UCSD

UCSD

Published at San Diego, California

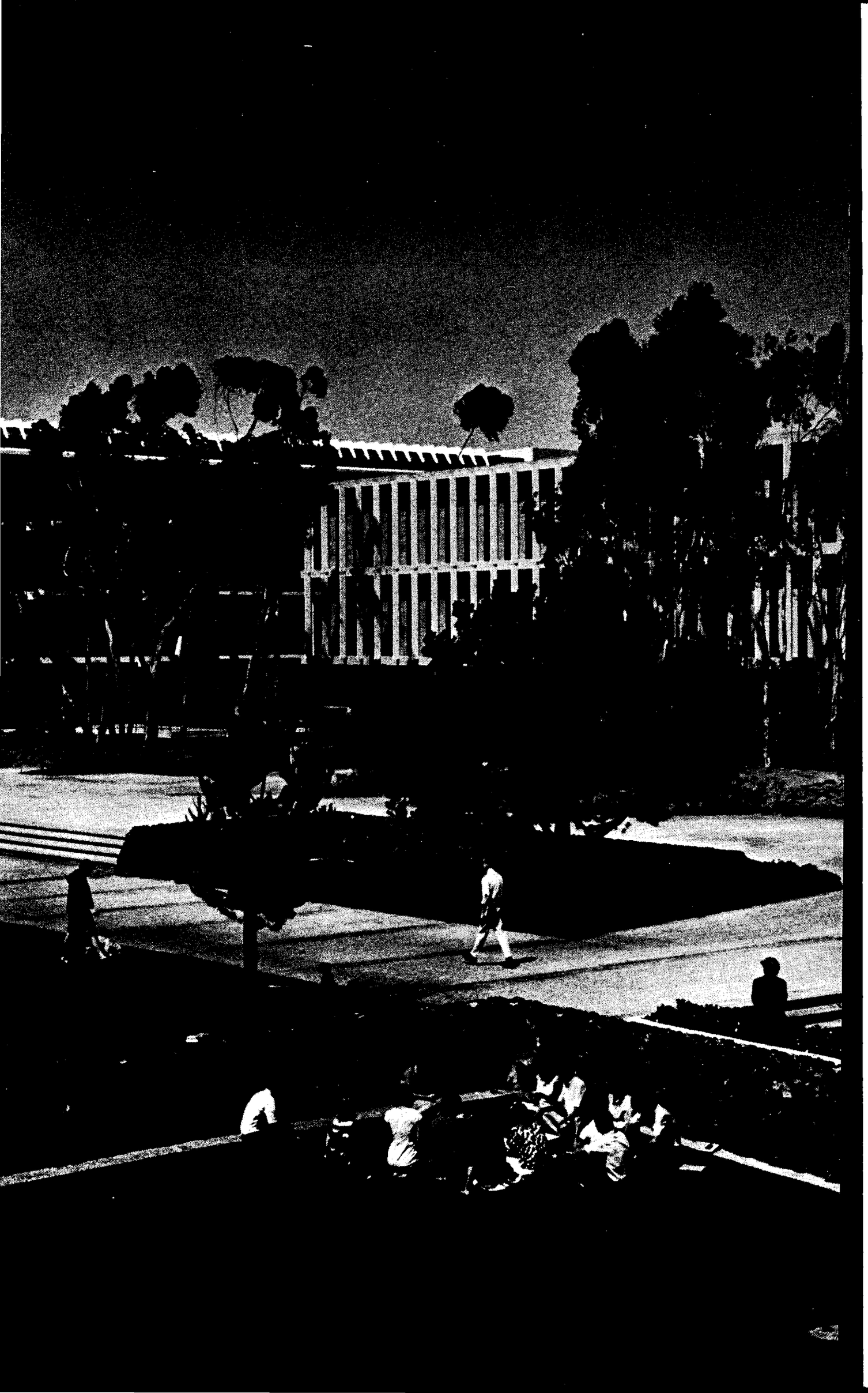
Volume 1, Number 1, August, 1968

A series of administrative publications of the
**University of California, San Diego, P.O. Box 109,
La Jolla, California 92037.**

Application to mail at second-class postage rates
is pending at La Jolla, California.

Four issues a year: June, August, September, and October

All announcements herein are subject to revision.
Changes in listings of faculty and administrative personnel
may occur subsequent to the date of publication.



UNIVERSITY OF CALIFORNIA, SAN DIEGO

"We are committed
to providing the most favorable environment
for the spirit of free inquiry."

Charles J. Hitch, *President*
UNIVERSITY OF CALIFORNIA

GENERAL CATALOG

Fall, Winter, and Spring Quarters, 1968–69

Price, $1

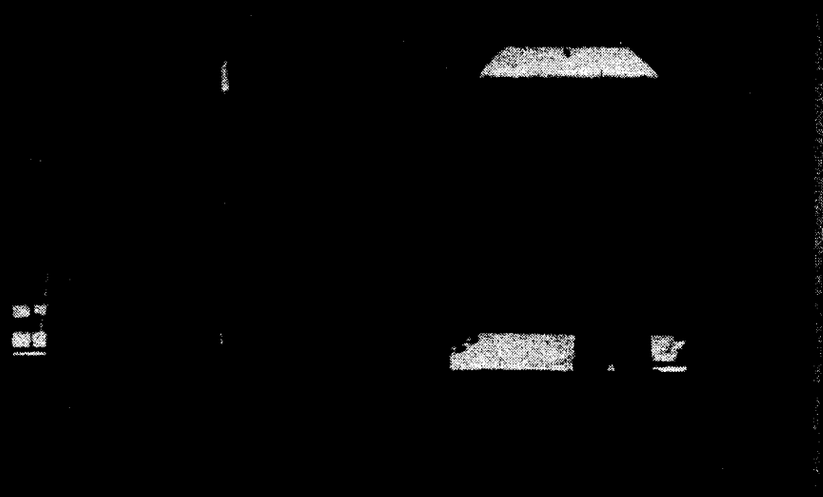
University of California, San Diego
P.O. Box 109 | La Jolla, California 92037

Academic Calendar 1968—1969

	Fall 1968	Winter 1969	Spring 1969
Final dates for filing applications for admission to undergraduate standing in regular, limited, or special status, including applications for a second bachelor's degree (file with Admissions Officer).	Mar. 1—Fri.	Nov. 1—Fri. (1968)	Feb. 1—Sat.
Final dates for filing applications for intercampus transfer (file with Registrar).	Mar. 1—Fri.	Nov. 1—Fri. (1968)	Feb. 1—Sat.
Final dates for filing applications for readmission to undergraduate standing (file with Registrar).	Aug. 26—Mon.	Dec. 5—Thu. (1968)	Feb. 26—Wed.
Administrative holiday.	——	Jan. 1—Wed.	——
Quarter begins.	**Sep. 23—Mon.**	**Jan. 2—Thu.**	**Mar. 31—Mon.**
Registration, counseling, testing, and orientation.	Sep. 23—27 Mon.—Fri.	Jan. 2—3 Thu.—Fri.	Mar. 31—Apr. 1 Mon.—Tue.
Final dates for paying fees without penalty. $10 late-registration fee will be assessed after this date.	Sep. 27—Fri.	Jan. 3—Fri.	Apr. 1—Tue.
Instruction begins.	**Sept. 30—Mon.**	**Jan. 6—Mon.**	**Apr. 2—Wed.**
Final dates for filing applications for advancement to candidacy for the master's degree (at least one quarter must intervene between advancement to candidacy and conferring of degree).	Oct. 1—Tue.	Jan. 7—Tue.	Apr. 2—Wed.
Final dates for filing applications for advancement to candidacy for the Ph.D. degree (at least three quarters must intervene between advancement to candidacy and conferring of degree).	Oct. 1—Tue.	Jan. 7—Tue.	Apr. 2—Wed.
Final dates for filing official study-list packets without $10 late fee.	Oct. 4—Fri.	Jan. 10—Fri.	Apr. 8—Tue.
Final dates for filing official study-list packets without lapse of status and $10 reinstatement fee.	Oct. 9—Wed.	Jan. 15—Wed.	Apr. 14—Mon.

Final dates for adding courses. Final dates for dropping courses without late fee.	Oct. 11—Fri.	Jan. 17—Fri.	Apr. 15—Tue.
Final dates for filing notice of candidacy for the bachelor's degree to be conferred at end of quarter (file in Provost's Office).	Nov. 1—Fri.	Feb. 7—Fri.	May 6—Tue.
Final dates for name cards to be filed by graduate and undergraduate students who expect to receive their diplomas in the quarter shown.	Nov. 1—Fri.	Feb. 7—Fri.	May 6—Tue.
Final dates for filing with the doctoral committee an appropriate draft of dissertation for a Ph.D. degree to be conferred at end of quarter.	Nov. 4—Mon.	Feb. 7—Fri.	May 1—Thu.
Academic and administrative holiday.	——	Feb. 12—Wed.	——
Final dates for undergraduates to drop courses without penalty of F grades or to file notice of withdrawal without penalty of F grades. $3 fee, each petition.	Nov. 8—Fri.	Feb. 14—Fri.	May 13—Tue.
Final date for filing applications for graduate fellowships (Office of Graduate Studies and Research).	——	Feb. 15—Sat.	——
Academic and administrative holidays.	Nov. 28—29 Thu.—Fri.	——	May 30—Fri.
Final dates for filing with Registrar's Office completed copies of thesis for master's degree or dissertation for Ph.D. degree to be conferred at end of quarter.	Dec. 6—Fri.	Mar. 14—Fri.	Jun. 6—Fri.
Instruction ends.	**Dec. 7—Sat.**	**Mar. 15—Sat.**	**Jun. 7—Sat.**
"Free" Day. No student- or faculty-sponsored events are to be scheduled for this day.	Dec. 9—Mon.	Mar. 17—Mon.	Jun. 9—Mon.
Final examinations.	Dec. 10—14 Tue.—Sat.	Mar. 18—22 Tue.—Sat.	Jun. 10—14 Tue.—Sat.
Quarter ends.	**Dec. 14—Sat.**	**Mar. 22—Sat.**	**Jun. 14—Sat.**
Administrative holidays.	Dec. 23—25 Mon.—Wed.	Mar. 28—Fri.	——

Contents



The University of California

THE STATEWIDE INSTITUTION

The University of California celebrated its one-hundredth birthday this year. Founded in 1868 by an act of the State Legislature, it is a unique institution made up of nine campuses strategically located throughout the state. The first of these campuses was established at Berkeley, and others followed at San Francisco, Los Angeles, Davis, Santa Barbara, and Riverside. The most recently established campuses are at San Diego, Irvine, and Santa Cruz.

Each of these campuses has its own distinct character and personality. At the same time, the spirit of cooperation prevails in the necessary sharing of certain educational and research facilities, and in the common participation in statewide scientific institutes. It is possible for graduate students registered at one campus to take courses or do research at another campus of the University. Undergraduates on any UC campus may take advantage of the University's Education Abroad Program to study at a foreign university.

Any qualified student may obtain an education at the University of California. Instruction in the arts and sciences, as well as fundamental training for many of the professions, is available. At present, there is a choice of some two hundred curricula and majors that lead to degrees, certificates, or credentials. Each year approximately eight thousand students earn degrees at the bachelor or first professional level and another three thousand earn advanced degrees.

The University operates several major research stations, including the Lawrence Radiation Laboratory, Lick Observatory, and the Los Alamos Scientific Laboratory, and numerous agricultural experiment stations and extension offices. In addition to its regular program of instruction, the University provides educational services throughout the state in the form of continuing adult education programs, informational services for agriculture, and business and professional conferences and institutes.

THE ADMINISTRATION

The organization and government of the University is entrusted, under the State Constitution, to the Regents of the University of California.

The Board of Regents is composed of twenty-four members, sixteen of whom are appointed by the Governor and eight of whom are ex officio members, by reason of the public offices they hold. The executive head of the University, in all its departments and on all its campuses, is the President. He and his staff direct the development of major policy for the entire institution. The Board of Regents appoints the President, and he is directly responsible to them. On each campus the chief administrative officer is the Chancellor, also appointed by the Regents. He and his staff are in charge of all activities on their particular campus.

Subject to the approval of the Board of Regents, the conditions for the admission of students and the granting of degrees and certificates are determined by the Academic Senate. The Senate, which is composed of the faculty and certain administrative officers, also authorizes and supervises all courses of instruction in the academic and professional schools and colleges of the University.

THE SAN DIEGO CAMPUS

The Setting

The University of California, San Diego, is situated near the northern limits of the city of San Diego. Occupying nearly a thousand acres, the campus site spreads from the seashore at the north side of La Jolla Cove, where the Scripps Institution of Oceanography is located, across a large portion of the adjacent Torrey Pines Mesa, high above the Pacific Ocean. Much of the land is wooded; to the east and north lie mountains, to the west the sea.

San Diego is California's oldest and third-largest city, with a metropolitan-area population of just over a million. It has much to offer UCSD students and faculty in the way of cultural and recreational activities.

Within the city, and accessible to the campus, are scores of public beaches, including those of Mission Bay, an area that is being developed into one of the finest aquatic centers in the world. The nearby mountains offer skiing in the winter, hiking and camping the year around. Just beyond the mountains the vast and beautiful Anza-Borrego desert stretches to the Colorado River.

In downtown San Diego is Balboa Park, one of the largest city parks in the country and home of the world-famous San Diego Zoo. The Fine Arts Gallery of San Diego, the Timken Gallery, the Museum of Natural History, and other museums are located in the park. Here also stands the Old Globe Theatre, a replica of an Elizabethan playhouse, where community theater is offered throughout the year and the renowned National Shakespeare Festival is held each summer.

The recently completed Community Concourse, featuring a 3,000-seat civic theater and extensive convention and exhibition facilities, is located in the heart of the city, offering residents and visitors major musical and dramatic productions and providing a beautiful new home for the San Diego Symphony, ballet, and opera.

A major sports stadium in nearby Mission Valley provides playing fields for San Diego's major league football and baseball teams. An indoor sports arena near Mission Bay is the home of San Diego's professional basketball and ice hockey teams.

The city's attractions are many and varied. Theater, museums, music, art, sports—all are available in San Diego.

The History

The San Diego campus of the University of California had its origins in the closing years of the nineteenth century when Berkeley zoologists selected La Jolla as the site for a marine station on the Pacific. This project, which eventually became the Scripps Institution of Oceanography, was made a part of the University of California in 1912. When, in the late 1950's, it was decided to establish a general campus of the University at San Diego, the Scripps Institution—with its distinguished though small staff of scientists—formed the nucleus of the new enterprise.

At first, only graduate studies and degrees in the physical and natural sciences were offered. In the fall of 1964 the campus accepted its first undergraduates, offering a basic lower-division curriculum to prepare students for majors in the humanities, the social sciences, the biological sciences, the physical sciences and mathematics.

The Future

The San Diego campus is expected to reach maximum growth by 1995, with a student enrolment of 27,500. By that time twelve interrelated colleges in clusters of three or four will have been established, each of which will accommodate approximately 2,300 students and provide a wide variety of both undergraduate and graduate programs. The objective is to give students and faculty the opportunity of working together in small academic units while at the same time enjoying the advantages of a major university. Two colleges, Revelle and Muir, are now in operation. Others will be opened at three-year intervals.

