169,445

Graduate Degrees Awarded in 1997-98

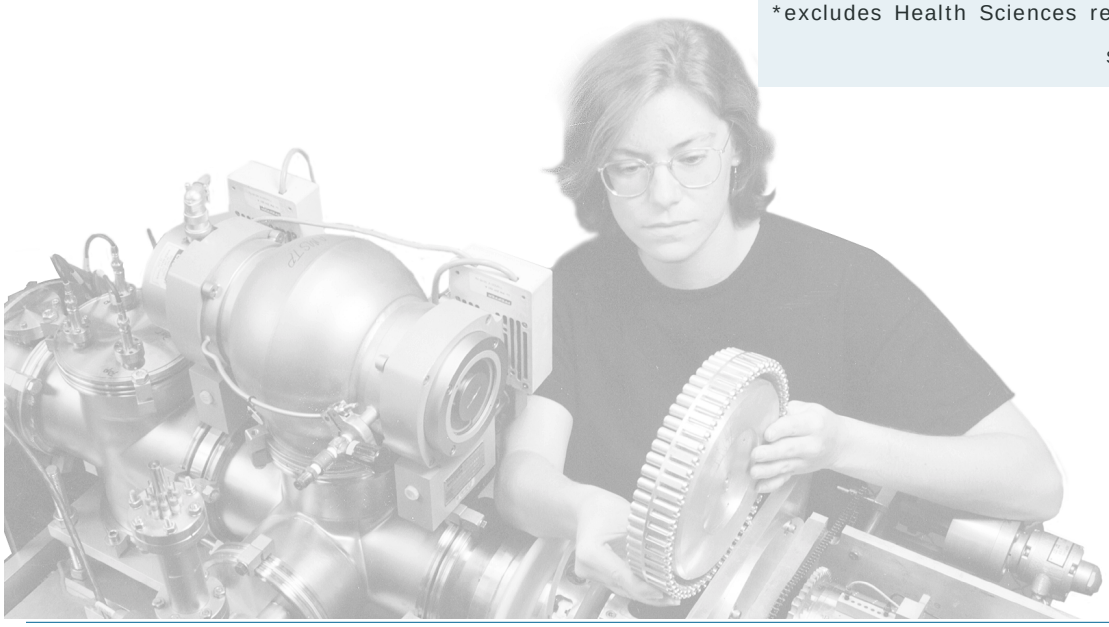
Doctoral (non-Health Sciences)	2,650
Master's (non-Health Sciences)	
Professional (e.g., M.B.A., J.D.)	3,030
Academic	3,240
Health Sciences (M.D., D.V.M.)*	1,800
Total	10,720

Fall 1998 Graduate Enrollments, by Field

Engineering/Computer Sciences	4,730
Social Sciences/Psychology	4,540
Physical Sciences/Mathematics	3,375
Life Sciences	3,070
Humanities	2,300
Arts	1,375
Health Sciences*	7,350
Other Professional Programs	
Business	3,460
Law	2,330
Other (e.g., Education, Social Work)	2,930
Multi/Interdisciplinary & Other	755
Total	**36,215**

*excludes Health Sciences residents

Source: University of California



And UC's graduate programs are poised to do more

In technology... As a high-technology state, California will rely on highly educated workers even more than does the nation as a whole, especially in newly emerging fields. UC must help meet these needs by preparing more graduate-level engineers, computer scientists and biomedical workers, both as doctoral researchers and new types of professionals at the master's level. Here are some examples of programs UC campuses are developing to meet the future:

- **UC Santa Cruz:** molecular, cellular and developmental biology and biomolecular engineering to help keep California's biotechnology industry at the forefront.
- **UC San Diego and UC Santa Barbara:** chemical and materials physics, applied chemistry and computational physics.
- **UC San Francisco:** medical informatics and, in a joint program with UC Berkeley, bioengineering.
- On other campuses, the high-tech economy is spurring enrollment growth in non-science areas, such as UC business programs on management of high-tech businesses and digital arts programs that merge the arts and technology for California's expanding multimedia industry.

In the Pacific Rim... California needs graduate programs that can prepare entrepreneurs and policy formulators who understand the business, culture, and traditions of nations ranging from Korea to Chile. A few examples of programs being developed include:

- **UC San Diego:** a new master's program in international technology management.
- **UCLA**: professional master's in international policy.
- **UC Davis and UC Santa Barbara**: programs in East Asian languages.

