

Office of the President  
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Undergraduate Education: Discussion of the Report of  
the Task Force on Lower Division Education

The teaching of undergraduate students is one of the central missions of the University of California. The University's commitment to its undergraduates is to provide them with the opportunity for an education of the highest quality, one in which both general education and the major are valued as important components of the educational experience. To that end, the administration is continually engaged in activities both Universitywide and on the campus to assess and improve the quality of undergraduate education.

The current Universitywide effort to assess and improve undergraduate education involves a review of lower division education at the University by a broadly representative task force of faculty, administrators, and students. The charge given to the Task Force on Lower Division Education was complex and comprehensive: (1) to review the University's mission to teach lower division students; (2) to review the nature and quality of the lower division curriculum; (3) to review the quality of teaching and learning; and (4) to review the quality of academic support services.

Two developments external to the University had direct bearing on the charge and helped to shape and focus the subsequent work of the Task Force: the publication of three national reports on the quality of undergraduate education, which focused attention and debate on the declining quality of undergraduate education and the need for major reform; and the initiation of a major review of the Master Plan of Higher Education by the California Legislature.

The national reports raised questions about the nature of the educational experience for first and second year students, the commitment of faculty to those lower division students and the coherence of general education, which provided a stimulus for a close look at lower division education in particular. Each UC campus was asked to assess its undergraduate programs in light of the concerns raised in the national reports, and the information from these self-assessments was incorporated into the preliminary report of the Task Force which was provided to The Regents in February.

The Commission to Review the Master Plan for Higher Education began its review of postsecondary education in California with a review of the community colleges. Issues such as articulation of community college courses with University courses and the transfer of community college students to UC campuses became central to the Commission's discussions. Because of the importance of the relationship between these issues and lower division education at the University, the Task Force incorporated these issues into its charge.

The final report of the Task Force was completed in June 1986. It describes the lower division experience and presents a cogent analysis of the issues described in its charge. It reaffirms the mission of the University to teach undergraduates and provides a set of far reaching recommendations that targets specific areas of concern and suggests specific steps for reforming the curriculum, improving the quality of teaching, improving educational

continuity, and improving information and quality control. (For the full text of the recommendations, see the Executive Summary which serves as the introductory section of the final Task Force report.)

Although the final report of the Task Force was submitted only recently, two steps have already been taken to initiate implementation of several recommendations. The first step has been to forward the Task Force report to the campuses and the Academic Senate for review and comments. Comments are due in the Office of the President by December 1.

Second, in response to the Task Force recommendation that significant attention be given to the training, supervision, and evaluation of Teaching Assistants, two actions have been taken. First, the 1987-88 budget request includes an item for \$750,000 to expand and enhance programs that prepare Teaching Assistants for their classroom duties. The University has had a long standing commitment to improving the training of Teaching Assistants, and since the establishment of the Instructional Improvement Program in 1973, the University has developed a wide range of innovative programs for Teaching Assistants. Additional funding will make possible both broadening of existing programs and evaluating the impact of various approaches to Teaching Assistant preparation. The University is also renewing its request to reduce the ratio of students to Teaching Assistants from 44:1 to 40:1.

There is also a need to expand dissemination of information on effective Teaching Assistant training programs within the University. Therefore, in addition to the budget item developed to provide resources for the training of Teaching Assistants, a survey is being developed to gather detailed information across the system on Teaching Assistant programs and the ways in which Teaching Assistants are used on each campus.

One of the important points made by the Task Force report is that the University lacks adequate information on the lower division experience, including data on the educational roles of different categories of instructors. In response to this recommendation, the Office of the President is making preparations to expand the data base on the undergraduate experience. The information gathered will serve several purposes. Moreover, Senate Concurrent Resolution 55 requires the University to provide much of the same data about the lower division experience. The new data base will enable the University to respond to that Resolution.

Another key issue to which the Task Force report directs its attention is the quality of faculty teaching in the lower division. University academic personnel policies which define the review procedures for faculty contain requirements for gathering evidence on faculty performance, including evaluations from current and former students, and suggest that evidence from colleagues and others should be collected. The Task Force believes that these procedures can be improved. The Task Force report underscores the value of collegial input in the evaluation process, based on direct faculty peer observations of teaching and the subsequent discussion of those observations with colleagues. Responsibility for incorporating such changes rests with the faculty; hence, this and other recommendations have been referred to the campuses and the Academic Senate.

Facilitating transfer to the University from community college and State

University campuses is another of the major concerns in the Task Force report. To ease the process of transferring to the University, the Task Force recommends the development of a transfer core curriculum, a set of courses designed to meet the basic lower division requirements of the UC campuses. As a corollary to the transfer core curriculum, the Task Force recommends that the UC campuses initiate a reciprocity agreement under which each campus honors the course work taken to meet another campus's general education requirements. Activity directed at developing reciprocity arrangements has already begun. Last spring the Academic Senate asked the campuses to review carefully possible reciprocity arrangements. The Senate is continuing to focus attention on reciprocity. This fall, the Chair of the Academic Senate will meet with the leaders of the campus educational policy committees to consider seriously the development and implementation of a reciprocity agreement among the campuses.

Finally, there has been widespread public interest as a result of the dissemination of the Task Force report, leading to numerous presentations by the chair of the Task Force, Professor Neil J. Smelser, and others, to various groups inside and outside the University. This level of activity is expected to continue, because of the intense interest in the report--most particularly in its recommendations.

The major recommendations of the Task Force report are specific and concrete. They reflect the goal expressed in the Task Force Preliminary Report to avoid the diffuseness of the national reports and to focus on the issues of lower division education in the context of the University of California in the State of California. Moreover, in generating many of its recommendations, the Task Force drew on the exemplary programs on the various campuses of the University as the bases for its recommendations, suggesting that the University has, to date, developed a rich store of effective programs that are worthy of emulation.

A major Task Force recommendation focuses on how to increase direct contact between lower division students and faculty. The recommendation states that campuses should institute and expand freshman-sophomore seminars or their functional equivalents. Such a program would guarantee a chance for lower division students to interact with ladder-rank faculty in a small classroom setting. Such small classroom experiences offer, among other things, the opportunity for close, intense intellectual exchange between faculty and students, and among students. In addition, seminars provide an excellent opportunity for sharpening writing, speaking, and critical reasoning skills and can serve as an orientation to the college environment for the first year students.

As the Task Force report makes clear, the idea of the freshman-sophomore seminar is not new; in fact, the University presents an array of models for such a program on some of its own campuses. The Berkeley, Los Angeles, and Santa Cruz campuses offer some good examples.

At the Berkeley campus there have been freshman-sophomore seminars for several years, even though they are limited in number. The program features courses offered by regular faculty which focus on a central issue of the faculty member's field of study or cover a diverse set of disciplines and subjects. The topics range widely and the organization and requirements of the seminars

vary considerably. For example, in the Spring of 1986 course topics included Introduction to Modern Art, Death and the Value of Life, Plato and Platonism, the Individual and His/Her Society, and American Higher Education and the University of California.

Exemplifying the range of differences among the Berkeley campus seminars, the seminar on the Introduction to Modern Art was organized around a survey of major developments in modern art and required students to do weekly written assignments, often in the context of field work. The seminar on the Individual and His/Her Society focused on questions about the nature of the life cycle and ways in which individuals deal with various pressures. Substantial reading and two papers were required as well as a research proposal and a longer, more polished presentation of research data.