Scholars and researchers of international reputation in the humanities, the social sciences, and the natural sciences have been attracted to the UCSD faculty. The University's graduate students are drawn from the upper ranks of the nation's finest colleges and universities and from institutions of comparable standing throughout the world. The San Diego campus offers its students an opportunity for intimate association with some of the greatest names in American education today.

THE COLLEGES

Revelle College

Revelle College was named in honor of Dr. Roger Revelle, former University-wide Dean of Research, and for many years Director of UCSD's Scripps Institution of Oceanography. The College will be in its fifth year

of undergraduate instruction in 1968, with about eleven hundred lower-division students and eight hundred upper-division students.

Formerly called the School of Science and Engineering and later First College, Revelle College was established in 1958. After being temporarily housed on the Scripps campus, Revelle College moved into its first completed buildings during the 1963–64 academic year.

In 1960 Revelle College began a graduate program in the physical sciences. From that beginning, it has been rapidly developing its humanities and social science programs, and today the teaching program reflects a broad spectrum of learning. The undergraduate program is based on the axiom that the candidate for the Bachelor of Arts degree must attain an acceptable level of general education in mathematics, foreign language, the physical, biological, and social sciences, the fine arts and the humanities. He must attain a high quality of competence in one academic discipline, and an understanding of an academic area outside his major field. Students take a common lower-division curriculum, which is based on the principle that an undergraduate should not specialize in his major field until he has had a chance to learn something about the many fields that are open to him. It is anticipated that most graduates of Revelle College will undertake work in graduate schools. Therefore, the main effort in the upper-division years is devoted to intensive work in the major field, although the student will take approximately one-fourth of his upper-division courses in a noncontiguous minor.

The Departments of Aerospace and Mechanical Engineering Sciences, Biology, Chemistry, Earth Sciences, Economics, Literature, Philosophy, and Physics have their headquarters in Revelle College, and all undergraduate majors offered at UCSD are available to Revelle College students. (See *Contents* for *Revelle College.*)

Muir College

In the fall of 1967, John Muir College, second of the twelve colleges planned for UCSD, admitted its first students. During its first two years the college will occupy buildings on the Matthews Campus. In 1969 it will move to its permanent buildings on a site directly north of Revelle College.

The college was named for John Muir, the California naturalist, geologist, and writer. Born in Dunbar, Scotland, in 1838, Muir was educated in Scotland and at the University of Wisconsin. He explored the Sierra Nevada Mountains, Alaska, and the Arctic regions and worked for many years in the cause of forest preservation and the establishment of national parks and forests. His books are still widely read for their vivid and engaging descriptions of the land and the people of early California. Muir made his home in Martinez, California. He was awarded an honorary degree by the University of California in 1913. He died in 1914.

John Muir College offers a balanced program of instruction in all of the principal areas of learning. Students may choose among several ways of fulfilling the general education requirements and are expected to assume some responsibility for developing patterns of study that accord with

their interests and aspirations. There are many opportunities for independent study and for direct participation by undergraduates in research and creative work. (See *Contents* for *Muir College.*)

Third College

On January 30, 1967, the University Regents approved the appointment of Dr. Armin Rappaport as Provost of The Third College on the San Diego Campus. Dr. Rappaport, who was Professor of History on the Berkeley Campus, began his duties as Provost on July 1, 1967.

Third College is scheduled to begin instruction in the fall of 1970 in the Matthews Campus area now occupied by John Muir College. As is the case with UCSD's ultimate plan for each of the twelve semi-autonomous colleges, The Third College will accommodate approximately 2,300 to 2,500 graduate and undergraduate students.

The School of Medicine

The University of California, San Diego, is developing a new school of medicine which began its teaching activities in July, 1966, by offering internship and residency programs. The first undergraduate medical class will enrol in September, 1968, and the new Basic Science Building will be completed in early 1969. Plans call for a later increase to an entering class size of ninety-six students.

The UCSD School of Medicine will offer a curriculum that will emphasize maximum flexibility and close affiliation with the general campus. The first year will be taught by faculty members from the campus departments, together with faculty members from clinical departments of the School of Medicine. Emphasis will be on cell biology, biochemistry, organ physiology and pharmacology. Attention also will be given to behavioral and social sciences, and the students will be introduced to clinical medicine. Opportunities for contact with research and investigation will be enhanced by the uniquely integrated relationship with the faculty in the campus Departments of Biology, Chemistry, Physics, Mathematics, and comparable departments in the behavioral and social sciences.

The second-year curriculum will introduce the student to anatomy and organ structure and function in disease. It will also include an integrated course in the neurosciences. During both first and second years, students will be assigned to multidiscipline laboratories where they will be supervised by instructors from various departments. During the second year, courses in introduction to clinical medicine and in behavioral and social sciences will continue.

During the third year, students will be introduced to the tools of clinical medicine and will pursue a core clinical curriculum at the three hospital facilities which will be operated by, or affiliated with, the School of Medicine. The 600-bed University Hospital of San Diego County is currently operated by the School of Medicine and will be supplemented by a

350-bed University Hospital and an 800-bed Veterans Administration Hospital on the La Jolla campus.

The fourth-year curriculum will be largely elective, allowing a student to pursue his individual interests by taking medical or surgical clerkships, clinical or basic science electives, or continued research. Individual study will be organized as a concentration area supervised by special faculty groups, and will lead to the presentation of a thesis.

Selection Factors

Selection will be based on the applicant's scholastic record, letters of recommendation, performance on the Medical College Admission Test, and a personal interview.

A catalog containing more complete information on the School of Medicine is available in the Office of Student Affairs, UCSD School of Medicine, University of California, San Diego.

Programs for Prospective Medical Students

UCSD offers no special premedical program. An undergraduate student considering medicine as a career may choose any program leading to the bachelor's degree, provided that he elects those additional courses which the medical schools of his choice require for admission. This is complicated by the fact that different medical schools have somewhat different admission requirements. All medical schools, however, require courses in general physics, inorganic chemistry, mathematics, the humanities, and the social and behavioral sciences, with most schools requiring additional work in chemistry and biology. The program of a major in biology at UCSD should satisfy the admission requirements of almost all medical schools.

The Faculty of the School of Medicine

Name	Title	Department
Bearden, Alan J., Ph.D.	Assistant Professor	Chemistry
Bloor, Colin M., M.D.	Assistant Professor	Pathology
Braunwald, Eugene, M.D.	Professor	Medicine
Braunwald, Nina, M.D.	Associate Professor	Surgery
Bridgman, Charles F., Ph.D.	Assistant Professor	Neurosciences
Bullock, Theodore H., Ph.D.	Professor	Neurosciences
Carrington, Charles R. B., M.D.	Assistant Professor	Pathology
Covell, James W., M.D.	Assistant Professor	Medicine
Deutsch, J. Anthony, Ph.D.	Professor	Psychology
Doolittle, Russell F., Ph.D.	Associate Professor	Chemistry
Dutton, Richard W., Ph.D.	Associate Professor	Biology
Evans, John W., M.D., Ph.D.	Assistant Professor	Mathematics
Fantino, Edmund J., Ph.D.	Assistant Professor	Psychology
Friedman, William F., M.D.	Assistant Professor	Medicine

Fronek, Arnost, M.D., C.Sc.	Associate Professor	Aerosp. & Mech. Eng. Scs.
Fung, Yuan-cheng, Ph.D.	Professor	Aerosp. & Mech. Eng. Scs.
Galambos, Robert, M.D., Ph.D.	Professor	Neurosciences
Garren, Leonard D., M.D., D.M.D.	Professor	Medicine
Garsia, Adriano M., Ph.D.	Professor	Mathematics
Gault, James H., M.D.	Assistant Professor	Medicine
Getoor, Ronald K., Ph.D.	Professor	Mathematics
Grobstein, Clifford, Ph.D.	Professor, Dean of the School	Biology
Hagiwara, Susumu, M.D., Ph.D.	Professor	Scripps Institution of Oceanography
Halasz, Nicholas A., M.D.	Associate Professor	Surgery
Hamburger, Robert N., M.D.	Professor	Pediatrics
Hammel, Harold T., Ph.D.	Professor	Scripps Institution of Oceanography
Harris, Seymour E., Ph.D.	Professor	Economics
Intaglietta, Marcos, Ph.D.	Assistant Professor	Aerosp. & Mech. Eng. Scs.
Jones, Oliver W., M.D.	Associate Professor	Medicine
Kaplan, Nathan O., Ph.D.	Professor	Chemistry
Lasser, Elliott C., M.D.	Professor	Radiology
Liebow, Averill A., M.D.	Professor	Pathology
Lindsley, Dan L., Ph.D.	Professor	Biology
Livingston, Robert B., M.D.	Professor	Neurosciences
McGuire, William J., Ph.D.	Professor	Psychology
Nguyen-Huu, Xuong, Ph.D.	Assistant Professor	Physics
O'Neil, Thomas M., Ph.D.	Assistant Professor	Physics
Orloff, Marshall J., M.D., Ph.D.	Professor	Surgery
Pool, Peter E., M.D.	Assistant Professor	Medicine
Price, Paul A., Ph.D.	Assistant Professor	Biology
Ross, John Jr., M.D.	Professor	Medicine
Roth, Thomas F., Ph.D.	Assistant Professor	Biology
Simon, Harold J., M.D., Ph.D.	Assistant Professor	Community Medicine
Sobel, Burton E., M.D.	Assistant Professor	Medicine
Steinberg, Daniel, M.D., Ph.D.	Professor	Medicine
Stokes, Joseph, III, M.D.	Professor	Community Medicine
Thorson, John W., Ph.D.	Assistant Professor	Neurosciences
Tschirgi, Robert D., M.D., Ph.D.	Professor	Neurosciences
Varon, Silvio S., M.D., Eng.D.	Associate Professor	Biology

Wheeler, Henry O., M.D.	Professor	Medicine
Yoder, Richard D., M.D.	Assistant Professor	Community Medicine
York, Charles J., D.V.M., Ph.D.	Associate Professor	Pathology
Zweifach, Benjamin W., Ph.D.	Professor	Aerosp. & Mech. Eng. Scs.

The Scripps Institution of Oceanography

The Scripps Institution was originally an independent biological research laboratory. It became an integral part of the University of California in 1912 and at that time was given the Scripps name in recognition of the interest and financial support of Miss Ellen Browning Scripps and Mr. E. W. Scripps. The scientific scope of its research has grown to embrace physical, chemical, geological and geophysical studies of the oceans as well as biological studies. Continuing investigations are conducted of the topography and composition of the ocean bottom, of waves and currents, and of the flow and interchange of matter between seawater and the ocean bottom or the atmosphere. Its own research ships have extended the geographic scope from the Institution's beach and the adjacent coastal waters to all of the world's oceans.

The education program has grown hand in hand with the research program. Instruction is on the graduate level only and students are not usually admitted except as candidates for the Ph.D. Although there is a rapid rate of increase, there are less than a thousand persons currently active as marine scientists, of whom a significant portion are Scripps graduates. Their studies are marked by a high degree of interdisciplinary and international collaboration. Many nationalities are represented among the staff and student body.

The Institution has eight oceanographic research vessels. Their cruises vary from local, limited-objective trips to round-the-world expeditions. Major cruises planned for 1969 include a cruise to New Guinea and nearby islands by the "Alpha Helix," completion of a twelve-month, round-the-world cruise by the "Argo," and the maiden voyage of the newest vessel, the "Melville," up the St. Lawrence Seaway and down the Atlantic coast into the Caribbean and home. The "Thomas Washington" will cruise down the west coast of South America.

Academic work is conducted through the SIO Department and its six curricular groups—biological oceanography, physical oceanography, marine biology, marine geology, marine chemistry, and geophysics. The sixty professors are complemented by an academic staff of more than a hundred research scientists, many of whom have a regularly scheduled part in the instructional program.

Investigations supported by contracts and grants funded from extra-University sources, primarily Federal, cover a wide latitude of marine research. The general research effort is conducted by four divisions, designated Marine Biology Research Division, Ocean Research Division,

Geological Research Division, and Scientific Support Division. The diversity of their work is extended by three Federally-sponsored laboratories: the Marine Physical Laboratory, the Physiological Research Laboratory, and the Visibility Laboratory, and by other specialized groups such as Scripps Tuna Oceanography Research and Applied Oceanography Group —and by the Marine Life Research Group, sponsored by the State of California.

Organizationally separate, but sharing close affiliation and proximity with Scripps, are the University of California's Institute of Geophysics and Planetary Physics and Institute of Marine Resources. The Fishery-Oceanography Center, recently built on the San Diego campus by the U. S. Bureau of Commercial Fisheries, is occupied by a laboratory of the Bureau and by the Inter-American Tropical Tuna Commission.

The combination of a large scientific staff and extensive facilities provides an extraordinary opportunity for the small student body (approximately 160) to enjoy close contact with existing oceanographic concepts and active participation in research.

The Faculty of Scripps Institution of Oceanography

Name	Title	Department
Arrhenius, Gustaf O., Ph.D., D.Sc.	Professor	Scripps Institution of Oceanography
Arthur, Robert S., Ph.D.	Professor	"
Backus, George E., Ph.D.	Professor	"
Benson, Andrew A., Ph.D.	Professor	"
Bramlette, Milton N., Ph.D.	Professor Emeritus	"
Bullard, Edward C., Ph.D.	Professor	"
Bullock, Theodore H., Ph.D.	Professor	Neurosciences
Cox, Charles S., Ph.D.	Professor	Scripps Institution of Oceanography
Craig, Harmon, Ph.D.	Professor	"
Curray, Joseph R., Ph.D.	Associate Professor	"
Davis, Russ E., Ph.D.	Assistant Professor	"
Duntley, Seibert Q., Sc.D.	Professor	"
Eckart, Carl, Ph.D.	Professor	"
Engel, A. E. J., Ph.D.	Professor	"
Enright, James T., Ph.D.	Associate Professor	"
Fager, E. W., Ph.D., D.Phil.	Professor	"
Fox, Denis L., Ph.D.	Professor	"
Gibson, Carl H., Ph.D.	Assistant Professor	Aerosp. & Mech. Eng. Scs.
Gieskes, Joris M. T. M., Ph.D.	Assistant Professor	Scripps Institution of Oceanography
Gilbert, J. Freeman, Ph.D.	Professor	"
Goldberg, Edward D., Ph.D.	Professor	"
Hagiwara, Susumu, M.D., Ph.D.	Professor	"

Hammel, Harold T., Ph.D.	Professor	"
Haubrich, Richard A., Ph.D.	Associate Professor	"
Haxo, F. T., Ph.D.	Professor	"
Hendershott, Myrl C., Ph.D.	Assistant Professor	"
Holland, Nicholas D., Ph.D.	Assistant Professor	"
Hubbs, Carl L., Ph.D.	Professor Emeritus	"
Inman, Douglas L., Ph.D.	Professor	"
Isaacs, John D., B.S.	Professor	"
Johnson, Martin W., Ph.D.	Professor Emeritus	"
Keeling, Charles D., Ph.D.	Professor	"
Lal, Devendra, Ph.D.	Professor	"
Lewin, Ralph A., Ph.D.	Professor	"
MacIntyre, Ferren, Ph.D.	Assistant Professor	"
McEwen, George F., Ph.D.	Professor Emeritus	"
McGowan, John A., Ph.D.	Associate Professor	"
Menard, Henry W., Jr., Ph.D.	Professor	"
Mullin, Michael M., Ph.D.	Assistant Professor	"
Munk, Walter H., Ph.D.	Professor	"
Newman, William A., Ph.D.	Assistant Professor	Scripps Institution of Oceanography
Nierenberg, William A., Ph.D.	Professor, Dean of the Institution	Physics
Parker, Robert L., Ph.D.	Assistant Professor	Scripps Institution of Oceanography
Peterson, Melvin N., Ph.D.	Associate Professor	"
Phleger, Fred B, Ph.D.	Professor	"
Raitt, Russell W., Ph.D.	Professor	"
Rakestraw, Norris W., Ph.D.	Professor Emeritus	"
Revelle, Roger R., Ph.D.	Professor Emeritus, Director Emeritus	"
Rosenblatt, Richard H., Ph.D.	Associate Professor	"
Schaefer, Milner B., Ph.D.	Professor	"
Scholander, Per F., M.D., Ph.D.	Professor	"
Shepard, Francis P., Ph.D.	Professor Emeritus	"
Spiess, Fred N., Ph.D.	Professor	"
Vacquier, Victor, M.A.	Professor	"
Van Atta, Charles W., Ph.D.	Assistant Professor	Aerosp. & Mech. Eng. Scs.
Volcani, Benjamin E., Ph.D.	Professor	Scripps Institution of Oceanography
Wheelock, Charles D., M.S.	Professor Emeritus	"
Winterer, Edward L., Ph.D.	Professor	"
Wooster, Warren S., Ph.D.	Professor	"
ZoBell, Claude E., Ph.D.	Professor	"

The University Library

The University Library of the University of California, San Diego, consists of the Central Library, the Science and Engineering Library, the Biomedical Library, the Scripps Institution of Oceanography Library, the Cluster I Library, and the Lower Division Reading Room. The Library contains more than 500,000 volumes and receives 13,000 periodical and other serial publications.