In meeting social and environmental challenges... Because California and the United States will face many domestic social and environmental challenges, campuses are also proposing targeted growth in programs directed to issues arising from immigration, poverty, health care, crime, urbanization, and the environment. Some of the programs under consideration for growth include:

- **UC Davis:** programs to provide solutions to problems of water quality, soil sustainability, and transportation.
- **UC Riverside:** pest management, conservation biology, and agricultural biotechnology.
- **UC Irvine:** master's and doctoral programs in urban and regional planning to address problems associated with increasing urbanization.
- **UC Merced:** programs relating to the Sierra Nevada and the immense cultural diversity in the Central Valley of California.

In educating our citizenry... But the University of California is more than a mechanism to nurture scientific research and economic growth. Because universities exist, generations of us learn the wonders of Beethoven's symphonies and Walt Whitman's poetry. We see the world through the eyes of remarkable artists and philosophers who light our way even though they have been gone for centuries. In teaching history, universities help us develop informed opinions about what is right and what is wrong in present-day public policy. A university produces practical results, but it also lifts our hearts.

College and university faculty bear a special responsibility to provide the advanced education that helps create an informed, literate, and humane citizenry. The faculty educates those who will bring joy to our lives, broaden our horizons and make the important decisions of the 21st century.

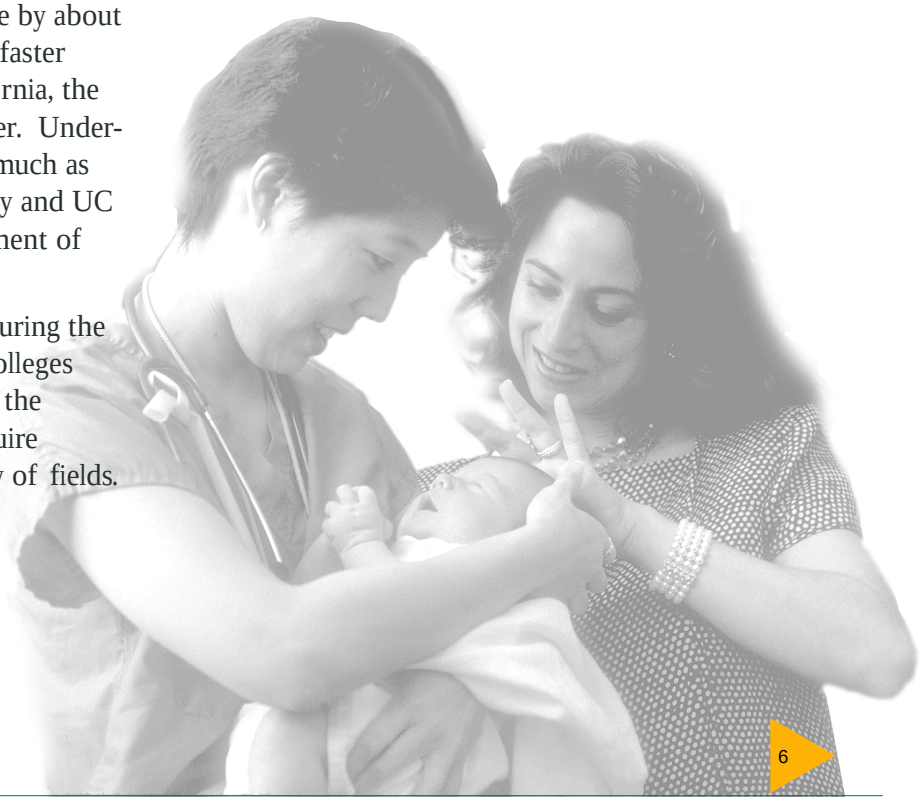
UC is one of the nation's most important sources for the next generation of college and university faculty. Nationally, enrollments at four-year institutions are projected to increase by about 8 percent between 1998 and 2005, with faster enrollment growth after 2005. In California, the needs for new faculty will be even greater. Undergraduate enrollments could increase as much as 132,000 at the California State University and UC by 2007, according to the State Department of Finance.

In addition, faculty who will retire during the next several years must be replaced at colleges and universities in California and across the nation. Meeting all these needs will require additional Ph.D. faculty in a wide variety of fields.