The Los Angeles campus has developed an extensive program of freshman-sophomore seminars which includes seminars of the type already described offered by regular faculty in the College of Letters and Science, but which also includes two additional interesting innovations. The Professional Schools Seminar Program (PSSP) offers about 30 seminars each year taught by faculty from 11 professional schools. Students are required to do substantial writing, and class participation is required as part of the grade. The PSSP courses focus on general education topics in the context of the faculty member's professional expertise. Examples of courses include Disease in Society, taught by faculty from the medical school, in which students spend class time in the rare book library reviewing classic texts in order to compare past experience with modern knowledge. Conflict in Central America, offered by a professor in Industrial Relations, focuses on the sociopolitical environment and economic instability which result from the conflict. The instructor arranges a number of field trips including visits to the United States-Mexico border for discussions with the border Patrol and other agents; students also visit an East Los Angeles barrio. There is a term paper that the student must defend in front of the class.

Second, the campus has recruited a number of emeritus faculty to teach freshman-sophomore seminars. This program makes use of the accumulated wisdom and abilities of faculty who have been with the University for many years, and in addition, provides these emeritus faculty with an important link to the ongoing activities of the campus, which they find very satisfying. Such emeritus faculty receive modest stipends for their services.

The Santa Cruz campus offers a comprehensive set of models for freshman-sophomore seminars which provides every lower division student with a direct contact with a faculty member in a seminar setting. Each College at Santa Cruz requires its freshmen to complete a limited enrollment core course. The focus of the seminars varies from College to College and the pedagogical approaches vary as well. As an example, Cowell College's core course, designed by the entire College faculty, focuses on civilizations through three themes: gender roles, family membership, and being or feeling marginal. The syllabus begins with the 20th century and moves backwards to Greeks civilization, the reverse of similar traditional courses. Students meet regularly in classes of 22 with a College faculty member. There is a common reading list for all the students in the core course; and though all students meet as a large group for lectures every two weeks, the basic format for the core course is the seminar. Students are required to complete five essays

during the quarter and other kinds of writing exercises to help engage them in the class.

Other campuses of the University have seminar programs as well. Santa Barbara initiated a program in 1974; some of those courses are now part of an honors program. Revelle College at San Diego offers its freshmen an interdisciplinary humanities program which emphasizes the integration of writing skills into the humanities. Irvine has honors seminars which provide small classroom experiences for some lower division students.

While freshman seminars are not a new idea and excellent models exist, the Task Force recommends that this kind of experience should be extended to all lower division students. The Task Force recognized that there are important issues of resource allocation if this goal is to be achieved. To accommodate half an entering class of 3,000 would require 100 faculty-led seminars. To begin to address the problem of resources, the Task Force has made several suggestions including: (1) departments could give some less popular courses somewhat less often, thus freeing faculty for freshman-sophomore seminars; and (2) emeriti, from campuses with significant numbers of emeritus faculty, could be called into service, following the Los Angeles campus model.

The freshman-sophomore seminars typify the Task Force's concrete recommendations grounded in the context of the University. The guidance provided by the recommendations offers an effective map for enhancing undergraduate education at the University. Once the campuses and the Senate have responded to the recommendations from their own perspectives the University can chart the full course to implement the Task Force recommendations.

## GRADUATE ENROLLMENT PLANNING, 1985-86 THROUGH 2000-01

### INTRODUCTION

The University of California's fifteen year graduate enrollment plan will project a graduate student body of a size, quality, diversity, and balance designed to respond to the changing needs of California and the nation for advanced training and research. Economic forecasts for the State of California and predictions about the future job market nationally argue that graduate and teaching credential enrollment must grow by the year 2000 to meet society's need for

- 1) renewal of the faculties across all of higher education,
- 2) expansion of academic and nonacademic research,
- 3) professionals with advanced training to serve an increasingly complex society, and
- 4) a strengthened and expanded core of school teachers and educational leaders in the K-12 sector.

Prominent among these needs is the renewal of the nation's faculties, soon to experience an accelerating wave of retirement that will continue into the next century. The University must plan graduate enrollment now to assure that the finest scholars will be prepared to assume the places of those who retire, a necessity for maintaining the quality of higher education in America. Equally important is advanced education for the highly trained individuals upon whom research and the University's increasingly complex nonacademic job market depend. California, in particular, continues to develop an economy of considerable diversity and complexity that will require an infusion of highly trained professionals at a greater rate than is true for the nation as a whole. Finally, the preparation of post-baccalaureate teaching credential holders needs proportionally greater expansion to satisfy both current and future shortages.

The graduate enrollment plan will place these long-term needs in the context of (1) improving balance between undergraduate and graduate numbers; within graduate education, between professional programs and the academic core; and between domestic and foreign students in technological fields; (2) enhancing selectivity; and (3) increasing racial/ethnic diversity. In the long run, this plan will assure the readiness of the University of California to accommodate the sharply accelerated growth in undergraduate enrollments anticipated during the opening years of the twenty-first century.

While this plan will incorporate certain key assumptions about how the market for highly trained individuals will develop in the future, there are important caveats. The rapid expansion of American graduate education from the 1950s to the end of the 1960s led during the 1970s to a widespread mismatch in many traditional letters and science fields between numbers of doctorate holders and faculty openings. While many doctoral recipients succeeded in applying their advanced training to nonacademic careers and their unemployment rate remained very low absolutely and in comparison to unemployment rates in the economy at large, there was a widely held perception that graduate education was overbuilt and responding inadequately to the conditions of the job market.

In fact, enrollments followed the market and dropped markedly in many traditional humanities and social sciences fields. As a result, the academic job market in these areas is approaching an equilibrium between openings and candidates. Concurrently, certain fields that were producing more graduates than the job market could absorb in the early 1970s, notably some areas of engineering, now experience acute faculty shortages that will not be easily remedied in the near future, as well as a continuing and competing critical need in the nonacademic sector. The excellence of the University of California's graduate programs has given its graduates a competitive edge in the academic market, one that will continue, especially as the possibility of faculty shortages in the next fifteen years grows; and the University's graduates will continue to be prized by business, industry, and other employers.

Prudent planning steers a course between over- and under-anticipating the demands--or the shape--of the job market in the future. In the fifties and sixties, it was the relative uniformity of growth across all disciplines that contributed to the placement difficulties of the 1970s. This plan will avoid such pitfalls by projecting differential growth in disciplinary areas, based on differences in anticipated needs. In addition, the plan will be geared to peg growth at a rate designed to avoid the "boom or bust" cycles through which we have recently passed, and to leave a modest margin of unallocated numbers that will provide for unpredictable areas of future growth.