The Central Library, in the Humanities-Library Building, consists of a basic collection and specialized graduate collections in the humanities and social sciences. The Library's Special Collections of rare and valuable books include important collections of the Renaissance, D. H. Lawrence, Ernest Hemingway, Baja California, and the Spanish Civil War.

The Science and Engineering Library, in Urey Hall, contains strong collections in aeronautics, astrophysics, atomic energy, chemistry, electronics, engineering, instrumentation, mathematics, missiles research, physics and space sciences.

The Biomedical Library, on the Court Level of the Humanities-Library Building, has been established to serve the School of Medicine and the health-related sciences. The Biomedical Library will move to permanent quarters in the Basic Sciences Building of the Medical School in December, 1968. A branch of the Biomedical Library is maintained at the University Hospital.

The Scripps Institution of Oceanography Library has outstanding collections in oceanography, marine biology and underseas technology, and also specializes in geology, geophysics and zoology publications.

The Cluster I Library, at Matthews Campus, serves the basic needs of undergraduate students in Muir College and temporarily contains the Central Library's collections in music and art.

The Lower Division Reading Room, in the basement of the Humanities-Library Building, provides reserved books for lower-division courses in Revelle College.

The Computer Center

The UCSD Computer Center operates a large Control Data Corporation 3600 computer, together with several smaller computers. Most students and staff do their own programming. The actual operation of the computer system is performed by professional computer operators. Non-credit programming courses are conducted by the Computer Center. Programming consultants are available to answer questions on programming. The Computer Center staff develops new operating systems and other programs to improve the efficiency and usefulness of the computers.

THE INSTITUTES AND CENTERS

At UCSD there are several institutes and centers established to promote advanced research programs and to provide opportunities for graduate

student support in several broad disciplines, sometimes spanning the areas of knowledge encompassed by several academic departments. The senior staff of these units consists of faculty members in related academic departments. The study programs of graduate students supported by institutes and centers are administered by the academic departments in which they are enrolled. The institutes and centers which are operative at present at UCSD are described below; new units will be created as the campus grows.

Institute of Geophysics and Planetary Physics

The San Diego branch of the University-wide Institute of Geophysics was established in 1960. Present research activities emphasize the study of the earth's strain field by measurements of gravity, tilt, displacement, and longitudinal strain; of normal modes of the earth; of tides, waves, turbulence, and the circulation in the atmosphere and oceans.

The Institute does not grant degrees, but makes its facilities available to graduate students from various departments who have chosen to write their dissertations on problems of the earth. Members of the Institute staff now hold joint appointments with the Departments of the Scripps Institution of Oceanography, Aerospace and Mechanical Engineering Sciences, Physics, Applied Electrophysics, and Mathematics.

Institute for Information Systems

The Institute for Information Systems (IIS) is a center for collaborative research for departments concerned with all aspects of information theory, communications research, systems analysis, and related topics. The cooperating units are the Departments of Aerospace and Mechanical Engineering Sciences, Applied Electrophysics, Linguistics, Mathematics, Psychology, and the Computer Center. The work of IIS will be concerned with such topics as information theory, detection theory, information storage and retrieval, general linguistics, human information processing, probability theory, coding in the nervous system, and brain models. Apart from individual and cooperative research projects, the activities of the Institute include interdisciplinary seminars, postdoctoral research and instruction, conferences, and research workshops.

Center for Human Information Processing

The Center is an autonomous unit of the Institute for Information Systems. It is intended to provide facilities for research for members of the Department of Psychology in the areas of perception, psychophysics, attention, memory, detection theory, psychoacoustics, information integration, social psychology, and cognitive functions. The Center participates in interdisciplinary work with the departments in the Institute for Information Systems. The work of the Center concentrates on research projects, postdoctoral studies, workshops, conferences, and discussions.

Institute of Marine Resources

The Institute of Marine Resources was established in 1954 to provide a center for the interest of all members of the University of California concerned with marine resources. Its programs involve research as well as education and public service. Marine resources are considered to include not only the materials which come from the sea, such as the minerals, fish, and seawater itself, but also the capacities of the sea for transportation, recreation, waste disposal, and production of energy. The broad objective of the Institute is to accumulate and disseminate knowledge of the sea's resources. This requires study not only of the contents and nature of the ocean and its boundaries, but also the social, legal, economic, and political aspects of its uses. There are a great many opportunities for graduate students, as the diversity of these subjects indicates.

Institute for Pure and Applied Physical Sciences

This Institute is an interdisciplinary research unit which brings together members of the Departments of Applied Electrophysics, Aerospace and Mechanical Engineering Sciences, Chemistry, Physics, and Scripps Institution of Oceanography. The Institute is concerned with aerospace sciences, nuclear physics, hydrodynamics, molecular and solid-state physics, theory of liquids, spectroscopy, radiation transport, and numerical methods. Specific subjects of research include superconductivity, ferromagnetism, phase stability and melting points, plasma physics, hydromagnetics, high temperature gas dynamics, fluid mechanics, nuclear structure and reactions, ionospheric and atmospheric physics, laser physics, atomic and molecular structure and reactions, and numerical analysis.

Institute for Studies in Developmental Biology

The object of this Institute is to promote teaching and research in the field of developmental biology. Various disciplinary groups within the biomedical sciences are, or soon will become, associated with the Institute. The common aim of these groups is to study developmental problems in different types of organisms, with approaches ranging from the molecular to the behavioral. Current research and instructional programs are in the field of developmental genetics, photobiology, reproductive biology, cytodifferentiation, biochemical embryology, tissue-tissue interactions, and morphogenesis of subcellular components.

University Extension

University Extension makes available the resources of the University on a statewide basis to individuals and organizations. Extension programs are organized toward the following educational aims: (1) the intellectual and cultural development of adults; (2) the dissemination of new knowledge resulting from teaching and research activities within the University; (3) the continuing education of scientific, technical, and professional

personnel; (4) the development of special educational programs for public and private organizations and agencies; and (5) public affairs education through programs designed to aid adults in meeting their responsibilities as citizens.

The Extension program takes a variety of forms: classes, discussion groups, correspondence courses, conferences, institutes, short courses, lectures, motion picture production, radio broadcasts, educational television, and vocational counseling and testing (Santa Barbara and Los Angeles only).

Through its Urban Affairs Department, University Extension works to better the San Diego community—in human relations, planning, education, housing, and other problems that plague urban areas. Often, work is done in cooperation with such groups as the Economic Opportunity Commission, the Citizens' Interracial Committee, Head Start, and the Community Action Programs.

Veterans may use the educational benefits available to them under Federal and State laws to enrol in the University of California Extension classes, provided the classes are part of their prescribed and recognized objectives approved by the Veterans Administration.

For detailed information on University Extension, local or statewide, write or telephone University Extension, University of California, San Diego, P.O. Box 109, La Jolla, California 92037. Telephone 453-2000, extension 2061.

Education Abroad Program

The Education Abroad program offers opportunities to undergraduate students of the University of California to study in universities overseas. It is administered for the entire University by the Santa Barbara campus and serves also as a source of information on all types of educational exchange experiences.

In 1968-69 the University will continue the operation of its study centers in France, Germany, Hong Kong, Italy, Japan, Spain, Sweden, and the United Kingdom, and open new centers in Ireland, Israel, Lebanon, and Mexico. The Study Centers' primary purpose is to provide a sound academic experience in a different educational system. They also enable the University of California students to become deeply involved in the language and culture of the host country.

Eligibility requirements are: upper-division standing in the University at the time of participation, two years of university-level work in the language of the country with a B average or equivalent, an overall B average, seriousness of purpose, and an indication of ability to adapt to a new environment. Transfer students are eligible if they meet the language requirement and have completed at least one language course in the University of California. (The language requirement is not applicable to the centers in Hong Kong, Japan, Israel, and Lebanon, but study of the languages of those countries will be required as part of the pro-

gram.) Special arrangements can be made for the participation of graduate students.

The participants will spend from nine to eleven months abroad, including a special orientation program, six or seven weeks of intensive language preparation where applicable, a full academic year in the university of their choice, and some vacation travel. The program in Mexico City is for the summer and fall quarters or the winter and spring quarters only.

Each student will be concurrently enrolled on his home campus and in the host university and will receive full academic credit for courses satisfactorily completed.

The Regents endeavor to bring this year abroad within the reach of all students, regardless of their financial resources.

Applications for 1969-70 will be accepted from September 30, 1968, through January 10, 1969. (Applications for the United Kingdom must be filed no later than November 15, 1968.)

Further information is available from the Director, Education Abroad Program, 1205 South Hall, University of California, Santa Barbara, or the Dean of International Education, Building 250, Matthews Campus, University of California, San Diego.

Admission to the University

UNDERGRADUATE STANDARDS OF ADMISSION

The admission requirements of the University of California are based on two principles:

1. That the best assurance of success in the University is shown by high quality of scholarship in previous work.
2. That the study of certain specified subjects will give the student both good preparation for study in the University and reasonable freedom in choosing his field of specialization.

All communications concerning undergraduate admission should be addressed to the Office of Admissions, 102 Matthews Campus, University of California, San Diego, La Jolla, California 92037.

Application for Admission

An application for admission should be filed with: Office of Admissions, 102 Matthews Campus, University of California, San Diego, La Jolla, California 92037.

Application forms may be obtained from the Office of Admissions during the periods listed below. The applicant is urged to apply early in the filing period to avoid unnecessary delays in the processing of his application.

Undergraduate applications, including intercampus transfers, must be filed for the fall quarter between October 1 and March 1, for the winter quarter between May 1 and November 1, and for the spring quarter between August 1 and February 1. A summer quarter is not offered at the present time at San Diego.

Admission requirements are uniform on all campuses of the University. Admission entitles the student to attend the campus of his choice if the required facilities are available. Since applications will be processed and acted upon in only one Office of Admissions, applications should not be directed to more than one campus.

If after an applicant has filed for admission his plans change, and he prefers to register on a different campus, he must write to the Director of Admissions, 570 University Hall, University of California, Berkeley,

California 94720, indicating the campus at which he now wishes to register and the reason for his change. His records will be transferred to the campus he indicates, provided facilities are available there. Such requests must be received within the filing periods shown above. These filing periods apply to *all* undergraduate applicants (regular, special, limited, second degree, and intercampus transfer).

Application Fee

A nonrefundable fee of $10 is charged for each application for admission filed. Remittance by bank draft or money order, payable to *The Regents of the University of California,* must be attached to the application.

Transcripts of Record

Each applicant is responsible for requesting the high school from which he graduated and each college he has attended to send official transcripts of record directly to the Office of Admissions where his application is on file.

Those applying as entering freshmen should ask the high school to submit, as soon as possible, preliminary transcripts showing the complete record through the sixth semester and listing courses in progress or planned. In every case, a final transcript, which includes a statement of graduation and a list of courses and grades for the seventh and eighth semesters, will be necessary.

Those applying in advanced standing should arrange for the graduating high school to send immediately to the Office of Admissions a complete and final transcript including a statement of graduation. Transcripts from the last college attended should include a statement of good standing or honorable dismissal. A preliminary transcript should show work in progress.

Any additional schools attended after an application for admission has been filed are considered to be part of the applicant's record and must be reported to the Office of Admissions. Transcripts and other documents submitted become the property of the University and cannot be returned.

Notification of Admission

Applicants for admission to the fall quarter will be notified regarding admission beginning about January 15, and most will have been notified by April 15. Applicants for the winter and spring quarters will be notified as soon as possible following receipt of all appropriate transcripts. (Delays may occur if required documents or fees have not been received by the Office of Admissions.)

Those admitted will be required to return a *statement of intention to register,* together with a nonrefundable fee of $50, which will be credited to the university registration fee if the student registers in the quarter for which he applied.

Failure to Register

An applicant who is not eligible for admission or one who has been admitted but fails to register in the term for which he applied, and who thereafter desires to attend the University, must submit a new application for admission, with a $10 fee.

Subject A: English Composition

Every undergraduate must demonstrate an acceptable level of ability in English composition. This requirement may be met by:

1. Achieving a grade of 5, 4, or 3 in the College Entrance Examination Board (CEEB) Advanced Placement Examination in English, *or*
2. Achieving a score of 600 or higher in the CEEB Achievement Test in English Composition, *or*
3. Achieving a score below 600 but above 470 in the CEEB Achievement Test in English composition and writing an acceptable Subject A writing sample, *or*
4. Entering the University in advanced standing and writing an acceptable Subject A writing sample, *or*
5. Entering the University with credentials showing the completion of an acceptable college-level course in English composition with a grade of C or better.

The Subject A writing sample, which is constructed by the Subject A Committee, is administered at centers throughout the state on the last Saturday in April, and is also offered on campus at the opening of each quarter. A fee of $5 is charged for the writing sample. Students who have not been notified of their score on the Achievement Test in English Composition at the time of the April writing sample should not take the writing sample until the opening of their first quarter in the University, if it is then necessary.

Satisfaction of the Subject A requirement is determined by the Office of Admissions. Students not meeting the requirement in one of the ways described above must enrol in the non-credit course in Subject A during their first quarter of residence in the University. (See *Interdisciplinary Courses: Subject A.*) A fee of $45 is charged for the course. Students whose work is of superior quality may, on recommendation of the Committee on Subject A, be permitted to withdraw from the course at a date to be determined by the Committee. Such students are regarded as having satisfied the Subject A requirement. A student who does not complete the course with a mark of Satisfactory must repeat the course each term while he is regularly enrolled until a mark of Satisfactory is given him. Satisfaction of the Subject A requirement is prerequisite to taking any regular course involving English composition and to receipt of the bachelor's degree.