Matching growth to changing demand

Because UC is mindful of its role as California's public research university, its plans for growth and changes in graduate programs are intended to be both responsive and responsible. For example, campuses are prepared to:

- Expand enrollments where needs are greatest and contract or maintain a steady state where job prospects for graduating students are less promising.
- Increase the proportion of master's students to meet the demand in emerging occupations and bring research-trained graduates rapidly into business, government and industry.
- Increase enrollment significantly in teacher credentialing and associated programs.
- Launch a new degree program for working adult professionals, the Master of Advanced Study, to meet the needs for the latest knowledge related to their work, arranged to accommodate work schedules.



But California is under-investing in graduate education

It is clear that California's economy and society will require more graduate training. But California is under-investing in graduate education.

- Compared with other states, **California educates a very low proportion of graduate students**, falling in the lower third of all states in terms of graduate students per state resident aged 25-64 and per state resident with a B.A.
- California is one of only five states in which **graduate enrollments have declined** during the last decade (the others are Arkansas, Connecticut, Kansas and Oklahoma).

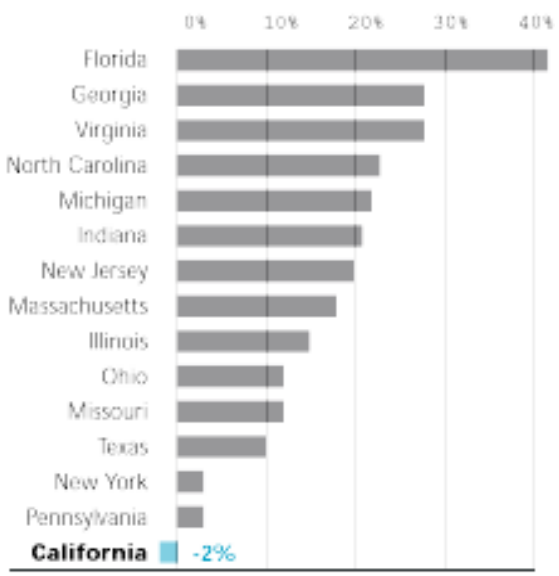
No matter how you look at it, California is falling behind in graduate education. We're dead last among major states in the growth of our graduate enrollment.

How has this occurred?

- While UC's undergraduate enrollment is largely driven by population growth, graduate enrollment is determined by policy, not by demographics. Numbers of graduate students are determined each year in budget negotiations, and for the past three decades, the State has funded other priorities.

Total Percent Change in Graduate Enrollment in the 15 Largest States

1986-1996



What does this mean for UC?

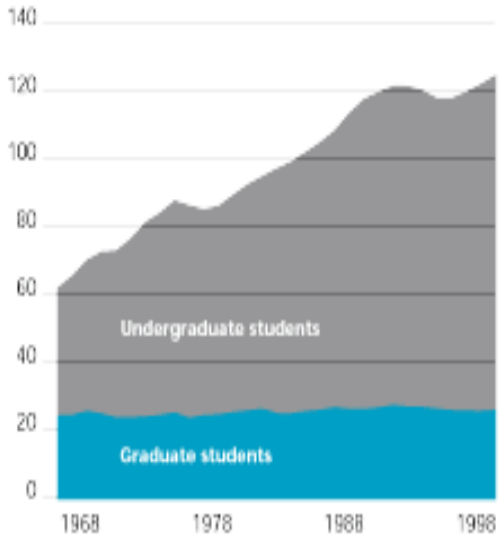
- Graduate enrollment at the University of California has **hardly grown at all** in the past 30 years. It has climbed 7 percent, compared with 100 percent growth in undergraduate enrollment.
- It is actually **lower now than it was a decade ago**, both in number and as a percentage of total enrollment.
- UC's graduate programs are able to admit only 28 percent of all who apply, and demand will grow as undergraduate enrollments continue to increase.
- UC's graduate enrollment as a percentage of total campus enrollment – 17.2 percent – is **lower than the percentages** at all of the universities the State uses as official comparisons for UC.