By the same token, it is not intended that the graduate plan should hamper the University's ability to meet societal need for advanced training and research by exercising excessive cautiousness based solely on predictions about the national job market. California differs substantially from the United States as a whole in demographic trends, rate of economic growth, and the components of that growth; in aggregate, these differences point to less severe cyclical variations and greater long-term potential for growth in California than in the country as a whole. This report also takes into account the fact that combined projections of future enrollments and faculty hiring needs may stimulate a process of adjustment that alters the actual course of events. For example, predictions of declines in undergraduate enrollments in the 1980s exacerbated the limited prospects for permanent faculty employment in the humanities and social sciences, as universities increasingly relied on part-time faculty in those fields; and that situation contributed to the decline in humanities and social sciences enrollments described above. However, for a variety of reasons, instead of undergraduate enrollment declines, there have been steady increases that are now expected to accelerate sharply after 2000. As a result, universities have begun to fear that they may face a shortage of outstanding candidates for faculty positions in the core academic disciplines. Intense competition for the best graduate students may be impending, and on the horizon may be a wave of anticipatory competition to hire the best faculty in order to maintain excellence when the predicted new enrollment bulge occurs.

There is evidence that these events are beginning to occur. In the year during which the University has been developing this plan, news about what other institutions are doing to hire promising new faculty while the buyer still has the advantage over the seller suggests that the University of California may have to move forward briskly with its own enrollment and related planning. Columbia University's plan to enhance its ranks of young

faculty, for example, has received national attention. (See, for example, "Promising Young Scholars Now in the Demand for Academic Jobs," The Chronicle of Higher Education, Sept. 3, 1986, p.1) A necessity, the urgency of which increases as the demographic composition of California continues its rapid transformation, is to move more rapidly toward developing faculties (as well as other cadres of highly trained professionals) that fully reflect California's racial and ethnic diversity. The approaching need for rapid faculty renewal will present an opportunity to increase dramatically the presence of underrepresented ethnic and racial groups, as well as women, in the fields in which they continue to be underrepresented.

Finally, the plan will propose a new enrollment category, post-baccalaureate credential students, to highlight the University of California's commitment to expanding its preparation of teachers and K-12 leaders as its contribution to satisfying current and future shortages of teachers.

#### PROCESS FOR DEVELOPING THE PLAN

Graduate enrollment planning in the University differs fundamentally from undergraduate enrollment planning. For undergraduates, the University has a long-standing commitment to accept and educate all eligible California high school graduates who wish to attend. As a result, planning concentrates on estimating demand. By contrast, planned graduate enrollments are based on very different criteria; these will be discussed in detail below.

In May 1985, the Office of the President asked each campus to reassess its level of graduate enrollment contained in the 1984-1986 Graduate Enrollment Plan and to assess its longer-term enrollment potential to the year 2000. In November 1985, each campus submitted both a preliminary long-range graduate and an undergraduate enrollment plan. The Office of the President, working with the campuses and the systemwide Academic Senate, developed a set of eight long-range planning principles to guide development of the graduate enrollment plan. These principles were presented and elaborated in a February 1986 report to the Legislature. The planning principles included (1) need for research, (2) placement, (3) future need for advanced training and research, (4) balance, (5) foreign students, (6) selectivity, (7) graduate student support, and (8) affirmative action. The Office of Academic Affairs in the Office of the President gathered and analyzed information, conducted surveys of academic professional societies concerning the academic labor market, and consulted with University planning and administrative groups as appropriate, and with the California Postsecondary Education Commission, concerning the planning principles. In August 1986, the campuses submitted their formal enrollment plans with justifications according to the eight planning principles. The results of the Academic Affairs study process were used to evaluate the formal graduate enrollment plans and justifications, and to develop a series of options for a systemwide plan. The Office of the President is in the process of considering a range of planning options that includes distribution of growth in graduate enrollments by campus and discipline, in the context of the planning principles above. The current plan will build on the three year 1984-1986 Graduate Enrollment Plan, and many of the points in this present report were adumbrated in that plan. Tables that display options under consideration for the final plan will be presented during the meeting of the Committee of the Whole on October 16, 1986.

## JOB MARKET TRENDS: SOME PLANNING ASSUMPTIONS

Future societal needs for graduate and professional training and research are shaped by many forces. Demographic and economic trends, needs for new knowledge, and interdependence between education and the economy and culture are important factors. As new knowledge emerges from research, new and interdisciplinary fields will develop. As the nation grows, it will need more highly trained people in an expanding labor force. These trends will be especially evident in California and they form the background for graduate enrollment planning by indicating the direction and something of the magnitude of change; but the University cannot and should not translate such trends into specific estimates concerning particular jobs, or specific job estimates into graduate enrollments 15 years hence. This plan reasserts caveats of previous enrollment plans: that the purposes of graduate education are broader than training for job slots, that job markets are unpredictable and cyclical (the market for engineers during the last twenty years is a good example of that), and that the new knowledge generated by people with advanced training ultimately alters and recreates the job market itself: the development of biotechnology is a vivid recent illustration of that fact.

About half of those who earn doctoral degrees in the 1980s (and more than half in fields such as chemistry and engineering) are going into private industry, government, and other nonacademic employment. Studies show that their work is largely in activities appropriate to the training they have received. Most of those who earn professional degrees (e.g., business, engineering, law) make their careers outside higher education, as do new teachers with basic teaching credentials. About half of those who earn doctoral degrees go into college and university employment in times when the academic labor market is strong. Somewhat fewer do so at present. Many new doctoral recipients take postdoctoral appointments for a time, moving to employment in one of the two sectors later. In California, better than 50% of domestic and permanent resident doctoral recipients whose post-graduation plans are known stay in the State. This is a sign of California's highly developed education, private, and public sectors.

Regarding academic job market trends, the Office of the President analyzed the needs for replacement and growth separately. The national dimensions of the replacement market are outlined in studies of faculty age demography and of projected vacancies resulting from retirements and other separations; a particularly notable recent study is American Professors: A National Resource Imperiled by Howard R. Bowen and Jack H. Schuster of the Claremont Graduate School. The Office of the President projected vacancies and replacement needs for the University of California, and presented to The Regents' Committee on Educational Policy, last May. The Office of the President also gathered preliminary indications of replacement needs for doctoral faculty in the California State University and the California Community College systems, and studied how institutions comparable to the University of California seem to be responding to the faculty replacement question. Finally, extensive surveys of a number of professional societies led to an assessment of the current supply and demand balance in the academic job market. Current placement reports and typical lead times between entry into graduate programs and completion of the doctorate were factors in the assessment. The growth projected in the plan thus will reflect a general assessment of the broad trends in career opportunities for University of California graduate academic and professional students, and a closer assessment of the outlook for faculty appointments for

doctoral recipients from the University of California, with a strong focus on the letters and science fields.

## RESEARCH

Renewed national interest has led to substantial growth in basic research in recent years. The Federal agencies that underwrite academic research are concerned with needs for more basic scientific and technological investigation because of the interdependence between economic strength and research. They are concerned about the international competitive challenge to U.S. leadership in science and technology. The issues and the solutions are long-term in nature.

The academic sector continues to be the primary agent for Federally supported basic research. The National Science Board recently reported to President Reagan that the Federal government supports the position that the stimulation of technological innovation will improve economic welfare. As a result, changing Federal policy has led to an increase in direct support of basic research both in the university and in the private sector. In order to promote technology transfer to industry, the government has been working to remove legal and regulatory barriers to workable university-industry research relationships. Federal support for academic basic research grew at an annual rate of 3.6% a year in real terms between 1980 and 1985. Total academic expenditures for basic research grew at a 4.1% rate. The physical sciences, computer sciences, engineering, and biotechnology have received most of the increased support.