Preparation for University Work

In addition to the high school subjects required for admission to the University, certain preparatory subjects are recommended for many University curricula to give the student an adequate background for his chosen field of study. Lack of a recommended high school course may delay graduation from the University. Details of these recommendations will be found in the bulletin *Prerequisites and Recommended Subjects,* which is ordinarily in the hands of high school and junior college counselors and which may be obtained from the campus Office of Admissions or the University Dean of Educational Relations, University Hall, University of California, Berkeley, California 94720.

A student needing additional preparation is advised to attend one of the many excellent California junior colleges. There he can take courses applicable toward the requirements of the college or school of the University in which he wishes to enrol.

Freshman Standing

An applicant for admission to freshman standing is one who has not registered in regular session in any college-level institution since graduation from high school.

If, at the time of high school graduation, the applicant does not meet the requirements given below for admission to freshman standing or does not qualify by examination, he must meet the requirements for admission to advanced standing. An exception to this regulation will be made only if the student's deficiency was the result of his not having studied one or more required high school subjects. Such a student can sometimes remove the deficiency during the summer; he should consult the Office of Admissions in advance.

Admission to Freshman Standing

An applicant for admission to freshman standing must meet the requirements listed below.

Graduation from High School

An applicant who has been graduated from a California high school with the required scholarship average in the prescribed courses will be admitted to the University. When a resident of California has been graduated from a high school outside California, the acceptability of the record is determined by the Office of Admissions.

Subject Requirements

A. HISTORY, 1 UNIT

This must consist of 1 unit of United States History, or one-half unit of United States History and one-half unit of civics or American Government.

B. ENGLISH, 3 UNITS

These must consist of three units of English composition, literature, and oral expression.

C. MATHEMATICS, 2 UNITS

These must consist of two units of subjects such as elementary algebra, geometry, intermediate and advanced algebra, trigonometry, calculus, elementary functions, matrix algebra, probability, statistics, or courses combining these topics, but excluding arithmetic and such nonacademic subjects as shop mathematics and business mathematics.

D. LABORATORY SCIENCE, 1 UNIT

This must consist of an eleventh- or twelfth-grade year course in one laboratory science. Both semesters must be in the same subject field.

E. FOREIGN LANGUAGE, 2 UNITS

These must be in one language. Any foreign language with a written literature is acceptable.

F. ADVANCED COURSE, 1 (OR 2) UNITS

This must be chosen from the following:

Mathematics, a total of 1 unit of second-year algebra, solid geometry, trigonometry, or an advanced course for which trigonometry is a prerequisite. Foreign language, either 1 additional unit in the same foreign language offered under *e* or 2 units of another foreign language. Science, 1 unit of either chemistry or physics in addition to the science offered under *d*.

ELECTIVES

Additional elective units to complete the minimum of 15 standard entrance units are also required.

Scholarship Requirements

At least a B average is required in courses taken after the ninth year used to meet the subject requirements. Grades received in elective courses or in courses taken in the ninth year or earlier are not used in computing this average. Subject requirements are satisfied by courses in which a grade of C or higher has been assigned. Grades are considered on a semester basis, except from schools that give only year grades. Grades are accepted as they appear on the transcript.

In determining the B average, a grade of A in one course will be used to balance a C in another, but an A may not be used to compensate for D, E, or F grades.

Courses taken in the ninth year or earlier in which a grade of D or lower is received may be repeated to establish subject credit.

Courses taken after the ninth year in which a grade of D or F is received may be repeated to establish subject credit or to improve scholarship. Courses may be repeated in an amount not to exceed a total of 1 unit of the *a*-to-*f* pattern. Grades earned in such repetitions will not be counted higher than a C in determining scholarship average.

Examination Requirements

As a requirement for admission all Freshmen applicants and advanced-standing applicants who have earned less than 12 units of college credit subsequent to high school graduation must submit scores from the following examinations given by the Educational Testing Service for the College Entrance Examination Board: (1) the Scholastic Aptitude Test, (2) three achievement tests, which must include English, social studies or foreign language, and mathematics or science.

An applicant whose scholarship average in the required high school subjects is 3.00 to 3.09 inclusive, must achieve a minimum total score of 2500 on the required examinations. The test results of applicants with a grade-point average of 3.10 or higher will be used for purposes of counseling, guidance, placement, and satisfaction of Subject A if possible.

Admission by Examination Alone

An applicant ineligible for admission to freshman standing on the basis of his high school record, and who has not attempted college work subsequent to high school (except during the summer session immediately following graduation), may qualify for admission by examination. See also under *Nonresident Applicants*, this section.

To qualify by examination, the applicant must present scores in the Scholastic Aptitude Test (S.A.T.) and three Achievement Tests, which must include:

1. English Composition
2. Social Studies or Foreign Languages
3. Mathematics or Sciences

The tests must not be taken before completion of the first half of the eleventh grade. The Achievement Test in English composition cannot be used to satisfy the Subject A requirement unless taken after completion of the eleventh grade. The tests may be repeated if necessary without special limitation other than that the verbal and mathematics scores on the Scholastic Aptitude Test must be from the same sitting. The total score on the Scholastic Aptitude Test must be at least 1100; the scores on the three Achievement Tests must total at least 1650; and the score on any one Achievement Test must not be less than 500.

Arrangements to take the tests should be made with the Educational Testing Service, P.O. Box 1025, Berkeley, California 94701, or P.O. Box 592, Princeton, New Jersey 08540. The fees are to be paid to the Educational Testing Service. Scores will be regarded as official only if they are received by the Office of Admissions directly from the Educational Testing Service.

Test Dates	Penalty Dates or Application Deadline
November 2, 1968	October 5, 1968
December 7, 1968	November 2, 1968
January 11, 1969	December 7, 1968
March 1, 1969	February 1, 1969

May 3, 1969	April 5, 1969
July 12, 1969	June 14, 1969

Applicants should arrange to take the tests as early as possible so that the scores can be reported in time to be considered for admission.

Advanced Standing

An applicant who has registered in a junior college, a four-year college, a university, extension classes of college level, or any comparable institution since graduation from high school is subject to regulations governing admission to advanced standing. However, an advanced-standing applicant who has earned less than 12 units of college credit subsequent to high school graduation must satisfy the examination requirement for freshman applicants as described above. The applicant may not disregard his college record and apply for admission to freshman standing.

Admission to Advanced Standing

An applicant for admission to advanced standing must meet the requirements listed below:

The requirements for admission to advanced standing vary in accordance with the high school record of the applicant. Each applicant, however, must present from the last accredited college or university attended a statement of good standing and an academic record with a grade-point average of C (2.0) or better. If the record established in any one accredited institution is below a C (2.0) average, an additional unit and scholarship requirement will be imposed on subsequent credit completed to offset the deficit incurred. In addition, the applicant must meet one of the following conditions:

1. An applicant who was eligible for admission to the University in freshman standing may be admitted at any time he has established an overall grade-point average of C (2.0) or better.
2. An applicant who was ineligible for admission to the University in freshman standing, but whose only deficiency arose from not having studied one or more of the required high school subjects, may be admitted when he has (*a*) satisfied the subject requirements for admission to freshman standing with a grade of C or better in the appropriate courses, and (*b*) established an overall grade-point average of C or better.

   Exception: Deficiencies in subject requirements will be waived in an amount not exceeding 2 high school units if the applicant has established a minimum of 84 acceptable quarter units or 56 acceptable semester units passed with a grade-point average of 2.4 or better. Subject deficiencies in excess of 2 units must be satisfied.
3. An applicant who was ineligible for admission to the University in freshman standing because of low scholarship or a combination of low scholarship and incomplete subject preparation (omission,

or by grades of D or lower) may be admitted when the following conditions are met:

a. He has established a minimum of 84 acceptable quarter units or 56 acceptable semester units passed with a grade-point average of 2.4 or better.
b. He has satisfied, by appropriate courses, subject requirements for admission to freshman standing, except that subject deficiencies will be waived in an amount not exceeding 2 high school units.

Credit for Work Taken in other Colleges

The University grants unit credit for courses consistent with its curriculum that have been completed in colleges and universities accredited by appropriate accrediting agencies.

As an integral part of the system of public education of California, the University accepts, at full unit value, approved transfer courses completed with satisfactory grades in the public junior colleges of the state. Frequently, students who intend to complete their advanced studies at the University will find it to their advantage to complete the first two years of their college course in one of the many excellent California public junior colleges. After a student has earned 105 quarter units or 70 semester units acceptable toward a degree, no further credit will be granted for courses completed at a junior college, although subject credit may still be earned.

The decision regarding the acceptability of extension courses taken at an institution other than the University rests with the Office of Admissions. The decision regarding the applicability of such course work in satisfaction of degree requirements rests with the faculty of the particular school or college in which the student plans to enrol.

Nonresident Applicants

It has been necessary to place some limitation on enrolment of applicants who are not residents of California; therefore, only those of exceptional promise will be eligible for admission. The requirements below are designed to admit nonresident applicants whose standing, as measured by scholastic records, is in the upper half of those who would be eligible under the rules for California residents.

Admission by High School Record

Graduation from High School. The acceptability of records from high schools outside California will be determined by the Office of Admissions.

Subject Requirements. The same subject pattern as for a California resident is required.

Scholarship Requirements. The scholarship requirements for a resident applicant apply to a nonresident applicant, except that the scholarship average must be 3.4 or higher in the required high school subjects.

Examination Requirement

A nonresident applicant must take the same College Entrance Examination Board tests required of a resident applicant (see above). The test scores submitted will be used for purposes of counseling, guidance, placement, and when possible, satisfaction of the Subject A requirement.

Admission by Examination Alone

A nonresident applicant who is ineligible for admission to freshman standing and who has not attempted college work subsequent to high school (except during the summer session immediately following high school graduation) may qualify for admission by examination. The requirements for a resident applicant apply to a nonresident applicant, except that the scores on the three Achievement Tests must total at least 1725.

Admission to Advanced Standing

In addition to the regular admission requirements, a nonresident applicant for admission to advanced standing must have maintained a grade-point average of 2.8 or higher in college subjects attempted and acceptable for transfer credit. If the applicant did not have at the time of high school graduation an average of 3.4 or higher in courses satisfying the required subject pattern, he must present a minimum of 84 acceptable quarter units or 56 acceptable semester units passed with a grade-point average of 2.8 or higher.

Admission of Undergraduate Foreign Students

Undergraduate foreign students must have a sufficient command of English to benefit from study conducted in that language. To demonstrate this, every student whose native language is other than English must take the *Test of English as a Foreign Language* (TOEFL) prior to coming to the United States. Arrangements for the test may be made by writing to the Educational Testing Service, P.O. Box 1025, Berkeley, California 94701, or P.O. Box 592, Princeton, New Jersey 08540. The results of this test will be used to determine whether the applicant's command of English is sufficient to enable him to pursue his studies effectively. Foreign students whose command of English is slightly deficient will be required to take a non-credit English course, and, therefore, a reduced program. For this reason, foreign applicants are strongly advised to perfect their English before coming to the United States.

In addition to an adequate English background, the foreign student must have adequate funds to cover all fees, living and other expenses, and transportation connected with his stay in the United States. He should bear in mind that expenses are likely to be heaviest at the beginning. (See *Contents* for *Fees and Expenses.*)

Admission regulations are the same for foreign students as for domestic students. (See *Undergraduate Standards of Admission* above.) Because

educational systems vary from country to country, the foreign student is urged to submit completed documents as early as possible.

For information concerning health insurance requirements for foreign students, see *Contents* for *Health Service.*

GRADUATE STANDARDS OF ADMISSION

To be considered for admission, an applicant should hold a bachelor's degree or its equivalent. His preparation ought to be comparable to that provided by the relevant undergraduate program of the University of California. Applications are evaluated in terms of scholastic qualifications and formal training for the graduate field of study.

The Dean of Graduate Studies or the department in which the applicant wishes to pursue graduate studies may deny him admission if his scholastic record is undistinguished or his undergraduate preparation is judged to be inadequate as a foundation for advanced work.

Procedures

The prospective graduate student must file with his major department a completed application form and a transcript of his record from each college and university he has attended not later than two months before the opening of the quarter in which he plans to enrol. There is an application fee of $10. An applicant who has taken the Graduate Record Examination should submit a copy of the results with his application. This is especially important for those students whose grade-point averages are near the minimum required (3.0, or *B* average) for admission to regular graduate status. A single form may be used to apply both for admission and for University-administered financial support, but the deadline for the latter is earlier. (Students applying for fellowships should arrange to have all supporting materials in the hands of their major departments by February 15.)

Forms and more detailed instructions may be obtained from the departments, the Office of Admissions, or from the Office of Graduate Studies and Research. The Medical School and certain departments have special procedures; each applicant is therefore urged to communicate with his prospective major department as early as possible.

Returning students applying for readmission must submit transcripts of any academic work taken since they were last enrolled in the University of California, San Diego. Such students are urged also to submit recommendations and other evidence that they can continue to meet UCSD's academic standards. New students renewing a previously filed application must submit similar documents covering the period since they last applied.

Graduate Foreign Students

In addition to an acceptable professional background, applicants from outside the United States must have sufficient command of English to

benefit from graduate study which is almost entirely conducted in that language. They must also possess funds adequate to cover all fees, transportation, and living expenses. They are held to the same regulations governing admission as are native applicants, except that their application materials should be received by their departments four months before the beginning of the quarter in which they plan to enrol. Since education outside this country may be based upon systems or methods different from our own, it is especially important that foreign applicants submit evidence that their academic background is substantially equivalent to that provided by an acceptable undergraduate program in the United States.

Every student whose native language is other than English must take the *Test of English as a Foreign Language* before coming to the United States. Arrangements for taking this test may be made by writing to Educational Testing Service, P. O. Box 1025, Berkeley, California 94701, or P. O. Box 592, Princeton, New Jersey 08540. The results of this test will be used to determine whether the applicant's command of English is sufficient to enable him effectively to pursue graduate studies in the United States. Foreign students whose command of English is deficient will be required to take a non-credit course in that language and, therefore, a reduced graduate program. For this reason foreign applicants are strongly advised to perfect their English before coming to this country.

Foreign students are required to provide health insurance for dependents who accompany them. Suitable insurance policies and additional information are available at the Student Health Service.

Applicants from outside the United States who are granted admission are urged to write as soon as possible to the Office of International Education, University of California, San Diego, which can assist them in many ways in making a smooth transition from their undergraduate education abroad to graduate studies and research in the United States.

Non-Degree Study; Duplicate Degrees

Most students enter as candidates for degrees, but under special circumstances others may be admitted for graduate study. Students who do not desire to become candidates for advanced degrees must meet the same admission requirements as those who intend to earn degrees. They must apply for admission to a specific field of study, and the Dean of Graduate Studies must be satisfied that their program has scholarly or professional intent.

The duplication of advanced degrees is discouraged. A student who has received a master's degree at another institution may not become a candidate for that degree in the same field at UCSD, although he may petition for a master's degree in a different field. The holder of a Ph.D. degree may not become a candidate for that degree in any field.

Postdoctoral and Visiting Scholars

The University provides opportunities for postdoctoral scholars to work with members of the faculty. All interested candidates should make arrangements for special study or training with the department or research unit with which they are to be associated. Upon arrival, postdoctoral scholars should apply at the Office of the Registrar for a Certificate of Enrolment, which is official evidence of their affiliation with the University and which entitles them to certain special privileges, including reduced charges for some University functions. No fee is charged for the certificate. It is to be noted that the category of postdoctoral scholar does not include visiting scholars with permanent positions at other institutions nor interns or residents receiving advanced training leading to a professional certificate. The University of California has always been hospitable to faculty members and researchers from other institutions who wish to visit the University; facilities for study are made available whenever possible.