Undergraduate and Graduate Students as a Percentage of Total General Campus Enrollment

	Graduate	Undergraduate
1968	28.6	71.4
1998	17.2	82.8

Source: University of California

General Campus Undergraduate and Graduate Enrollments 1968-1998 in thousands



Source: University of California

California has an opportunity to build on UC's quality

UC undergraduate programs across all fields rank among the best in the nation

- An authoritative National Research Council study of doctoral programs found that eight UC doctoral programs ranked No. 1 in their academic fields in terms of faculty quality – a key indicator of doctoral program quality. The same study showed that more than one-third of all UC programs evaluated – at eight UC campuses – ranked in the top 10.
- More than half of the 229 UC doctoral programs evaluated ranked in the top 20 in their fields, a record unmatched by any other university system in the nation.
- Excellence is spread among all nine campuses. For example, UC Riverside ranks No. 1 among public universities in total number of journal publications per faculty member and UC Santa Barbara was ranked No. 2 among all public universities in overall research performance, in a study conducted by researchers Hugh Davis Graham and Nancy Diamond (The Rise of American Research Universities: Elites and Challengers in the Postwar Era, 1997).
- UC's graduate professional schools rank very highly, too, according to ratings by *U.S. News & World Report*. For example, UC had nine programs in the top 10 in education, engineering, public policy, law, business, medicine, and veterinary medicine.

UC graduates get jobs

- Contrary to popular impressions, unemployment among Ph.D. recipients from U.S. universities is quite low (in the 2-3 percent range), much lower than for the U.S. civilian labor force as a whole.
- New UC Ph.D.'s find employment quickly. For example, at UC San Diego, 95 percent of recent Ph.D.'s were employed or in further education shortly after graduation.
- Even in fields with difficult job markets, UC graduates do well. At UC Irvine, 90 percent of the English and comparative literature Ph.D. graduates since 1992 are employed in academic positions, with others finding employment in the private sector.
- In the professions, UC alumni often do even better. At UCLA's Anderson School of Management, 99 percent of the M.B.A. class of 1997 had accepted full-time offers or had developed entrepreneurial opportunities by September of that year.

UC Doctoral Programs are Top-Ranked

78 UC Graduate Programs are in the Top 10 Nationally

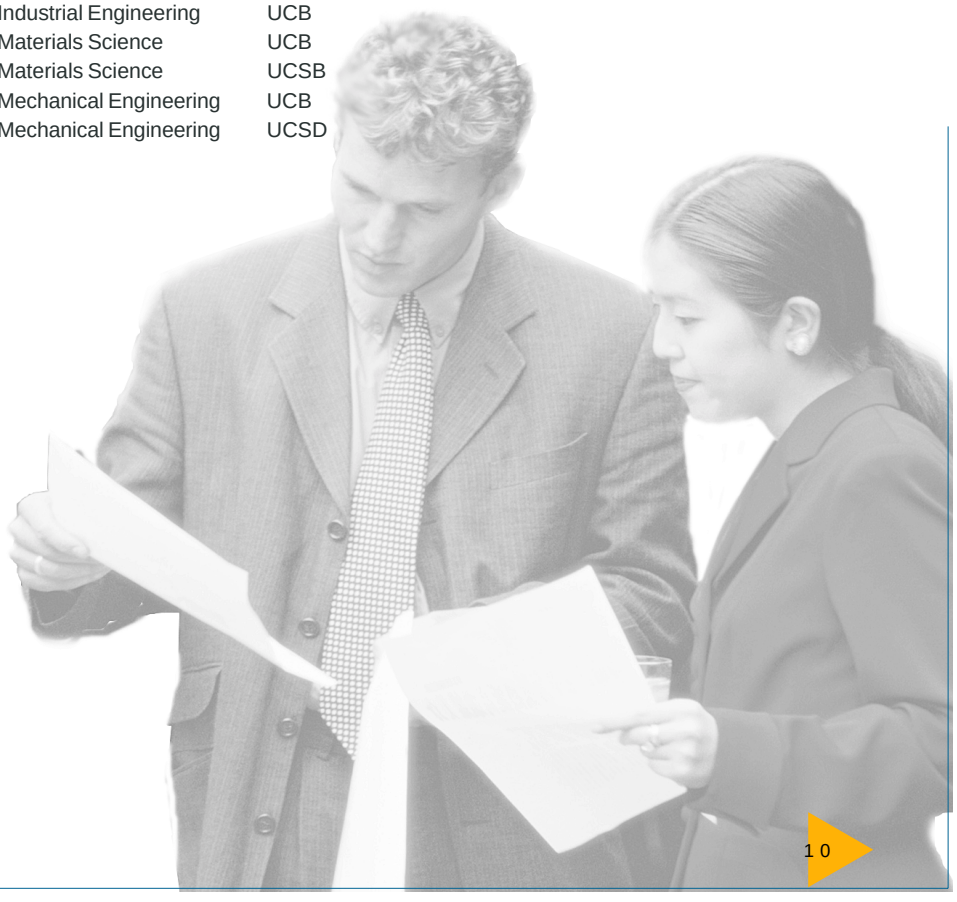
Biological Sciences	
Biochemistry/ Molecular Biology	UCSF
Biochemistry/ Molecular Biology	UCB
Biochemistry/ Molecular Biology	UCSD
Biomedical Engineering	UCSD
Cell/Developmental Biology	UCSF
Cell/Developmental Biology	UCSD
Ecology/Evolutionary/ Behavioral Biology	UCD
Ecology/Evolutionary/ Behavioral Biology	UCB
Genetics	UCSF
Genetics	UCSD
Genetics	UCB
Neurosciences	UCSD
Neurosciences	UCSF
Neurosciences	UCB
Phamacology	UCSD
Physiology	UCSD
Physiology	UCLA
Physiology	UCSF
Psychology	UCLA
Psychology	UCB
Psychology	UCSD