It is assumed that the Federal government will continue to shoulder major responsibilities for university-based research and that total support from all sources will continue to grow. For planning purposes, however, it is assumed also that Federal deficit-reduction and spending limitations, particularly the Gramm-Rudman reductions, could restrain growth of Federal support below a level sufficient to address the needs identified by the government.

In California, private and public groups that are studying the opportunities and challenges before the State as it moves into the twenty-first century increasingly recognize how important university research is to the State's future. The growing Pacific Rim economy and its challenge to California's high-technology preeminence have heightened these perceptions. For example, in a recent report on California and the Pacific Rim, the California Economic Development Corporation (CEDC) noted the principal reasons that California is the high technology capital of the world. The three primary factors are outstanding university science and engineering departments, high levels of university research and development funding, and strong cooperative ties between the academic and business sectors. Another recent report, a prospective look at California in the year 2000, developed by the Wells Fargo Bank, cited scientific and technological research conducted by universities and medical schools as important strengths of the regional economies within California.

In contrast to the science and technology fields, the humanities and, to some extent, the social sciences, suffer from a relative dearth of badly needed research support. Society greatly needs new knowledge, new perceptions, and

new syntheses from these fields, especially in view of trends in California in particular toward an international and multi-cultural society and toward an increasingly information- and communications-based economy. Interaction among the various branches of the humanities and between the humanities and the social sciences, natural sciences, and technology must increase during the next 15 years as a means of grappling with the growing complexities of work and culture in modern societies. The humanities and social sciences have a crucial role to play in raising the issue of how society is to value and wisely use the products of its advanced science and technology.

#### DEMOGRAPHIC, ECONOMIC, AND EDUCATIONAL FACTORS

Trends in the national and State population, economy, and job markets are important general factors in assessing overall needs for the kinds of advanced training and research provided by the University. While there are some inconsistencies among economic forecasts, in general, indications are that California will be a particularly active center of development in the next 15 years.

Historically, California has grown at a faster rate than the nation as a whole. According to a recent Congressional report, "The Bi-coastal Economy", (reported in the New York Times, 7/11/86, p. 29), economic growth during the past five years in California as well as in several East Coast states was nearly triple that of the rest of the country. While this higher degree of growth may be transitory, California is expected to continue outpacing national growth rates of population, employment, and economic output. That is the consensus of several recent predictions, including those of the Los Angeles campus Business Forecasting Project, the Center for Continuing Study of the California Economy, the National Planning Association, and the Wells Fargo Bank.

California's position in the Pacific Rim economy is a prominent factor in the latter report as well as in the CEDC policy study noted above. California's "nation state" economy already is larger than that of most nations. The CEDC ranks California seventh among leading economic powers in the world and predicts that it will rank fourth by the year 2000. Wells Fargo Bank ranks California sixth currently and fifth by the end of the century, noting that only the United States itself, the Soviet Union, Japan, West Germany, and France currently produce more goods and services.

This remarkable picture of the California of the future is based on a number of interrelated projections:

- Population growth and balance--The 1985 California population of 24.6 million will be joined by an additional six to seven million people by the year 2000. The balance among age groups, ethnic/racial groups, and native born/immigrant groups will continue to shift; the general population will gradually become older and more diverse in terms of ethnicity and place of birth. Much of the growth within minority groups (black, Hispanic, Asian) and immigrant groups (Hispanic, Asian) will be among school- and college-age youth, though substantial growth will be seen across all the age groups. In the later 1990s and beyond, the college-age population in general will grow rapidly.

- The size of the labor force and numbers of jobs will continue to grow more rapidly than the size of the overall population in the next 15 years, as has been true in the past; but there will be larger core of experienced workers than in the past. In California, job openings will grow by as many as six million by the year 2000, according to the Wells Fargo Bank.
- California's economic environment will be more competitive and more international. The most rapid growth will be in services and information-based business, where well-prepared, skilled professionals will be in demand. Manufacturing employment will grow more slowly than in the past, but high-technology concerns will continue to furnish the leading edge of technological advantage. Agriculture, now undergoing an economic and technological transition, should continue to be a major source of California's economic prosperity. The Wells Fargo report estimates that the Pacific Rim currently accounts for 41% of world business, and California handles about 80% of the business between the United States and Pacific Rim countries, a market with an enormous potential for expansion.
- To prepare for the future envisioned above, a range of critical issues in this era of school reform must be addressed now. California must strengthen the "infrastructure" or foundation for future growth and quality of life. In particular, the elementary-secondary school portion of the educational infrastructure must be strengthened, or much that is predicted cannot occur. As a Harvard scholar of Japanese studies, Thomas Rohlen, said in a recent commentary on school reform in Japan, "If the Japanese succeed in revitalizing their system of higher education and the Americans fail to improve the quality of their system up to 12th grade, there will be a further deepening of the American disadvantage."\*

#### NEEDS FOR TEACHERS

The teaching profession will be one of the fastest-growing employment areas in the country and the State in the next 15 years. According to the Western Interstate Commission for Higher Education (WICHE), nearly every Western state will face a serious deficit of elementary and secondary school teachers by 1995. The Western states may face greater shortages than the nation as a whole. If there is no increase in numbers of education graduates in the Western states, it may require as many as 6,000 teachers from the rest of the country to move to the West each year for the next decade, in order to close the gap.

The graduate enrollment plan will propose the creation of a third category of students separate from graduates and undergraduates: post-baccalaureate credential students. This category of student will consist of those working toward a teaching credential (fifth year program) who are not candidates for a graduate degree. The creation of this category of students will recognize the special nature of these credential programs and will highlight the University's role in teacher education. Once post-baccalaureate credential

\* Wall Street Journal, 4/28/86, p. 23.

students have been established as a separate category, future changes in the numbers of such enrollment can be planned and targeted separately from the other enrollment categories in order to recognize the special need to train additional teachers.

#### NEEDS FOR ADVANCED TRAINING

The plan will give great weight to future needs for faculty. The Office of the President reported to The Regents' Committee on Educational Policy last May on the analysis of the University's replacement needs, based on projected retirements and other separations between 1985 and 2000. As reported at that time, the projections show that 40%, or about 3,000 of the University's ladder rank faculty, will retire by the year 2000 (assuming that faculty continue to retire, on average, at age 65). When other separations and the planned overall enrollment growth of 32,000 undergraduate, post-baccalaureate credential, and graduate students are considered in addition, another 3,000 faculty will be needed. To fill the nearly 6,000 projected vacancies, the University will need to hire slightly more than 400 faculty per year between now and 2000, compared to the current pattern of fewer than 300 hires per year.

The Office of the President surveyed the California State University and California Community College systems to determine their projected needs for replacement of faculty who have completed appropriate graduate degree programs. The California State University system currently has approximately 11,000 permanent, ladder rank faculty and a projected turnover of 8,700 by 2000 (approximately three-quarters of CSU's permanent and temporary full-time faculty currently hold doctorates). CSU's present plan is to recruit only 8,000 replacements in anticipation of possible staffing shifts in the future. The Community Colleges currently employ about 15,600 contract and regular faculty, of whom 44%, or 6,900, will reach age 65 by the year 2000. Only 8% of those retirees have doctoral degrees. The Community Colleges would need to replace 550 retiring faculty with new doctorate holders. Estimating separations apart from retirements and possible changes stemming from the Review of the Master Plan for Higher Education, it can be predicted that the Community Colleges will hire at least 1,000 new doctorates over the 15-year period. (This analysis does not consider the Community Colleges' extensive hires of master's degree holders, many of whom performed their degree work at the University of California.) Altogether, the three public segments of higher education in California, at a conservative estimate, will hire a total of 15,000 doctoral faculty by the end of the century, and that figure does not include the substantial additional hires among California's independent colleges and universities, which also anticipate a growing number of retirements in addition to other replacement needs.