Muir College

THE CHARACTER OF THE COLLEGE

John Muir College is a community of scholars engaged in inquiry and the exchange of ideas, and its planners have taken this into account in everything from the curriculum to the design and placing of the buildings. They intend that learning shall reach beyond the classrooms into many other aspects of life in the community.

The permanent buildings of John Muir College will facilitate integration of learning and living. Small classrooms have been placed in the residence halls so that discussions begun in class can be carried on beyond the class, into the corridors and lounges, and onto the campus itself. Several faculty offices are also placed in the residence halls, and faculty members who enjoy informal conversations with students will be able to meet them easily, in agreeable surroundings. Through the generosity of Mr. Ernest W. Mandeville, the first Honorary Fellow of John Muir College, a suite for distinguished visitors will be provided in one of the residence halls. Students not living in the residence halls will be able to participate fully in the life of the college. The lounge areas of the college are planned to include them; they will have ample room for storing books and equipment; and there will be rooms in the residence halls in which they can stay overnight when they wish to remain on campus to study, attend a lecture, take part in a discussion or organizational meeting, rehearse for a play or concert, or simply to be with their friends. Finally, the flow of life in the college as a whole is intended to stimulate curiosity about all aspects of research and learning in the college—curiosity which should lead to unexpected and adventuresome choices of courses, as, for example, when a student specializing in music becomes inquisitive enough to elect a course in experimental psychology or one of the computer sciences.

In 1968–69 the college will be located in temporary buildings on the Matthews Campus.

The general education requirements and the curriculum as a whole encourage active rather than passive learning by involving the students directly with research and creative work. The science courses will provide opportunities for a student to choose his own problem and design his

own experiment; the fine arts courses will include periods of studio work or its equivalent. All first-year students are required to complete a course in contemporary issues. There will be a special reading room where they can find periodicals and newspapers from all over the world, maps, charts, pictures, and other visual aids on exhibit, and books especially chosen for their relevance to the issues under discussion. Most important of all, the students will be working among faculty members, postdoctoral fellows, and graduate students who are themselves actively engaged in creation and discovery.

Active learning necessitates self-education and opportunities for independent study. The programs in the sciences and fine arts obviously foster these. Moreover, subject to certain restrictions, a student may substitute reading courses for regular courses, permitting him to investigate in more than usual depth the topics of special interest to him. Superior students will be eligible for the Honors Program of the college. Once admitted to the program a student may be allowed to complete by means of independent study any general education requirements he has still to finish. Exceptional students will occasionally be admitted upon entering the college and thus be eligible to meet any of the general education requirements by independent study. The major programs provide many forms of independent study. They are not confined to the last two years, but may be undertaken by students of the college whenever the departments or the directors of interdisciplinary majors judge them to be ready. Finally, those students who choose not to pursue a major (see below) will be expected to complete projects that demand much independent investigation.

In John Muir College no new theory, no new discovery, no new work of art will long go unexamined or undiscussed. It will not be a comfortable place for those whose minds are made up.

The Requirements for Graduation

To receive a bachelor's degree from John Muir College a student must:

1. Meet the general University requirement in Subject A. (See *Admission to the University.*) This requirement asks that the student demonstrate an ability to write English without gross errors in spelling, grammar, diction, sentence structure, and punctuation. Satisfaction of the requirement in Subject A is a prerequisite to taking any further course in which the writing of themes or papers forms a substantial part of the student's work.
2. Meet the Muir College requirement in writing proficiency. This requirement asks that the student demonstrate an ability to write English according to standards appropriate for all college work.
3. Fulfil the general University requirement in American History and Institutions. This requirement may be fulfilled in *one* of the following ways: (*a*) by passing, in no more than two tries, an examination which is given twice each year under the direction of the Com-

mittee on American History and Institutions; (*b*) by satisfactorily completing a one-quarter course in American History; (*c*) by presenting proof of having satisfied the present state requirement as administered at another collegiate institution within the state; (*d*) in the case of a transfer student, by having successfully completed a course in either American History or American Government at another recognized institution of higher education.

4. Pass 45 full courses or their equivalent.
5. Fulfil the general education requirements described below. Exemption from part or all of the course work taken to fulfil a given requirement will be granted to properly qualified students. (Exemption does not reduce to less than 45 the number of courses required for graduation.) Others who have prior training which is not enough to warrant exemption but does put them ahead of the ordinary student may be allowed to fulfil part or all of a requirement by independent study. Finally, as noted above, a student admitted to the Honors Program may be allowed to complete by means of independent study any general education requirements still to be finished.
6. Show in some form a concentration and focus of studies as part of his preparation for the bachelor of arts degree. This requirement may be fulfilled by a departmental or interdisciplinary major, but a major itself is not required. (For discussion of major programs, see below.) Normally a student who is affiliated with John Muir College and wishes to undertake a major program as his form of concentration would choose one offered in the College. (The opportunity to engage in the program would be an important reason for choosing Muir College.) However, the student may fulfil this requirement by completing any major program offered at UCSD to which he can gain admission.

A student who does not choose to meet this requirement by means of a major must complete a special project, normally undertaken in the senior year, having such scope and significance that it integrates and summarizes much of the student's learning. Some appropriate projects might be, for example, a thesis-length essay in literature, history, or anthropology; field research on a social problem of the San Diego area; composing a three-movement work for a string quartet; painting a mural.

Students who do not undertake a major must have their programs for the junior and senior years approved by a faculty adviser and the Provost of the College. Their plans of study must have some rationale, and they will be expected to explain for what purposes they have chosen a particular pattern of courses. Under no circumstances should students suppose that a non-major program is, or can be made to be, less authentic than the ordinary one involving a major.

The General Education Requirements

Unless granted an exemption from the work undertaken to fulfil a requirement or allowed to complete all or part of that work by means of independent study, each student is expected to:

1. Complete a three-term sequence of courses which will serve as an introduction to a cultural tradition.
2. Complete a three-term sequence of courses in one of the humanities or fine arts.
3. Complete a three-term sequence in mathematics. *This requirement must be completed before the end of the sophomore year.*
4. Complete four courses in the sciences. A list of courses suitable for fulfilling this requirement will be provided at the time of enrolment.
5. Complete a course on contemporary issues. *This requirement must be met during the first year.*
6. Demonstrate conversational proficiency adequate to engaging in ordinary class discussions in a foreign language, and reading ability in that language sufficient for passing the graduate reading examination.

Introduction to a Cultural Tradition. Students select one from among several three-term sequences which inquire into the nature of particular cultures by way of their literary, artistic, historical, philosophical, and socio-anthropological aspects. Wherever feasible, instructors will designate readings in the pertinent language. If a considerable number of students have a reasonable competence, the instructor may group them into an honors section in which appropriate foreign language readings will be discussed. Students enrolled in an honors section, if they make a grade of B or above, would have that fact noted in their college records. At the discretion of the instructor, a student who demonstrates adequate competence may be certified as having fulfilled the language requirement.

The Humanities and Fine Arts Sequences. Students select one from among several three-term sequences which provide either (a) an introduction to one of the humanities or (b) an introduction to an artistic medium intended to develop sensitivity and standards of critical judgment. In addition to the ordinary lectures and discussion meetings, the courses in the arts include some studio or creative work and, where appropriate, attendance at performances and exhibitions.

Course sequences being offered at present which will satisfy the humanities and fine arts requirement are: Drama 1A-1B-1C; History 30A-30B-30C; Literature 1A-1B-1C; Music 1A-1B-1C; Visual Arts 1A-1B-1C. (See *Departments of Instruction.*)

The Mathematics Sequences. With the help of the Mathematics Department the student will select from among three sequences the one which best fits his diverse interests, training, and educational goals. Students who will not use mathematics as a tool in further work can select a sequence which deals with fundamental concepts of mathematics without insisting upon technical proficiency. Students planning to take advanced

courses or major in the physical sciences can select a more traditional sequence in calculus and analytic geometry. Certain well-prepared and well-motivated students will be encouraged to take three courses on special topics, such as probability and statistics, or the theory of games. During each term at least one such topics course will be offered. Students initially enrolled in another sequence will be allowed to transfer to a topics course if they show sufficient aptitude. Students who have had college-level mathematics for which UCSD grants credit will be considered to have satisfied part or all of the mathematics requirement.

Departments may designate particular mathematics sequences as prerequisites for advanced work in their fields. (For further information on this point see the discussion of major programs below.)

For courses offered in satisfaction of the mathematics requirement, see *Departments of Instruction: Mathematics.*

The Science Sequence. The science requirement is intended to inculcate general literacy with respect to the basic assumptions, ideas, and methodologies underlying scientific inquiry, together with some understanding of the role of science itself as a social institution whose dynamism profoundly affects modern cultures. Each student is expected to take not less than four courses from a list which is now being developed. Students who do not plan to major in a science may take any four on the list; however, certain courses especially designed for them are being planned at the junior-senior level. Therefore, students who do not plan to major in science would normally not enrol in science courses in the freshman and sophomore years but would wait to take the junior and senior courses.

The various science departments may specify up to five courses on the list which must be taken *before the junior year* by students who wish to pursue advanced work in the sciences. Students planning to major in applied electrophysics should take the courses numbered 2A through 2E. A sequence for students planning to major in biology is being developed. It will be numbered 3A through 3E. The courses in these two sequences also serve to fulfil the science requirement of the College.

Full information regarding the science courses and which ones should be chosen to meet the different needs and plans of the students will be available at each enrolment period.

The Contemporary Issues Courses. The contemporary issues requirement can be met in one of two ways: by attending a series of lectures and discussions involving members of the faculty and distinguished visitors (Contemporary Issues 1), or by enrolling in a freshman seminar which concentrates upon a single area or problem (Contemporary Issues 2.)

The lecture course is under the direction of the Provost and a steering committee of faculty members and students. Particular effort will be made to present leaders in public affairs of the moment. Insofar as possible, discussions will be guided by the students themselves. The course will be supplemented by selected reading and occasional papers.

The freshman seminars will be offered each term and will be limited to fifteen students. The staff will consist of members of the faculty from

all areas of learning, chosen for their interest in the topics, without regard to college affiliation. Freshmen who wish to fulfil the requirement by means of a seminar must indicate their preference at the beginning of the year, even though the seminar of their choice may not come until the second or third term. They are welcome to attend the lectures given in the large course, but not the discussion meetings. (See *Interdisciplinary Courses: Contemporary Issues.*)

Both the large lecture course and the freshman seminars will make use of the facilities of a special reading room in which students may study at leisure books, periodicals, newspapers, and pictures and other visual aids accumulated from all parts of the globe and arranged to supplement the discussions then under way.

Language Proficiency. As indicated above, some of the sequences which may be taken to fulfil the cultural traditions requirement demand competence in a foreign language. Successful completion of one of these is regarded as evidence of having fulfilled the language requirement, and no other proof of proficiency is required. Students who do not complete such a sequence will be expected to demonstrate their proficiency in other ways, ordinarily by means of an examination.

The languages in which students may demonstrate proficiency are French, German, Spanish, and Russian. Basic instruction is available to students who wish to begin or to continue study leading to proficiency in one of these languages. Instruction is sometimes available in Greek, Latin, Italian, Arabic, and other languages, and students who wish to study one of these languages in order to fulfil the requirement should consult the Provost, who can approve the attainment of proficiency in them after consulting with the director of the Language Program. For information on language courses see *Interdisciplinary Courses: Language.*

Transfer Students

Transfer students accepted by Muir College will, in general, be held to the lower-division general education requirements and to the lower-division prerequisites for a major. The general education requirements, however, will be interpreted rigorously only for those subjects that are directly related to the student's proposed major. The Provost, in consultation with appropriate departments, will evaluate the credentials of each transfer student on an individual basis. Transfer without penalty will be authorized upon approval of the Provost and the responsible department. A transfer student at the junior or senior level may be admitted to a major even though he has not completed the lower-division general education requirements. In such cases, the general requirements must be completed before graduation. (See *Admission to the University: Advanced Standing.*)

Major Programs

A student in John Muir College may pursue any major program offered at UCSD for which he is prepared, though normally he would undertake

one offered in the college. He may begin the major whenever he is judged ready for it. However, all programs can be completed by students who start them at the beginning of the junior year, and it is likely that most students will wait until then to begin.

Below is a list of subjects in which major programs will be available. Interdisciplinary programs will be developed later.

Anthropology
Applied Electrophysics*†
Biology
History
Linguistics
Literature
Mathematics*
Music
Psychology*
Sociology
Visual Arts

*Requires a particular mathematics sequence.

†Requires a particular sequence of courses to be completed by the end of the second year.

The Honors Program

Admission to the honors program calls for a special recommendation by either the Provost or a departmental chairman, and normally requires at least a B average. In special cases a student may be permitted to enter the Honors Program immediately upon arrival at John Muir College, but this would require, for a freshman, an A average at high school or, for a transfer student, an A-minus average at his previous institution. (Owing to the newness of Muir College and the smallness of the faculty, it is not possible for the time being to permit freshmen to do honors work; it is our hope that the honors program can be fully implemented to include freshmen in the near future.) To remain in the Honors Program a student must normally maintain at least a B average and must demonstrate by superior achievement his capacity for honors work. Once admitted, a student may be allowed to complete by means of independent study any general education requirements still to be finished.

Honors students engaged in a major program will be offered opportunities and be expected to show accomplishments beyond those of the ordinary student. An honors student may participate in special seminars, tutorial programs, or courses normally open only to graduate students, or he may be permitted to undertake an especially challenging project of his own. Honors students not pursuing a major would differ from other non-major students in having more opportunities for independent work, especially on the senior project. Whether majoring or not, the honors student will be able to develop a pattern of study that gives scope to his superior qualifications.

The Honors Program will be supervised by a faculty accreditation

committee consisting of the Provost, his adviser for non-departmental honors students (both those not taking a major and those pursuing an interdisciplinary major), and the relevant departmental advisers for other honors students.

Reading Courses and Examinations

Subject to certain restrictions, a student in John Muir College can substitute reading courses for regular courses. To help him to comprehend a reading course as a whole and to understand how it relates to the content of his regular courses, he will be allowed a suitable period of reflection (not to exceed two terms after the end of the reading course) and then be required to take an examination on the reading.

A student may use reading courses during a particular term only if he has had his program approved by an appropriate faculty member *at least one term in advance of his entering the program.* Arrangements for the examinations on the reading must be made and approved at the same time. Proposals for reading that necessitates an inordinate amount of special faculty work will have to be denied.

The First Year

John Muir College offers the incoming student considerable freedom in choosing the courses for his first year. This freedom should be wisely used to fit a program to the student's particular training and interests, leaving some scope for exploration of new areas of learning while attending to the requirements for graduation which are best fulfilled during the first two years.

To help incoming students and their advisers with the planning of the first year's program, four possible combinations are described below.

The first combination is suited to students with the usual preparatory training in language and mathematics who do not expect to take advanced work in the physical sciences.