Humanities and Arts	
Art History	UCB
Classics	UCB
Classics	UCLA
Comparative Literature	UCI
Comparative Literature	UCB
English	UCB
French	UCB
French	UCI
German	UCB
Linguistics	UCLA
Linguistics	UCB
Linguistics	UCSC
Music	UCB
Philosophy	UCB
Philosophy	UCLA
Religion	UCSB
Spanish/Portuguese	UCB

Physical Sciences/Mathematics	
Astrophysics/Astronomy	UCB
Astrophysics/Astronomy	UCSC
Chemistry	UCB
Chemistry	UCLA
Geosciences	UCB
Geosciences	UCSD
Mathematics	UCB
Oceanography	UCSD
Physics	UCB
Physics	UCSB
Statistics	UCB
Statistics (Biostatistics)	UCB

Engineering/Computer Science	
Aerospace Engineering	UCSD
Aerospace Engineering	UCLA
Biomedical Engineering	UCSF
Biomedical Engineering	UCB
Chemical Engineering	UCB
Civil Engineering	UCB
Computer Sciences	UCB
Electrical Engineering	UCB
Electrical Engineering	UCLA
Industrial Engineering	UCB
Materials Science	UCB
Materials Science	UCSB
Mechanical Engineering	UCB
Mechanical Engineering	UCSD

Social Sciences	
Anthropology	UCB
Anthropology	UCLA
Anthropology	UCSD
Economics	UCB
Geography	UCSB
Geography	UCB
Geography	UCLA
History	UCB
History	UCLA
Political Science	UCB
Political Science	UCLA
Political Science	UCSD
Sociology	UCB
Sociology	UCLA



Source: National Research Council

Let's work together to strengthen California's future through graduate education

To achieve this, UC will:

- **Carefully design and regularly review graduate programs** so that quality is assured and programs that are no longer needed for changing times are modified or discontinued.
- **Identify ways to maintain the budgetary flexibility needed to enable continued investment** in valuable new initiatives.
- **Leverage all campuses' strengths** through the complementary approaches of individual campus development and intercampus cooperation.
- **Strengthen communication** with employers, graduate students, alumni, and public officials to ensure that opportunities are identified and implemented so that graduate and professional programs can continue to meet state needs and help students gain the skills they need to be successful.
- **Increase graduate student diversity.**
- **Expand current efforts to reduce the time graduate students take to complete their programs** by monitoring progress closely, providing support services and increasing student financial support.
- **Develop better and more complete information on the career patterns** of UC graduate and professional degree recipients to assist campuses as they consider and plan for growth in specific graduate programs.

And UC needs your help to:

- **Ensure that adequate funding exists** – for student financial aid, and for the programs in which students enroll.
- **Secure State funding** that keeps pace with both enrollment growth and inflation. In addition to funding the faculty positions needed for a growing student population, this is an important source of funds for teaching assistantships.
- **Continue a strong federal commitment** to the basic research that provides research assistantships for graduate students, and to student financial aid.
- **Support UC's arguments to the State and Federal governments** that will foster graduate enrollment growth in areas of importance to California. Growth will target, for example, the shortage of high-tech scientists and engineers, the needs of the entertainment industry, and disciplines that foster international connections, preserve and clean up the environment, and look for solutions to major social and educational problems facing California.
- **Pursue creative opportunities** that enhance international connections with California. The recently negotiated agreement between UC and the Mexican government's science and engineering agency, CONACYT (Consejo Nacional de Ciencia y Tecnología), which provides block grant funding for promising Mexican graduate students, is a model that can be more widely pursued with other national agencies.
- **Identify appropriate industry relationships** to provide research assistantships and fellowships for graduate students. The training of researchers, particularly in engineering and in the physical and life sciences, has been the source of countless inventions and entire new industries, which keeps the private sector healthy and vital. Carefully thought-out programs that match educational interests with opportunities for guided work in industrial settings, or that involve bringing industry researchers into the University for appropriate joint projects that support graduate students could be pursued.
- **Increase donor contributions for graduate fellowships.** If UC's campuses are to continue to compete with comparable universities nationally, many of whom are conducting campaigns for graduate student support, UC must do the same.