#### ACADEMIC LABOR MARKET SUPPLY AND DEMAND

##### Patterns of Employment

By 1984, about 750,000 persons of all ages held Ph.D. degrees and were active in the U.S. labor force, according to the Bowen and Schuster study cited above. About 431,000 (51%) held academic appointments and 319,000 (43%) were employed outside educational institutions. Data since 1950 show that the proportion of Ph.D. degree holders in all fields who have held academic

appointments has fallen from 65% in 1970 to 57% in 1985.

Over the long run, mobility between the academic and nonacademic sectors is affected by the relative strength of demand from each sector. Between 1960 and 1980, the percentage of physical scientists and engineers in academic positions fell from 54% to 34%, while those employed in business and industry increased from 35% to 53%. Demand in the nonacademic sector accounted for much of the shift, especially in engineering. Life scientists also participate in active nonacademic markets provided by government and private laboratories. While shifts have not been as dramatic as for engineers and physical scientists, academic placements accounted for 59% to 67% of the employment of life scientists in the 1960-1980 period. The market for humanists has shifted considerably also; but in this case, the shift reflects the shrinking availability of academic employment, especially after 1973. Academic employment of humanists dropped from 93% of those who earned doctorates in 1960-64 to 75% in 1976-80. In addition and for similar reasons, academic employment of social scientists dropped from 71% to 54% in the same period. However, during that period, there was also a considerable expansion of fields that serve large nonacademic job markets, notably psychology, which contributed to the shift.

#### The Current Market: Overview and Letters and Science

The aggregate supply of new doctoral degree recipients has stayed constant at 31,000 - 32,000 since the mid-1970s, despite the large increase in baccalaureate degree holders. Many of the best students who in the past might have considered preparation for the academic market instead have been attracted to professional fields such as medicine, law, and business. The stable annual supply of new doctorates in general reflects student perceptions about the academic job market. However, some fields represent exceptions to that observation. The nonacademic market for baccalaureate engineers has been so strong that only a moderate increase of engineering doctoral degree recipients, primarily foreign nonresident students, has occurred, despite the existence of a relatively strong academic job market. The number of new doctoral degrees conferred in the physical sciences and mathematics has expanded moderately in the last few years. Numbers of doctorates in the life sciences have been stable; the expansion in the biological sciences shown in this plan reflects to a large extent the major growth in biotechnology.

\* The humanities and, to a lesser extent, the social sciences became depressed areas of the academic labor market during the 1970s. However, this appears to be changing. The number of doctorates awarded fell so steeply between 1973 and 1984 that the gap between each year's new supply of doctoral recipients and the new academic job openings is closing rapidly. A 1983 study of the state of the humanities\* documented that the nonacademic job market to which many of the last decade's graduates moved has provided employment that is in fact appropriate to the training received. For example, philosophers specializing in logic have applied their training to the computer science field. There are instances of exciting new nonacademic employment fields for humanists. Linguistics is a prime example. Doctorally-trained linguists are in demand at such firms as IBM and Boeing, which require their expertise in several of the emerging computer fields such as artificial intelligence with

\* Mary Belisle and Betty D. Maxfield, Humanists on the Move, 1985.

an emphasis in natural language communication. Large manufacturing firms, such as Lockheed and General Motors, hire linguists for research on language control in robotics. The field of natural language applications to computers is expected to grow significantly in the next five years.

That the humanities are branching out into entirely new varieties of employment is a positive development. It is likely, however, that the core employment market for humanists will continue to be academic. In the recent past, 1980 through 1984, 63% to 65% of all new Ph.D. degree recipients in the humanities had confirmed plans for employment immediately after graduation; *only* about 45% of all new Ph.D. degree recipients in the humanities had confirmed plans for academic employment. The period just completed now appears to mark the lowest point of academic job availability, and an upward adjustment has begun to take place. A variety of evidence points to the new equilibrium. For example, in 1984, the number of new academic appointments immediately after graduation rose slightly, the first increase since 1973. The Modern Language Association points to several indicators of improvement. In foreign language, comparative literature, and linguistics, the proportion of new Ph.D. degree holders finding tenure track positions rose from a low of 31% in 1981-82 to 38% in 1983-84, a return to the mid-1970s rate; and overall, 60% of the 1983-84 graduates found full-time academic employment compared to 51% in 1981-82. Another sign of improvement is the 30% increase between 1984 and 1985 in job vacancies posted in the MLA Job Information List.

In general, the Modern Language Association believes that there is equilibrium in the language and literature job market for new doctorate holders. Students are perceiving already that the job market is improving. ~~Several University of California campuses have reported as much as 20% increases between Fall 1985 and Fall 1986 in numbers of applications for graduate study in the humanities. In addition, in anticipation that the near future will see a shortage of humanists, the Andrew W. Mellon Foundation is funding a graduate fellowship program designed to attract the gifted students of today to prepare to fill the roles of retiring faculty of tomorrow.~~

Other evidence that the market for promising young scholars in the humanities is better now than it was a few years ago is surfacing in connection with what may be the first of the new competition for talented faculty. The September 3 Chronicle of Higher Education article cited above described some revealing examples. At the University of Minnesota, the dean of the College of Liberal Arts has been conducting a "mega-search" during 1986 for six tenure-track assistant professors to be hired now as a "mortgage" against retirements coming up in six or seven years. Targets of the dean's search are scholars with interdisciplinary interests in the history and theory of literature, culture, or the arts, who have the ability to teach in two or three disciplines. At Columbia, starting salaries for assistant professors in the humanities are being raised 35% this year, as recruitment progresses in anticipation of a retirement bulge in the very near future. Unless Columbia finds new professors, according to Vice President for Arts and Sciences Donald C. Hood, its programs in Middle East languages and culture are in danger of being decimated by retirement; and by 1995, half or more of the faculty must be replaced in East Asian languages and cultures, English and comparative literature, Italian, linguistics, music, and philosophy.

→ The social sciences have been experiencing a similar, though less severe,

academic job market depression over the past ten to twelve years. There are significant traditional nonacademic job markets for some of the major fields, such as economics and psychology. Political scientists have found new niches in government, as have many historians. The academic market is improving, though still not as strong as in the 1960s. The American Anthropological Society reports that many of the 50%-60% of new Ph.D. degree holders who find academic positions each year enter departments other than anthropology; of the 750 or so new doctoral recipients per year in economics, some 60% seek and find academic employment, as long as they are willing to accept jobs at other than their first choice institutions. According to the American Political Science Association, about 70% of each year's new political science doctorates find academic positions, though not all on the tenure track. History, a bellwether field for the humanities and social sciences, is seeing full employment of new American history Ph.D. degree holders (about 40% of all history doctorates earned) but a continuing weak market for other specialities.