Fall	Winter	Spring
Mathematics 1A or 5A	Mathematics 1B or 5B	Mathematics 1C or 5C
Language	Language	Language
Literature 1A	Literature 1B	Literature 1C
Elective	Elective	Elective
Contemporary Issues 1	Contemporary Issues 1	

Comment: A student taking this combination does not plan to do advanced work in biology or the physical sciences. If he wished to do such advanced work, he would need to take Mathematics 1A or 2A before beginning the appropriate science sequence (see next example). The mathematics requirement must be met before the end of the sophomore year. Thus one is not compelled to begin it immediately. However, many students will not wish to have an interval of a year between finishing high school and beginning their mathematics courses, and as a consequence will schedule

a sequence that will enable them to meet the mathematics requirement during the first year. Moreover, this combination assumes that the student needs a full year of language study in order to fulfil the language requirement, whether by means of a Cultural Traditions sequence or by means of an examination. It also assumes that the student wants to meet the humanities and fine arts requirement in the freshman year and has chosen a sequence of three literature courses for that purpose. Finally, the Contemporary Issues course of lectures, required of all freshmen except those admitted to a freshman seminar, is spread across two terms.

The second combination is appropriate to students who are interested in majoring in applied electrophysics or biology or in taking other advanced courses in the physical sciences.

Fall	Winter	Spring
Elective	Science	Science
Mathematics 1A or 2A	Mathematics 1B or 2B	Mathematics 1C or 2C
Language	Language	Language
Music 1A	Music 1B	Music 1C
Contemporary Issues 1	Contemporary Issues 1	

Comment: The science sequence for students planning more work in biology or the physical sciences should not be started until the students have completed either Mathematics 1A or 2A. Therefore science is undertaken in the winter term, which means that the students will complete Science 2E in the spring of the second year, as prescribed by the Departments of Applied Electrophysics and Biology. This example assumes that the student using it has to do a full year of language work and that he has decided to fulfil his humanities and fine arts requirement in the first year by studying music for three terms. Note that the student has a free elective in the first term, which can be used to explore subjects (such as psychology and sociology) which he has not encountered before coming to college. Or, he might use this elective to gain admission to a freshman seminar, in which case he would not need to take the Contemporary Issues lecture sequence (although he would be welcome to attend the lectures).

The third combination would be an appropriate one for students who do not plan to use mathematics as a tool for further work and who are qualified to begin a major program in the freshman year. (Students may begin a major as soon as they are judged ready for it. On the other hand, those who wish may wait until the first term of the junior year before undertaking it.) In this example we assume that the major is in music.

Fall	Winter	Spring
Mathematics 5A	Mathematics 5B	Mathematics 5C
Language	Language	Language
Music 101A	Music 101B	Music 101C
Elective	Elective	Elective
Contemporary Issues 1	Contemporary Issues 1	

Comment: Only an unusually well-prepared student should think of attempting to begin a major in the first year. Here, the student, after demonstrating a great skill and solid prior training, is admitted to Music 101A. It should be noted that the music courses listed here do not satisfy the humanities and fine arts requirement. Therefore the student following this program will need to take a three-course sequence in one of the humanities, such as literature, or one of the other arts, such as drama, sometime before graduation.

The fourth combination is appropriate to those students who are far better prepared in language and mathematics than most students entering American colleges and universities. As a consequence of their training, such students have more free electives and can do more advanced work from the outset.

Fall	Winter	Spring
Elective	Science	Science
First Course in a Cultural Tradition	Second Course in a Cultural Tradition	Third Course in a Cultural Tradition
Mathematics 10A	Elective	Elective
Art 1A	Art 1B	Art 1C
Contemporary Issues 1	Contemporary Issues 1	

Comment: In this example, the student plans to do advanced work in biology or the physical sciences and selects the appropriate science sequence. His training in mathematics is so excellent that he gains admission to Mathematics 10A and demonstrates such understanding of the subject that he is considered to have fulfilled the mathematics requirement. As a consequence, he has at least three electives in his first year. He may wish to use them for more mathematics courses, since one of the advantages of good prior training is the greater freedom to concentrate on those subjects that most interest one. Or, he may use the time to sample subjects which are new to him. This same student is so well prepared in a foreign language that he can begin at once a Cultural Traditions course using that language.

There are, of course, many other possible combinations. In seeking the one which best suits him, an entering student should keep several things in mind:

1. Students who will major in a science must complete five courses, which are begun in the winter term of the freshman year. Other students may take any four courses approved for this requirement, or they may take special upper-division courses which are being designed for them.

2. The mathematics requirement must be fulfilled by the end of the second year, and it is usually good practice to complete it during the freshman year so that skills acquired in high school will not decline. Students majoring in a science will need to take Mathematics 1A or 2A in the fall quarter of the freshman year.

3. Those students who need to take more language training should ordinarily begin it promptly.

4. Students should avoid aimless shopping around. The college grants freedom of choice in the assumption that it will be used to prepare a rational plan.

The Faculty of Muir College

Name	Title	Department
Alazraki, Jaime, Ph.D.	Acting Associate Professor	Literature
Anderson, Norman H., Ph.D.	Professor	Psychology
Antin, David, M.A.	Assistant Professor	Visual Arts
Axford, William I., Ph.D.	Professor	Applied Electrophysics/Physics
Banks, Peter M., Ph.D.	Assistant Professor	Applied Electrophysics
Baron, Samuel H., Ph.D.	Professor	History
Bercovitch, Sacvan, Ph.D.	Assistant Professor	Literature
Berman, Ronald S., Ph.D.	Professor	Literature
Booker, Henry G., Ph.D.	Professor	Applied Electrophysics
Bowles, Kenneth L., Ph.D.	Professor	Applied Electrophysics
Brach, Paul H., M.F.A.	Professor	Visual Arts
Brody, Stuart, Ph.D.	Assistant Professor	Biology
Campbell, James L., M.S.	Assistant Professor	Music
Carmack, Robert, Ph.D.	Assistant Professor	Anthropology
Céspedes, Guillermo, Ph.D.	Professor	History
Chapin, Paul G., Ph.D.	Assistant Professor	Linguistics
Chrispeels, Maarten J., Ph.D.	Assistant Professor	Biology
DeMoss, John A., Ph.D.	Associate Professor	Biology
De Laix, Roger A., Ph.D.	Associate Professor	History
Deutsch, J. Anthony, D.Phil.	Professor	Psychology
Dolin, Edwin F., Jr., Ph.D.	Assistant Professor	Literature
Donald, John D., Ph.D.	Assistant Professor	Mathematics
Douglas, Jack D., Ph.D.	Assistant Professor	Sociology
Eckart, Carl, Ph.D.	Professor	Physics Scripps Institution of Oceanography
Eke, Barry G., Ph.D.	Assistant Professor	Mathematics
Erickson, Robert, M.A.	Professor	Music
Evans, John W., M.D., Ph.D.	Assistant Professor	Mathematics
Fejer, Jules A., D.Sc.	Professor	Applied Electrophysics
Fillmore, Jay P., Ph.D.	Assistant Professor	Mathematics
Flanigan, Francis J., Ph.D.	Assistant Professor	Mathematics
Freeman, Gary L., Ph.D.	Assistant Professor	Biology
Fussell, Edwin S., Ph.D.	Professor	Literature
Gaburo, Kenneth L., D.M.A.	Professor	Music

Goodkind, John M., Ph.D.	Associate Professor	Physics
Gragg, William B., Jr., Ph.D.	Assistant Professor	Mathematics
Green, David M., Ph.D.	Professor	Psychology
Guillén, Claudio, Ph.D.	Professor	Literature
Gusfield, Joseph R., Ph.D.	Professor	Sociology
Halpern, Francis R., Ph.D.	Associate Professor	Physics
Helstrom, Carl W., Ph.D.	Professor	Applied Electrophysics
Holland, John J., Ph.D.	Professor	Biology
Jacobs, Irwin M., Sc.D.	Associate Professor	Applied Electrophysics
Jameson, Fredric R., Ph.D.	Associate Professor	Literature
Klima, Edward S., Ph.D.	Professor	Linguistics
Korevaar, Jacob, Ph.D.	Professor	Mathematics
Kuroda, Sige-Yuki, Ph.D.	Assistant Professor	Linguistics
Langdon, Margaret H., Ph.D.	Assistant Professor	Linguistics
Langham, Michael S., LL.D.	Professor	Drama
Ledden, Patrick J., Ph.D.	Assistant Professor	Mathematics
Lee, Eugene T. Y., Ph.D.	Assistant Professor	Mathematics
Lewak, George J., Ph.D.	Assistant Professor	Applied Electrophysics
Lewallen, Donald G., M.F.A.	Assistant Professor	Visual Arts
Lindsay, Peter H., Ph.D.	Assistant Professor	Psychology
Lohmann, Adolf W., Ph.D.	Professor	Applied Electrophysics
Luo, Huey-Lin, Ph.D.	Assistant Professor	Applied Electrophysics
Manaster, Alfred B., Ph.D.	Assistant Professor	Mathematics
Mandler, George, Ph.D.	Professor	Psychology
Masry, Elias, Ph.D.	Assistant Professor	Applied Electrophysics
McGill, William J., Ph.D.	Professor	Psychology
Michels, Joseph W., Ph.D.	Assistant Professor	Anthropology
Mills, Stanley E., Ph.D.	Associate Professor	Biology
Moore, Robert D., Ph.D.	Assistant Professor	Applied Electrophysics
Munsinger, Harry L., Ph.D.	Associate Professor	Psychology
Nee, Thomas B., M.A.	Associate Professor	Music
Newmark, Leonard D., Ph.D.	Professor	Linguistics
Ogdon, Wilbur L., Ph.D.	Professor	Music
Orloff, Marshall J., M.D., Ph.D.	Professor	Surgery
Parrish, Michael, Ph.D.	Assistant Professor	History
Perrin, Charles L., Ph.D.	Assistant Professor	Chemistry
Reynolds, George S., Ph.D.	Professor	Psychology
Rodin, Burton, Ph.D.	Associate Professor	Mathematics
Röhrl, Helmut, Ph.D.	Professor	Mathematics
Rosenblatt, Murray, Ph.D.	Professor	Mathematics

Rotenberg, Manuel, Ph.D	Associate Professor	Applied Electrophysics
Rumsey, Victor H., B.A.	Professor	Applied Electrophysics
Schalkwijk, Johan Pieter, Ph.D.	Assistant Professor	Applied Electrophysics
Sharpe, Michael J., Ph.D.	Assistant Professor	Mathematics
Silber, John J., Ph.D.	Professor	Music
Soulé, Michael E., Ph.D.	Assistant Professor	Biology
Stewart, John L., Ph.D.	Professor, Provost of the College	Literature
Thiess, Frank B., Ph.D.	Assistant Professor	Mathematics
Todd, Michael C., M.F.A.	Assistant Professor	Visual Arts
Tureck, Rosalyn	Professor	Music
Turetzky, Bertram J., M.A.	Assistant Professor	Music
Warschawski, Stefan E., Ph.D.	Professor	Mathematics
Wilden, Anthony G., Ph.D.	Assistant Professor	Literature
Wilhelmy, Roland A., Ph.D.	Assistant Professor	Psychology
Yip, Wai-lim, Ph.D.	Assistant Professor	Literature
York, Herbert F., Ph.D.	Professor	Physics

Honorary Fellows of the College

Georg von Bëkësy
Ernst Krenek
Ernest Mandeville
Claude E. Shannon
Robert Penn Warren

Revelle College

THE EDUCATIONAL PHILOSOPHY

With the establishment of Revelle College, the first college on the UCSD campus, the faculty was given a rare opportunity to shape an undergraduate curriculum that would, insofar as any educational program can, prepare its students for the modern world. From the outset of planning the curriculum, the faculty asked: What sort of knowledge must students have if they are to be liberally educated? In what areas? To what depth? How specialized must that education be in the undergraduate years?

The educational philosophy of Revelle College was developed in response to such fundamental questions. Its undergraduate program is based on the assumption that a student who is granted the Bachelor of Arts degree will have attained:

1. An acceptable level of general education in mathematics, foreign language, the physical, biological, and social sciences, the fine arts and the humanities.
2. Preprofessional competence in one academic discipline.
3. An understanding of an academic area outside his major field.

To this end, a lower-division curriculum has been established which should enable the student to acquire an understanding of the fundamental problems, methods, and powers of the humanities and the arts, the social and behavioral sciences, mathematics, and the natural sciences.

The lower-division curriculum assumes that an undergraduate should not concentrate heavily in a special field until he has had a chance to learn something about the various fields that are open to him. His general education must, then, be thorough enough for him to see the possibilities of those fields. Early in his career, he should know, as it were, three languages: his own, a foreign language, and the universal language of mathematics. He will learn more about his own culture in a two-year humanities sequence—an introduction to major literary, philosophical, and historical documents which requires the regular writing of essays. He will study a foreign language as a spoken, vital means of communication; studying that language, he will come to know something of the general nature of language itself. And he will study mathematics as part

of general education and as preparation for a required sequence of courses in the physical and biological sciences. Finally, he will, as a sophomore, study the social and behavioral sciences. He will also have some elective time in which he can take courses in disciplines that he would like to explore further. Once he has completed this program, he will be ready for the relatively more specialized work of the upper division.

During the student's upper-division years (junior and senior), his main effort will be devoted to intensive work in his major field at a level of competence that will enable him to continue his study in the graduate division.

The student's *general* education will not, however, stop at the end of the sophomore year; in addition to his major, every upper-division student will do a substantial fraction of his course work in an area of learning distinctly different in content and method from that of the major. (Generally, the following will be considered "areas of learning" in the above sense: mathematics and natural sciences; the social sciences; humanities.) The courses that the student elects for this noncontiguous minor must compose an integrally related complex which will equip him for continued informal study in adult life.

Revelle College stresses the broad character of its curriculum. Every student, for example, is required to achieve a certain competence in calculus. The emphasis on calculus and physical science is in some respects a deviation from educational theory of the last hundred years. The older "general education" theory demanded that scientists achieve a reasonable competence in the social sciences and humanities. The rising importance of science justifies the application of the theory to non-scientists as well.

Four years of college can at best yield only a limited knowledge; the major task is to train the student so that he can adapt quickly and effectively to the rapidly changing world.

THE GENERAL EDUCATION REQUIREMENTS

Revelle College students are required to demonstrate an acceptable level of basic knowledge in the humanities, fine arts, social sciences, language, mathematics, and the physical and biological sciences before entering a major academic field for specialization during the junior and senior years. They will reach the required level through a set of courses that comprise approximately 80 per cent of their work in the lower division (first two years).

Students are encouraged to meet the requirements of the lower division and the major requirements of the upper division as rapidly as possible. The entire program, including the general education requirements of the upper division, is designed to be completed in four years. Variations within the program will occur, of course, depending on the student's interests, prior training, and ability to make use of individual study. Those who demonstrate superior achievement and competence in an academic area may take advanced courses and individual-study programs

that give them an opportunity to complete degree requirements in fewer than four years.

Lower Division

In order to fulfil the minimum lower-division requirements in the principal fields of knowledge, the student takes a recommended set of courses, the prerequisites for which have been met by the general admission standards of the University.

The lower-division general education requirements are as follows:

1. Satisfaction of the general University Subject A requirement.
2. Three courses in mathematics (including calculus).
3. Three courses in a social science.
4. Five courses in the natural (physical and biological) sciences.
5. Verbal and reading proficiency in a modern foreign language.
6. Seven courses in humanities and the fine arts.

Subject A. Satisfaction of the University requirement in Subject A (see *Interdisciplinary Courses: Humanities; Subject A*).