To sum up...

California and the world now function in an economy that demands a highly educated workforce with the ability to innovate, perform research, and solve problems.

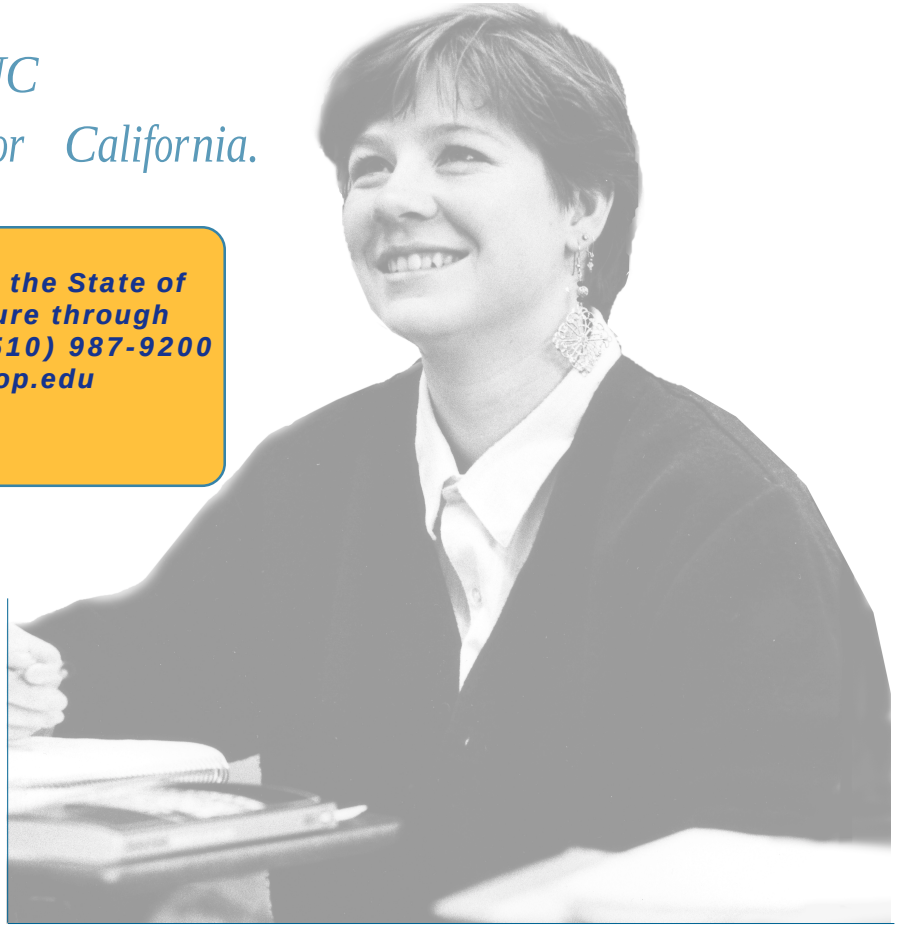
UC has a proven track record in providing quality graduate education, and its alumni have made tremendous contributions to California and the nation.

Yet California is under-investing in graduate education. Despite the overwhelming changes of the past 30 years, graduate education at UC has grown very little – 7 percent compared with 100 percent for undergraduate education. In fact, it is actually lower now than it was a decade ago, both in number and as a percentage of total enrollment.

It will take new partnerships, resources, and innovation if California, the nation, and the world are to reap the economic and social benefits that flow from expanded, targeted graduate education at the world's premier public university.

We invite you to help UC make discovery work for California.

If you want to help UC and the State of California invest in the future through graduate education, call (510) 987-9200 or email UC at grad.ed@ucop.edu for more information



The University of California

. . . It just may be
California's most valuable resource.