Geography and psychology are fields in which the nonacademic markets have grown. The Association of American Geographers has seen a drop from 95% to 70% of new Ph.D. degree recipients going into academic positions. However, markets based on the new technologies have absorbed increasing numbers, and specialists in satellite technology, computer mapping, and cartography are currently in short supply. In psychology, improved health insurance coverage for psychological services has contributed to a market shift for clinical psychologists, only 13%-14% of whom now enter academic employment. With the emergence of new interdisciplinary specialities such as cognitive psychology, neuropsychology, and gerontology, even the academic market is diversifying, as new psychology doctorates are receiving appointments in business and medical schools.

#### The Current Market: Overview of the Health Sciences

For purposes of this report, this discussion focuses on "graduate academic students," those who pursue work toward an advanced degree (M.A., M.S., Ph.D.) in a health-related discipline--the majority in the basic sciences, others in selected social and behavioral sciences. Upon completing their studies, such students generally become teachers and/or investigators in their chosen fields. As teachers, they will help to educate and train students, thus ensuring the future availability of health professions personnel; as investigators, they will play an important role in the advancement of health-related knowledge in the basic and clinical sciences and in the development of health service techniques and technology, as well as in the dissemination and application of the results of their research. Although these students are based in health sciences schools and the University plans their enrollments as a separate category, they are a part of the University's overall effort in graduate education and training; hence, they are included in this graduate enrollment plan.

In recent years, as a result of the rapid development of biotechnology industries and the expectation that this growth will continue exponentially, there has been increasing interest in the expansion of opportunities for graduate training in the basic disciplines underlying such industries. This interest is manifested not only by corporate and governmental entities and educational institutions that need appropriately prepared personnel, but also

by students who increasingly seek opportunities to prepare themselves to enter a rapidly growing field. As recently estimated by the Upjohn Company's Executive Director for Biotechnology, by 1990 there will be a need for at least 5,000 persons per year who are trained in biotechnology and related fields and are available for employment. This represents an increase of 50% over those available annually at the present time.

The demand for individuals with doctorates in the biomedical sciences is steadily increasing. The enormous growth in the knowledge base of these sciences, and the commercialization of this knowledge, particularly with respect to biotechnology and genetic engineering, combine to generate this increased demand. Not only do educational institutions require faculty to teach and carry out research in the underlying sciences, but the biomedical industry continues to expand and needs individuals with advanced education and training to develop and sustain its activities. Similarly, trained individuals are needed in other fields bearing on health, such as toxicology and pharmacology, neurosciences, occupational health and industrial hygiene, cell biology, biochemistry, biophysics, and microbiology.

The field of toxicology is receiving increased attention as the public and its governmental agencies become more and more interested in controlling or reversing the effects of toxic contamination of the environment. The University's commitment to serve societal needs for trained personnel in that area is evidenced by the many programs offered in its health professions schools, such as the School of Public Health at Berkeley; Davis's School of Medicine, School of Veterinary Medicine, Primate Center, and the Northern California Occupational Health Center; and the San Francisco campus's School of Pharmacy.

In addition, there will be increased employment opportunities for future faculty. As discussed above, the University is anticipating a substantial number of faculty retirements in the 1990s. In addition, as some of the recently established programs grow and as others may be added as a result of new developments in the biomedical sciences, more faculty will be needed. To prepare themselves for such positions in the future, students demand appropriate educational opportunities.

#### FUTURE DEMANDS

Nearly all the large letters and science professional societies represented above expect the number of academic positions to increase as retirements rise. Some disciplines anticipate shortages developing in the not too distant future. The American Institute of Physics expects a shortage of Ph.D. physicists by 1990, and the American Mathematical Society expects a growing shortage of Ph.D. degree holders in mathematics from now to the end of the century. (Though replacement of retiring faculty will be a big factor in this shortage, research mathematicians are already in short supply.) Continuing growth in demand for engineers and chemists has also been projected, but projections that distinguish academic and nonacademic markets are not readily available. Nevertheless, need for faculty in these areas will surely grow because of retirements. Professional societies in the humanities and social sciences also anticipate an increase in openings driven by an accelerating pattern of retirement.

In a more speculative vein, the Office of the President has considered the possibility that the job market predictions summarized above may not take into account another source of possible increase in demand for doctorally trained graduates across the letters and science fields. The call to improve undergraduate education, represented most recently by the final report of the University of California Task Force on Lower Division Education, has the potential to place added demands on graduate programs in the fields that provide general or breadth education for the curriculum. Reform of general education has led in most cases to expanded letters and science requirements and an intention to relieve what has been widely viewed as an over-professionalization of the undergraduate years. Within the University of California system, some campuses, such as Davis, have already made significant changes. The California State University system as a whole upgraded its general education requirements within the last two years. Across the country, major reevaluation is in progress.

The University's plan will include graduate enrollment increases in all the major disciplinary areas and professions over the full 15 years of the plan. Current job market information, however, points to the conclusion that in the first part of the 15-year period, there will be additional adjusting of the humanities and social sciences markets to Ph.D. output; in addition, a number of recent Ph.D. recipients who have not found tenure track appointments initially may be available to fill early rounds of openings brought about by the upcoming retirement bulge. We expect the plan, therefore, to show greater increases in humanities and social sciences after 1990 than before, while some increases in the sciences and engineering will be skewed to the earlier part of the planning period.

The Office of the President did not undertake a detailed survey of the current market for professional employment in such fields as law and business. These fields have had very large increases in enrollment and degree completion in the 1970s and early 1980s. Growth in demand for places in graduate programs has tapered off in the last two or three years. Market demand for M.B.A. degree holders appears to be more or less in balance with current output. Many business employers are increasing recruitment of liberal arts graduates, prizing their strengths in critical thinking and communication, and expecting to supply the specialized training on the job. The student demand for legal education has abated, and there is no immediate pressure from society to train more lawyers. Small increases will be planned in professional school enrollment other than in engineering, and full development of the new Graduate School of International Relations and Pacific Studies at the San Diego campus.

A professional area of special need is the doctorate in education. In no other recent period has there been a more urgent call for improvement of American education nor any greater opportunity to make basic reforms in the structure of schooling. The State needs superintendents, principals, and community college administrators who have the background, the training the knowledge to initiate and implement these reforms. The University of California has a special mission to develop school and Community College leadership at the advanced level and an obligation to make a major contribution in meeting California's need.

## BALANCE

Balance is an art of institutional development. The number of graduate students in doctoral and doctoral-track master's programs must be large enough to form a critical mass for effectiveness and to attract and retain an excellent faculty. The mix of graduate and undergraduate students should be such that effective education is possible at both levels. Within graduate education, there should be an appropriate mix of academic core and professional programs. Finally, the University of California is currently responding to the concern that there are too few domestic students in graduate computer science and engineering programs, another balance issue. A subsequent section addresses the mix of domestic and foreign students in these areas.

Analysis of the undergraduate/graduate mix has required close coordination of undergraduate and graduate long-range planning, examination of shifts in that mix within the University of California during the last twenty years, and consideration of the mix at peer institutions. A key number in the analysis of proper balance on a campus is the fraction of its graduate students as a percentage of its total enrollments. As already noted, these percentages have declined dramatically because of growth of undergraduate enrollment on most campuses since 1969, and at a number of campuses the percentages have fallen to a point that poses a threat to the continued stature of the campus as an institution with a major mission to provide research and graduate education. The proposed plan will restore these percentages to a level that is consonant with the mission of the University of California, and in a manner that is consistent with perceived State and national needs for persons with advanced degrees.