Mathematics. Mathematics has for centuries held an important place in education, in the sciences, and in the humanities. As an integral part of his liberal education, the student will be brought into contact with a significant area of mathematics. Furthermore, he will gain the facility to apply mathematics in his studies of the physical, biological and behavioral sciences.

Two beginning-year course sequences are offered for Revelle College students. Freshmen enrolment in these sequences is dependent on the student's high school and college preparation in mathematics as well as his future plans. Both sequences include integral and differential calculus and linear algebra. (See *Departments of Instruction: Mathematics.*)

Social Sciences. Until a single, integrated social science course sequence may be devised to meet this requirement, students will choose a lower-division course sequence offered by the Departments of Anthropology, Economics, Political Science, Psychology, or Sociology. The sequence Philosophy 20-21-22 may also be used to fulfil this requirement. (See *Departments of Instruction.*) One sequence must be taken in its entirety in order to satisfy the requirement.

Natural Sciences. The Natural Science sequences present the fundamental concepts of modern physical science and biology. For the student who may major in one of these disciplines, the courses provide a background and preparation for further study; for those students who will continue their studies outside the sciences, they offer an opportunity to gain a certain understanding and appreciation of current developments in these fields.

Two sequences are offered. A student enrols in one or the other sequence depending on his prior preparation in mathematics and his score on the Mathematics Placement Examination, which is given during the

registration period. Five courses in one sequence will satisfy the natural sciences requirement. (See *Interdisciplinary Courses: Natural Sciences.*)

Language. Revelle College has set its language requirements in terms of levels of proficiency that must be attained by the student, rather than in terms of a certain course or number of courses that must be passed. Two kinds of proficiency are required:

A. Oral proficiency.
   By the end of his sophomore year the student is expected to have demonstrated his ability to carry on ordinary conversation comfortably in a modern foreign language. The skill aimed at is what would be adequate for the student to continue his education by participating in substantive courses conducted in the foreign language, e.g., the courses offered by the Department of Literature on this campus or courses offered to native speakers of the language in their own country.

B. Reading proficiency.
   By the end of his sophomore year the student is expected to have demonstrated his ability to read ordinary material—e.g., newspapers and popular literature—in a foreign language. The level aimed at is that which college students in this country normally attain by the end of their second year of training in the language.

The normal preparation for lower-division language proficiency will be language courses in the student's freshman year. With normal high school preparation in language most students will require about a year of course work to prepare for the examination, but some students will take less time and some more, because of differences in ability, industry, and previous language work in high school, on other campuses, or in informal extracurricular activities (e.g., foreign movies, language clubs, language tables) involving the language.

To assist the student in attaining the required language proficiencies, three special kinds of aid are offered:

1. Self-instructional materials and equipment, which the student can use to advance his proficiency at his own optimum speed.
2. A program of small tutorial classes, conducted by native speakers of the language. A student's assignment to a new tutorial class will be a measure of his increased proficiency; the classes will be recomposed weekly to maintain homogeneity of class membership, permitting each class to be conducted at the highest level possible for each of its members.
3. Instruction by linguistic scientists about language and the learning of languages. This instruction is intended to broaden the scope of the student's education as well as to assist him in his own language study.

Humanities. The humanities sequence introduces the student to his cultural heritage. It rests on the principle that this heritage is best found in the great documents of Western Civilization in which it has assumed concrete form. The student is invited to confront these literary, philo-

sophical and historical documents directly; through lectures, group discussions, themes, and conferences he will learn to interpret them, to discover their interrelations, and to perceive their continuity.

The sequence opens with the study of contemporary works, then goes back to the Judaeo-Grecian beginnings and traces the development of Western Civilization forward again to the present. Essential to the course are the student's themes; in these he will be asked to come to direct and personal terms with what he has read, and to acquire the skills of clear and cogent expository writing. For the courses to be taken in fulfilment of this requirement see *Interdisciplinary Courses: Humanities.*

Fine Arts. One course is required and is usually taken in the freshman or sophomore year. Students may choose a course from Drama, Music, or Visual Arts. (See *Departments of Instruction.*)

FRESHMAN YEAR

Fall	Winter	Spring
Humanities 1	Humanities 2	Humanities 3
Language	Language	Language
Mathematics 1A or 2A	Mathematics 1B or 2B	Mathematics 1C or 2C
Fine Arts	Natural Science 1B	Natural Science 1C
or	or 2A	or 2B
Natural Science 1A		

SOPHOMORE YEAR

Fall	Winter	Spring
Humanities 4	Humanities 5	Humanities 6
Natural Science 1D	Natural Science 1E	Natural Science 1E or 2E
or 2C	or 2D	or Fine Arts
Social Science	Social Science	Social Science
Elective/Language	Elective/Language	Elective/Language

Upper Division

The Major

All undergraduate majors offered at UCSD are available to Revelle College students. Departments which have their headquarters in Revelle College are Aerospace and Mechanical Engineering Sciences, Biology, Chemistry, Earth Sciences, Economics, Literature, Philosophy, and Physics.

The major program requires twelve to fifteen upper-division courses, depending on the department in which the major is taken. See *Departments of Instruction.*

As changes in major requirements occur, students are expected to satisfy the new requirements insofar as possible. Hardship cases should be

discussed with the departmental adviser, and petitions for adjustment submitted to the Provost when necessary.

Restricted Electives

In addition to the major requirements, departments may require a student to pass a number of courses in his general area of learning. The requirement is intended to give breadth as well as depth to the student's major. The major program and related elective choices may total up to eighteen courses in the upper division.

The Noncontiguous Minor

In addition to the major and any restricted electives, Revelle College students are required to complete a noncontiguous minor—a coherent grouping of six courses in an area of studies *other than* that of the major. For the purposes of this requirement, the humanities, the social sciences, and the natural sciences (including mathematics) will be considered three different areas. The requirement may be met in either of the following ways:

1. *Project minor.* Such a minor centers on a problem or period chosen by the student after consultation with his minor adviser. It may be interdepartmental, so that the courses constituting it may be selected from various departmental offerings. However, the "center of gravity" of such a minor must be in a given department, that department being in an area other than the student's major. Every minor program of this kind, as well as any later changes in it, must be approved by a minor adviser.
2. *Departmental minor.* Such a minor consists of six courses taken within one department outside the area of the student's major. The student will consult with the minor adviser of the chosen department and determine with him which courses will constitute the minor. Every departmental minor as well as any later changes in it must be approved by the minor adviser of the department.

No more than three lower-division courses may be included in a minor program.

Each department will designate a minor adviser. Minor programs are subject to approval by the Provost.

The Graduation Requirements

In order to graduate from Revelle College, a student must:

1. Satisfy the lower-division general education requirements (including Subject A).
2. Complete a major consisting of at least 12 upper-division courses.
3. Complete a noncontiguous minor consisting of 6 courses (no more than 3 may be lower division).
4. Satisfy the University of California requirement in American History and Institutions. This requirement may be fulfilled in *one* of the following ways: (*a*) by passing, in no more than two tries, an

examination which is given twice each year under the direction of the Committee on American History and Institutions; (*b*) by satisfactorily completing a one-quarter course in American History; (*c*) by presenting proof of having satisfied the present state requirement as administered at another collegiate institution within the state; (*d*) in the case of a transfer student, by having successfully completed a course in either American History or American Government at another recognized institution of higher education.

5. Pass at least 48 courses.
6. Attain a C average (2.0) or better in all work attempted in the University of California (exclusive of University Extension) and a C average in all upper division courses in the major attempted in the University.
7. Meet senior residence requirement. (See *Rules and Procedures: Senior Residence.*)

Upon satisfaction of the graduation requirements, Revelle College will recommend that the student be awarded the degree Bachelor of Arts.

Honors in Revelle College

Provost's Honors will be awarded each quarter to students who complete the previous quarter's program with distinction according to criteria established by the Executive Committee of the College.

The Executive Committee of Revelle College will award College Honors with the bachelor's degree to students with a superior overall grade-point average at graduation. The honors designations and requirements for each are as follows: Honors, an overall average of 3.25; High Honors, 3.50; Highest Honors, 3.75. To be eligible for College Honors, a student must have completed at least 20 courses (80 quarter units) in the University of California.

A list of students graduating with College Honors will be published in the Commencement Program, and honors earned will be recorded on each student's diploma.

Transfer Students

Transfer students accepted by Revelle College will, in general, be held to the lower-division general education requirements and to the lower-division prerequisites for a major. The general education requirements, however, will be interpreted rigorously only for those subjects that are directly related to the student's proposed major. The Provost, in consultation with appropriate departments, will evaluate the credentials of each transfer student on an individual basis. Transfer without penalty will be authorized upon approval of the Provost and the responsible department. Some departments may require a transfer student with senior standing to satisfy a residence requirement within the major department. Students should consult their major advisers about the minimum number of courses required for this purpose.

In order to transfer to Revelle College from another college or school within the University of California, a student will be required to have a C (2.0) average or better on all work attempted at the University. (See *Admission to the University: Advanced Standing.*)

The Faculty of Revelle College

Name	Title	Department
Abelson, John N., Ph.D.	Assistant Professor	Chemistry
Andrea, Stephen A., Ph.D.	Assistant Professor	Mathematics
Ariotti, Piero E., Ph.D.	Assistant Professor	Philosophy
Arnold, James R., Ph.D.	Professor	Chemistry
Attiyeh, Richard E., Ph.D.	Associate Professor	Economics
Bear, Donald V. T., Ph.D.	Associate Professor	Economics
Bearden, Alan J., Ph.D.	Assistant Professor	Chemistry
Behar, Jack, Ph.D.	Assistant Professor	Literature
Bishop, Errett A., Ph.D.	Professor	Mathematics
Black, William C., Jr., Ph.D.	Assistant Professor	Physics
Blanco, Carlos, Ph.D.	Professor	Literature
Block, Barry, Ph.D.	Assistant Professor	Physics
Blume, Bernhard, Ph.D.	Professor	Literature
Bond, Frederick T., Ph.D.	Assistant Professor	Chemistry
Bradner, Hugh, Ph.D.	Professor	Aerosp. & Mech. Eng. Scs.
Brueckner, Keith A., Ph.D.	Professor	Physics
Burbidge, E. Margaret, Ph.D.	Professor	Physics
Burbidge, Geoffrey R., Ph.D.	Professor	Physics
Burton, Rodney L., Ph.D.	Assistant Professor	Aerosp. & Mech. Eng. Scs.
Butler, Warren L., Ph.D.	Professor	Biology
Casalduerò, Joaquín, Ph.D.	Professor	Literature
Chen, Joseph Cheng-Yih, Ph.D.	Assistant Professor	Physics
Clark, Leigh B., Ph.D.	Assistant Professor	Chemistry
Conlisk, John, Ph.D.	Associate Professor	Economics
Craig, Harmon, Ph.D.	Professor	Scripps Institution of Oceanography
Crowne, David K., Ph.D.	Assistant Professor	Literature
Dijkstra, Abraham J., Ph.D.	Assistant Professor	Literature
Doolittle, Russell F., Ph.D.	Associate Professor	Chemistry
Dunseath, Thomas K., Ph.D.	Associate Professor	Literature
Elliott, Robert C., Ph.D.	Professor	Literature
Ellis, Albert T., Ph.D.	Professor	Aerosp. & Mech. Eng. Scs.
Fahey, Robert C., Ph.D.	Assistant Professor	Chemistry
Feher, George, Ph.D.	Professor	Physics
FitzGerald, Carl H., Ph.D.	Assistant Professor	Mathematics
Frankel, Theodore T., Ph.D.	Professor	Mathematics

Frazer, William R., Ph.D.	Professor	Physics
Fredkin, Donald R., Ph.D.	Assistant Professor	Physics
Fung, Yuan-cheng, Ph.D.	Professor	Aerosp. & Mech. Eng. Scs.
Gibson, Carl H., Ph.D.	Assistant Professor	Aerosp. & Mech. Eng. Scs.
Gould, Robert J., Ph.D.	Assistant Professor	Physics
Green, Melvin H., Ph.D.	Associate Professor	Biology
Grobstein, Clifford, Ph.D.	Professor	Biology
Halkin, Hubert, Ph.D.	Associate Professor	Mathematics
Hamburger, Robert N., M.D.	Professor	Pediatrics
Harris, Seymour E., Ph.D.	Professor	Economics
Harrison, Newton A., M.F.A.	Assistant Professor	Visual Arts
Hawkins, James W., Ph.D.	Assistant Professor	Scripps Institution of Oceanography
Hayashi, Masaki, Ph.D.	Assistant Professor	Biology
Hegemier, Gilbert A., Ph.D.	Assistant Professor	Aerosp. & Mech. Eng. Scs.
Helinski, Donald R., Ph.D.	Associate Professor	Biology
Henry, Paul, S.J., D.D., D. es L.	Professor	Philosophy
Holbrook, John A., Ph.D.	Assistant Professor	Mathematics
Hooper, John W., Ph.D.	Professor	Economics
Huang, Nai-Chien, Ph.D.	Assistant Professor	Aerosp. & Mech. Eng. Scs.
Humphreys, Tom D., II, Ph.D.	Assistant Professor	Biology
Intaglietta, Marcos, Ph.D.	Assistant Professor	Aerosp. & Mech. Eng. Scs.
Jackson, Gabriel, Ph.D.	Professor	History
Kamen, Martin D., Ph.D.	Professor	Chemistry
Kirkby, Ronald V., Ph.D.	Assistant Professor	Philosophy
Kohn, Walter, Ph.D.	Professor	Physics
Kraut, Joseph, Ph.D.	Professor	Chemistry
Kroll, Norman M., Ph.D.	Professor	Physics
Langacker, Ronald W., Ph.D.	Assistant Professor	Linguistics
Lettau, Reinhard, Ph.D.	Professor	Literature
Libby, Paul A., Ph.D.	Professor	Aerosp. & Mech. Eng. Scs.
Liebermann, Leonard N., Ph.D.	Professor	Physics
Lin, Shao-Chi, Ph.D.	Professor	Aerosp. & Mech. Eng. Scs.
Linck, Robert G., Ph.D.	Assistant Professor	Chemistry
Livingston, Robert B., M.D.	Professor	Neurosciences
Loomis, William F., Jr., Ph.D.	Assistant Professor	Biology
Lovberg, Ralph H., Ph.D.	Professor	Physics