The percentages of graduate students as a fraction of total enrollment varies from campus to campus at the present time. The percentages proposed in the plan for the year 2000 will also vary from campus to campus. The University will not strive for simple numerical equality; rather the mix of programs on each campus has been the focus of examination.

Programs in the academic core (disciplines in letters and science) have both undergraduate and graduate components. The best balance between these components may vary somewhat from discipline to discipline. However, professional programs are much more heavily weighted toward the graduate level, often to the near or complete exclusion of a corresponding undergraduate program. Law is an example of this. Education enrollments, are with few exceptions, are at the graduate or post-baccalaureate level. Engineering has substantial undergraduate enrollments, but is nevertheless more heavily weighted toward graduate enrollments than is true of programs in the letters and science fields. Further, the presence of the Agricultural Experiment Station on three campuses introduces a component of research and graduate training through the Organized Research Faculty FTE, which is much larger in proportion to the undergraduate component than for other programs.

It follows that campuses that have well-developed and extensive professional programs will justify a higher percentage of graduate students. Berkeley and Los Angeles exemplify this pattern, with 25% to 30% of their total enrollments at the graduate level. At the other extreme is Santa Cruz, which has only begun development of professional programs; at the present time, the

proportion of total enrollments at the graduate level is significantly below 10%.

Because the graduate level predominates in professional programs, campuses with larger numbers of professional schools have a higher percentage of graduate students. Therefore, the issue of balance between graduate and undergraduate enrollments on a campus is linked closely to how the total graduate enrollment is distributed between letters and science disciplines (the academic core) and the professional schools. Across the system on average, graduate enrollments are distributed in a 60:40 ratio between letters and science and the professional school component shared by most of the campuses (business, education, and engineering). This distribution will not be planned to change to any great extent through 2000. (As it happens, the 60:40 split represents approximately the distribution in the campus plans developed at Irvine, San Diego, and Santa Barbara.) Hence, for planning purpose, the 60:40 distribution is used as a typical mix of the academic core and professional school component.

After careful analysis, the Office of the President has concluded that for a campus with the 60:40 ratio described above, there should be in the total enrollment a minimum proportion of 15% graduate students. This corresponds to a minimum or base line option for UC enrollment levels. A compelling case based on an analysis, program by program, of the appropriate number of graduate students per faculty member can be made that arrives at the conclusion that the percentage of graduate students should be about 18% instead of 15%. As a planning guide, options for graduate enrollment growth should correspond to choices of a target figure within the range of 15% to 18%.

Once such a target number is fixed, it is used to analyze campus balance. It is not expected that every campus would have a percentage equal to the target percentage--far from it. There would be deviations from it, but they would be understood and explainable in terms of deviation from the typical 60:40 split brought about, for example, by the presence of the Agricultural Experiment Station or, in the case of Santa Cruz, by being at an early stage in development of professional school programs.

Undergraduate/graduate balance in letters and science--the academic core--can be calculated by combining two assumptions discussed above with a third based on the proportion of letters and science students among all undergraduates.

- 1) Assume the systemwide average ratio of letters and science to business/education/engineering students;
- 2) Select a target proportion that graduate students represent of total enrollment, between the minimum or baseline 15% and programmatically based 18%; and
- 3) Assume an 80% to 85% proportion of letters and science students among all undergraduates (the systemwide average is a little less than 85%).

The resulting proportion of graduate students in letters and science will be between 11% and 14%, depending on the target proportion chosen between 15% and 18% and the proportion between 80% and 85% of letters and science undergraduates chosen.

The value of deriving this proportion is that it can be used both as a planning guide in establishing precise figures for the graduate enrollment plan and as a benchmark by which to measure the University of California against comparison institutions. Therefore, in each option, a proportion between 11% and 14% will be used to examine the graduate/undergraduate balance in letters and science. This does not mean that all campuses would have letters and science graduate students fixed at that target number, but rather that this number would be used to evaluate the proposed allocations to the campuses for suitable balance and equity of distribution. Whichever target is chosen, Berkeley will be substantially above the number, Los Angeles somewhat above, and Santa Cruz probably a bit below, with the understanding that Santa Cruz will move up toward the target number, but probably will not reach that point until after the year 2000.

At all events, no matter whether the low figure of 11% corresponding to the base line or minimum option for enrollment growth is chosen or a higher figure in the range is chosen, the University of California figures would fall below percentages at comparable institutions, even those at comparable public institutions. Finally it is not assumed that the University of California would continue with the range of proportions of graduate students that will be embodied in the plan, in the long run, that is, in the decades past the year 2000.

#### FOREIGN STUDENTS

The University of California is strengthened and enriched immeasurably by the presence of foreign graduate students enrolled in its programs. These are some of their countries' most talented young men and women. Their desire to attend the University of California and our acceptance of them are reflections of the international role the University can and should play, especially in the Pacific Rim. Many of these students remain the United States after completion of their graduate work and are productive contributors to the economy of the State and nation. In fact, national studies indicate that upwards of 60% remain the United States, and there is some evidence that the percentage of foreign graduates of the University of California who stay is even higher. The staffing crisis that many engineering and business faculties across the country have faced would have been much worse, were it not for the willingness and availability of foreign resident doctorates to accept faculty openings here. Moreover, other foreign graduate students return to their native countries to become leaders; and in their leadership roles, they improve international relations and trade with this country.

There is, however, concern that in some disciplines, notably engineering, the proportion of foreign graduate students has risen to a higher level than is appropriate. For talented domestic engineering baccalaureate students, the option of pursuing graduate studies is distinctly less attractive than taking a job in industry immediately. Not only are the graduate stipends that can be offered to such students overwhelmed by starting salaries in industry; in many cases, the equipment and facilities available in industry are superior to those available in a university. On the other hand, the choices available to talented students from abroad make continued graduate study much more attractive by comparison; and, in a sense, they have taken the places that are not filled by the talented domestic students who chose instead to go into industry. This is a national problem of deep concern. The pattern has to be

reversed if the country in the future is to have an adequate pool of highly trained people in these disciplines and enough people to fill faculty positions.

The University is committed to developing a plan to reduce the proportion of foreign graduate students in engineering and to increase the proportion of domestic students. A task force has been appointed to develop this plan. One component of the plan will be a referral system to be implemented this year, through which domestic applicants to one campus can be referred to other campuses for consideration in order to increase UC's yield of entering students from the pool of domestic applicants. Ways to increase the competitiveness of stipends offered to talented domestic students are under study as are cooperative programs with industry that will attract domestic students who have taken industrial jobs.

Foreign applicants are consistently subjected to higher standards than domestic students are and a significantly smaller percentage of foreign applicants is accepted. In spite of this, the proportion of domestic students is too low. The University's plan will balance the benefit and enrichment that derive from the presence of foreign students against the need to develop an adequate pool of domestic students with advanced training to meet State and national needs. Ultimately, the plan will involve setting goals for the percentage of foreign students and developing the means to achieve them.

#### STUDENT QUALITY

There are two student quality factors to which the University will give priority for improvement.

##### Selectivity

Research universities must attract the best students in order to have the best faculty and produce high quality research and teaching. It is expected that many of the kinds of high quality students who decided against training for academic careers in the past decade will choose to enter such careers in the next. The University will take advantage of shifting career interests to increase its already highly selective graduate admissions. Establishment of selectivity as a planning principle signals the intention to place a higher priority on raising selectivity than on expanding enrollments at the current level of selectivity. If selectivity standards cannot be maintained and raised, University of California enrollment will not grow as planned. This principle insures that graduate enrollments will remain firmly linked to State and national needs for persons with advanced training.

##### Financial Support

Financial support of graduate students in the academic core differs from the support of undergraduate and graduate professional students in ways that are critical to graduate enrollment planning.

Students often begin graduate study having exhausted personal and family resources and with loans still unpaid from their undergraduate study. The principal support for graduate students in the academic core is

University employment for services in teaching or research. Such employment not only makes graduate study possible for most students, it is an important part of graduate study--preparing students to become teachers and researchers--and it benefits the University. Teaching Assistants are bright, eager teachers, and Research Assistants contribute substantially to the research of the University.

Graduate professional students, preparing for careers in business, law, or education, seldom are supported in their studies by University of California employment. University teaching or research is not an integral part of their graduate study. The course load required in their curricula usually precludes University employment even if it were available. The professional student relies upon personal or family resources or upon loans.

Engineering is intermediate between the graduate academic core and professional programs in the fraction of graduate students supported but is more like the academic core programs in the types of support available to students.

The planning principle of selectivity, requiring that current levels be maintained or increased during the 15 years of the plan, means that the University must compete for and attract the most intellectually capable students. To do this, the University of California must offer support packages that are competitive with those offered by other major institutions. If the University is not able to offer competitive support and does not attract the high quality students, then growth to the planned enrollment levels will not take place. The Office of President will be undertaking a study of financial support of undergraduate and graduate students.

#### AFFIRMATIVE ACTION

In 1980, the U.S. Census counted 23.7 million people in California and recorded that 67% of them came from white, non-Hispanic backgrounds; 8% from black, non-Hispanic backgrounds (mostly Afro-American); 19% from Hispanic backgrounds of different races; and 7% from various Asian origins. In the years since the Census, migration and a growing number of births have increased California's population and changed its ethnic distribution, and both population growth and the increase in the proportion of minorities are expected to continue. By 2000, the population is projected\* to be 32.7 million and the ethnic distribution is expected to have changed to 54% non-Hispanic white, 37% Hispanic, 9% black, and 11% Asian. A central affirmative action goal of the University is to bring the ethnic and gender make-up of the faculty closer to that of California's population. That goal coincides with the opportunity to hire a substantial number of new faculty in the next two decades. As discussed earlier, campuses are beginning to consider hiring new faculty now, in preparation for the wave of retirements expected in the 1990s and in the first decade of the twenty-first century. It

\* According to the Center for the Continuing Study of the California Economy.

is hoped that such anticipatory hiring will help the University maintain its standards, and even more, its attractiveness to the best scholars, during the hiring bulge predicted for the last decade of this century. The continuing affirmative action efforts should contribute to rectifying the current imbalance in the number of women in fields in which they are underrepresented and of underrepresented minorities.

Merely applying affirmative action guidelines for new hires will not suffice, however, if minorities and women continue to be grossly underrepresented in graduate student ranks. In a effort to expand the pool of women and minorities, the University has developed programs to encourage them to undertake graduate education and to aspire to faculty careers. Among these are the President's Fellowship Program, which provides postdoctoral fellowships to outstanding minority and women Ph.D. degree holders for the specific purpose of encouraging their entry into academic careers in areas in which they are currently underrepresented, such as engineering and physics; the Dissertation-Year Awards, which are designed to provide dissertation year support to promising minority and women Ph.D. degree candidates; the Research Assistantship/Mentorship Program, which gives academically talented minority and women graduate students half-time research assistantships under faculty guidance to enhance their research skills; and the entire complex of programs known as Graduate Student Outreach, which includes summer bridge programs, campus visits by students, and faculty involvement in recruitment. For the longer run, the University programs undertaken in cooperation with the public schools to improve the preparation for college of minority students are expected to increase the number of students in the pipeline that leads to doctoral studies and academic careers. All these programs are expected to contribute to a changing faculty profile that reflects more accurately the growing diversity of California's population.

A disproportionate share of those minorities who do enroll for graduate study enroll in certain professional programs, notably business administration, law, and the health sciences. For instance, of the 250 blacks who in Fall 1985 enrolled in first-year graduate or professional studies in the University of California, 155, or 62%, enrolled in these professional disciplines. By contrast, only 40% of all first-year enrollments were in these professional programs. It is one of the greatest challenges facing the University to increase these woefully small numbers of black, Hispanic, and native American minorities who enroll in graduate programs, as well as the number of women in mathematics-based disciplines. In addition, the University of California must strive to increase the numbers and proportion of those enrolling in core academic programs who have a career goal of joining a college or university faculty. The types of programs in place and under development represent the University of California's aggressive efforts to achieve these goals; moreover, undergraduates must be made aware of the expanding job market that is foreseen in the near future for college and university faculty positions.

## CONCLUSION

As is true of the undergraduate enrollment plan, the graduate plan must be recognized as a best estimate of the future. Like the undergraduate plan, it should be reviewed at frequent intervals and, as changing trends warrant, it should be revised and extended. On one hand, if the development and growth of California's economy do not match the expectations summarized at the beginning

of this report, or if externally imposed restraints, such as the Gann limitation on State spending, seriously constrain the University's potential for growth, the planned growth in graduate enrollments may be difficult to achieve. On the other hand, if such key market factors as the predicted faculty retirement bulge create even greater than expected needs for doctorally-trained individuals, the University may have an obligation to increase planned graduate enrollments. If all three eventualities outlined above come about, the resolution for graduate planning purposes will be difficult indeed; and if graduate student enrollment cannot be increased as planned, the University of California and other California institutions of higher education may not be able to recruit the necessary faculty to accommodate the substantial increase in undergraduate enrollment demand projected for the opening years of the twenty-first century. These eventualities are only a sample of the external and internal factors that will have a bearing on future graduate enrollment planning.

One of the biggest unknowns is how research-in-progress will change the existing disciplines and what new disciplines will emerge from new knowledge being created at the present time. If we projected ourselves fifteen years into the past, we would find computer science a very different field from what it is today, and instructional and research applications of computers confined to a far narrower band of the curriculum than is true today. In general, the expanding recognition that certain research and curricular issues would profit most from an interdisciplinary approach was in an early stage. Today, computer science has become an essential discipline, and virtually all fields of study have found computer applications in research or the classroom. The expansion of interdisciplinary study and research is reflected across the University in a range that stretches from the Institute for Global Conflict and Cooperation to the Plasma and Fusion Research Institute. In the research initiatives of today--consider some of those in the 1987-88 budget request: the Pacific Rim, robotics, aging, toxics--we may be seeing the essential disciplines of fifteen years hence.

This plan will be designed to assure the continued preeminence of the University of California as a leader in graduate education and research, serving California, the nation, and the world. As the complexity of society increases and the problems grow thornier, the University's role becomes more central in finding paths toward solutions. A strong base of graduate and professional training, which sustains the excellence of higher education in America and contributes the highly trained professionals and leaders that a technologically and culturally complex society requires, is the key to finding these paths.