Luke, Jon C., Ph.D.	Assistant Professor	Mathematics
Ma, Shang-keng, Ph.D.	Assistant Professor	Physics
Maki, Kazumi, Ph.D.	Associate Professor	Physics
Makkreel, Rudolf A., Ph.D.	Assistant Professor	Philosophy
Malinovich, Stanley, Ph.D.	Assistant Professor	Philosophy
Malmberg, John H., Ph.D.	Professor	Physics
Marcuse, Herbert, Ph.D.	Professor	Philosophy
Masek, George E., Ph.D.	Professor	Physics
Mathews, William G., Ph.D.	Assistant Professor	Physics
Matthias, Bernd T., Ph.D.	Professor	Physics
Mayer, Joseph E., Ph.D.	Professor	Chemistry
Mayer, Maria Goeppert, Ph.D.	Professor	Physics
McIlwain, Carl E., Ph.D.	Professor	Physics
Mehlhop, Werner A. W., Ph.D.	Assistant Professor	Physics
Miles, John W., Ph.D.	Professor	Aerosp. & Mech. Eng. Scs.
Miller, David R., Ph.D.	Assistant Professor	Aerosp. & Mech. Eng. Scs.
Miller, Stanley L., Ph.D.	Professor	Chemistry
Monroe, James T., Ph.D.	Assistant Professor	Literature
Moore, Stanley, Ph.D.	Professor	Philosophy
Morrison, George R., Ph.D.	Associate Professor	Economics
Nachbar, William, Ph.D.	Professor	Aerosp. & Mech. Eng. Scs.
Nemat-Nasser, Siavouche, Ph.D.	Assistant Professor	Aerosp. & Mech. Eng. Scs.
Nguyen-Huu, Xuong, Ph.D.	Assistant Professor	Physics
Norman, Donald A., Ph.D.	Associate Professor	Psychology
Norton, David F., Ph.D.	Assistant Professor	Philosophy
Olfe, Daniel B., Ph.D.	Associate Professor	Aerosp. & Mech. Eng. Scs.
O'Neil, Thomas M., Ph.D.	Assistant Professor	Physics
Orr, Daniel, Ph.D.	Professor	Economics
Pawula, Robert F., Ph.D.	Assistant Professor	Aerosp. & Mech. Eng. Scs.
Pearce, Roy H., Ph.D.	Professor	Literature
Penner, Stanford S., Ph.D.	Professor	Aerosp. & Mech. Eng. Scs.
Peterson, Laurence E., Ph.D.	Associate Professor	Physics
Piccioni, Oreste, Ph.D.	Professor	Physics
Popkin, Richard H., Ph.D.	Professor	Philosophy
Prager, William, Sc.D., Eng.D.	Professor	Aerosp. & Mech. Eng. Scs.
Ramanathan, Ramachandra, Ph.D.	Assistant Professor	Economics

Rand, Sinai, Ph.D.	Associate Professor	Aerosp. & Mech. Eng. Scs.
Randel, Fred V., Ph.D.	Assistant Professor	Literature
Roberson, Robert E., Ph.D.	Professor	Aerosp. & Mech. Eng. Scs.
Ruff, Larry E., B.S.	Assistant Professor	Economics
Rumelhart, David E., Ph.D.	Assistant Professor	Psychology
Saltman, Paul D., Ph.D.	Professor, Provost of the College	Biology
Sarolli, Gian-Roberto, D.L.	Professor	Literature
Saunders, Jason L., Ph.D.	Professor	Philosophy
Schane, Sanford A., Ph.D.	Associate Professor	Linguistics
Schneider, Alan M., Sc.D.	Professor	Aerosp. & Mech. Eng. Scs.
Schrauzer, Gerhard N., Ph.D.	Professor	Chemistry
Schulman, Herbert M., Ph.D.	Assistant Professor	Biology
Schultz, Sheldon, Ph.D.	Associate Professor	Physics
Shenk, Norman, Ph.D.	Assistant Professor	Mathematics
Shore, Herbert B., Ph.D.	Assistant Professor	Physics
Shuler, Kurt E., Ph.D.	Professor	Chemistry
Simon, Melvin I., Ph.D.	Assistant Professor	Biology
Singer, S. Jonathan, Ph.D.	Professor	Biology
Smith, Donald R., Ph.D.	Assistant Professor	Mathematics
Sorenson, Harold W., Ph.D.	Assistant Professor	Aerosp. & Mech. Eng. Scs.
Stern, Herbert, Ph.D.	Professor	Biology
Stroll, Avrum, Ph.D.	Professor	Philosophy
Suess, Hans E., Ph.D.	Professor	Chemistry
Suhl, Harry, Ph.D.	Professor	Physics
Swanson, Robert A., Ph.D.	Associate Professor	Physics
Szanto, George H., Ph.D.	Assistant Professor	Literature
Thompson, William B., Ph.D.	Professor	Physics
Travis, William P., Ph.D.	Associate Professor	Economics
Traylor, Teddy G., Ph.D.	Professor	Chemistry
Urey, Harold C., Ph.D.	Professor	Chemistry
Van Atta, Charles W., Ph.D.	Assistant Professor	Aerosp. & Mech. Eng. Scs.
Vernon, Wayne, Ph.D.	Assistant Professor	Physics
Vold, Robert L., Ph.D.	Assistant Professor	Chemistry
Watson, Joseph W., Ph.D.	Assistant Professor	Chemistry
Wheatley, John C., Ph.D.	Professor	Physics
Wierschin, Martin W., Ph.D.	Assistant Professor	Literature
Williams, Forman A., Ph.D.	Professor	Aerosp. & Mech. Eng. Scs.
Williamson, Stanley G., Ph.D.	Assistant Professor	Mathematics
Wilson, Curtis A., Ph.D.	Professor	History
Wilson, Kent R., Ph.D.	Assistant Professor	Chemistry

Wong, David Y., Ph.D.	Professor	Physics
Wright, Andrew, Ph.D.	Professor	Literature
Zimm, Bruno H., Ph.D.	Professor	Chemistry
Zweifach, Benjamin W., Ph.D.	Professor	Aerosp. & Mech. Eng. Scs.

The Graduate Division

GRADUATE DEGREES OFFERED AS OF 1968-69

Applied Electrophysics	M.S., Ph.D.
Biology	Ph.D.
Chemistry	M.S., Ph.D.
Earth Sciences	M.S., Ph.D.
Economics	Ph.D.
Engineering Sciences:	
Aerospace Engineering	M.S., Ph.D.
Applied Marine Sciences	Ph.D.*
Applied Mechanics	M.S., Ph.D.
Bioengineering	M.S., Ph.D.*
Engineering Physics	M.S., Ph.D.
History	Ph.D.
Linguistics	M.A., Ph.D.
Literature, Comparative	Ph.D.
Literature, English	Ph.D.
Literature, Spanish	Ph.D.
Marine Biology	M.S., Ph.D.
Mathematics	M.A., Ph.D.
Music	Course Work**
Oceanography	M.S., Ph.D.
Philosophy	M.A., Ph.D.
Physics	M.S., Ph.D.
Psychology	M.A., Ph.D.

*Final approval pending.
**Graduate course work is now available.

The Nature of Graduate Instruction

Graduate courses are highly advanced courses which demand, on the part of instructors and students alike, critical analyses and research not usually encountered in undergraduate education. Graduate courses normally carry a number in the 200 series and may be conducted in any of several ways:

1) As advanced formal courses.
2) As seminars in which faculty and students present critical studies of specified divisions of knowledge.
3) As independent reading or study courses.
4) As research projects carried on under faculty supervision.

Work toward the Ph.D. degree requires a considerable amount of independent research. Therefore, students are allowed great flexibility in enrolment, provided they carry enough units to maintain and fulfil the residence requirements.

GENERAL REQUIREMENTS FOR ADVANCED DEGREES

Preparation

The background of a candidate for a graduate degree should be substantially equivalent to that provided by an appropriate undergraduate major in his field. If the candidate's preparation is found to be deficient, or if it fails to provide a proper foundation for advanced work, he must devote some time to certain undergraduate courses; this may require a longer period of residence than would otherwise be necessary.

Foreign Language Requirement

Most departments require students to demonstrate proficiency in one or more foreign languages. Before receiving the master's degree, or before taking the qualifying examination for advancement to candidacy for the Ph.D. degree, the student must satisfy the foreign language requirements established by his department and approved by the Graduate Council. Students are therefore strongly advised to acquire the best possible preparation in languages before entering graduate school; otherwise their programs may be seriously delayed.

Examinations to test the students' competence in the required languages are regulated by the Graduate Council. Reading proficiency in French, German, Russian, and Spanish is determined by completion of the ETS Graduate School Foreign Language Reading Examinations with a score equal to, or greater than, the approved minimum for each department. Oral proficiency in all languages and reading proficiency in languages other than the above (as may be authorized by the Graduate Council) is established by the Department of Linguistics, which acts in these matters as the agent of the Graduate Council.

The ETS exams are administered at UCSD by the Office of Testing. A student may satisfy reading proficiency in French, German, Russian, or Spanish before admission to Graduate School by having his score on the ETS examination forwarded to the Office of Testing, care of the Registrar's Office. (Only ETS scores will be accepted.)

The first attempt at an ETS examination is provided without charge; reexaminations are administered at a cost of $6 each. Special non-credit courses in required foreign languages are available for students who

wish to prepare for the examinations. (See *Interdisciplinary Courses: Language.*)

Standards of Scholarship

Only courses in which the student receives grades of *A, B, C, P* (Passed), or *S* (Satisfactory) are counted toward satisfaction of the requirements for a graduate degree. In addition, a graduate student must maintain a minimum grade-point average of 3.0 (*B* average) in all courses to continue in good standing.

Advisers

Normally the major department assigns every new graduate student an adviser to assist him in planning his degree program. A student may change his adviser at a later stage in his program by mutual agreement of all concerned.

THE MASTER'S DEGREE

Program of Study

The master's degree can be earned in either of two ways, one requiring a thesis and the other a comprehensive examination. Some departments offer both plans and others only one. (See department sections.) With the concurrence of his adviser, a student may select one of the two plans for fulfilment of the requirements for the master's degree. Under either plan all the requirements for the degree must be satisfied within twelve months after completion of the course requirements.

Plan I: *Thesis Plan*

Credit must be obtained for 36 quarter units, distributed as follows: at least 12 units in graduate courses in the major field, 6 additional units in graduate courses, 12 units in graduate or upper-division courses, and at least 6 research units which lead to a master's thesis to be approved by a committee of three faculty members appointed by the Dean of Graduate Studies.

Plan II: *Comprehensive Examination Plan*

Credit must be obtained for 36 units, at least 14 of which must be in graduate courses in the major field, 10 additional units in graduate courses and 12 units in graduate or upper-division courses. A comprehensive master's examination administered by the candidate's major department must be passed.

Advancement to Candidacy

A formal application for advancement to candidacy for the master's degree must be made through the Office of the Registrar. The application must be approved by the department concerned and by the Dean of Graduate Studies and must contain a detailed statement of the studies upon which the degree is to be based. Advancement to candidacy shall be con-

summated before the start of the quarter in which the degree will be conferred.

Residence Requirement

The minimum residence requirement is three academic quarters, at least one of which must follow admission to candidacy. Residence is established by satifactory completion of 6 units per quarter, including research.

THE DOCTOR OF PHILOSOPHY DEGREE

Programs of Study and Areas of Specialization

The general requirements for the degree Doctor of Philosophy are described below, and any special requirements are given in the department sections. Each student's schedule of course work and research is planned in consultation with his adviser, who will give consideration to the candidate's previous academic training, his career objective, the general regulations of the Graduate Division, and any specific departmental requirements. It is the student's responsibility to be aware of these regulations and requirements, and to satisfy them as early as possible. The major area of specialization is represented by a selection of courses which are closely related to each other and to the student's research, but which are not necessarily offered by the major department.

It should be pointed out that the degree Doctor of Philosophy is not automatically awarded for the technical completion of the requirements set forth herein, although such completion is necessary for the granting of the degree. A candidate is recommended for the doctorate only if he exhibits critical ability, scholarly knowledge, and mastery of his area of specialization. The student must demonstrate through his dissertation the ability to make original contributions to knowledge in his field. Throughout his career as a graduate student he must prove himself capable of independent work.

Residence Requirement

A doctoral program involves two stages of progress. The first stage requires at least three academic quarters of residence, and is spent in fulfilling the requirements established by the Graduate Division and by the major department (course work, teaching, language, residence, etc.). It is completed when the student passes the qualifying examination and is advanced to candidacy. The second stage is devoted to research and seminars, the preparation of the dissertation, and the final examination, and requires at least three academic quarters from the date of advancement to candidacy. To satisfy the residence requirement the student must spend at least three of the six academic quarters in continuous residence on the San Diego campus.

Qualifying Examination and Doctoral Committee

Upon nomination of the department or interdepartmental group overseeing the student's program, a doctoral committee is appointed by the

Dean of Graduate Studies. This committee conducts the oral qualifying examination, supervises and passes upon the dissertation, and conducts the final oral examination. The committee consists of five or more members; at least two shall be from departments other than that of the student's major. The qualifying examination tests the student's background in his general field and his preparation for independent research.

Candidacy

Each graduate student who wishes to become a candidate for the doctorate must file his application, approved by the doctoral committee, with the Registrar, who verifies that all formal requirements have been met and transmits the committee's recommendation to the Dean of Graduate Studies. Upon approval by the Dean and payment by the applicant of a fee of $25, the applicant is advanced to candidacy. This completes the first stage of his doctoral program.

Dissertation

A dissertation is required of every candidate for the Ph.D. degree. It must bear on his major area of study and show evidence of his ability to do independent research. The approval of the candidate's doctoral committee and of the Dean of Graduate Studies is required before the degree is awarded.

Candidates engaged in dissertation research often find it desirable or expedient to publish, prior to the conferring of the degree, certain findings that later will be incorporated in the dissertation. Under such circumstances, appropriate reference to the earlier publication should be included in the dissertation. The Graduate Division encourages such publication, but the entire dissertation is usually not published before the degree is conferred.

A draft of the dissertation must be submitted to each member of the doctoral committee at least four weeks before the final examination. Final copies of the approved dissertation must be filed with the Registrar for deposit in the University Library, preferably on the date of the final examination, and never more than a week later. Instructions for the preparation and submission of these may be obtained from the Office of the Registrar.

Final Examination

The candidate's final examination is conducted by his doctoral committee. The examination is oral and deals primarily with the subject of the dissertation and its relation to the student's general field of study.

Interdisciplinary and Special Courses

CONTEMPORARY ISSUES

Office: Building 412, Matthews Campus (Provost, Muir College)

These courses are administered by a committee chaired by the Provost of Muir College, and are to be used by Muir College freshmen in fulfilling the Contemporary Issues requirement of the college.

COURSES

1. Contemporary Issues **F-W**

A lecture course treating problems in public affairs. The lectures will be supplemented by discussion meetings, reading, and preparation of occasional papers. Both quarters must be taken in order to earn credit equivalent to that of an ordinary, single-quarter course.

2. Freshman Seminars on Contemporary Issues **F,W,S**

Seminars directed by members of the UCSD faculty and visiting professors, and treating in depth one contemporary issue or small group of related issues.

199A-199B. Special Studies in Contemporary Issues **F-W**

Individual reading and projects in the areas covered by the visiting lecturers for Contemporary Issues 1. Prerequisite: permission of Provost of Muir College and Director of Contemporary Issues.

CULTURAL TRADITIONS

Office: Building 412, Matthews Campus (Provost, Muir College)

These courses are administered by a committee chaired by the Provost of Muir College, and are to be used by Muir College students in fulfilling the Cultural Traditions requirement of the college.

COURSES

1A-1B-1C. Cultural Traditions: Greco-Roman **F-W-S**

A survey and analysis of the history, literature, philosophy, and art of the Greco-Roman World. Emphasis will be placed on the development of political and social institutions and on the distinctive features of artistic and intellectual life.

1A-1B-1C. Cultural Traditions: Hispanic **F-W-S**

An introduction to the cultural profile and diversity of the Hispanic world, past and present, in the Old and especially in the New World.

1A-1B-1C. Cultural Traditions: Islamic **F-W-S**

A survey in chronological order of the principal achievements of the Arab, Persian, and Turkish peoples in the cultural field, from pre-Islamic times to the present. Stress will be placed on social and cultural history, literature, philosophy and the arts. (Not offered in 1968–69.)

1A-1B-1C. Cultural Traditions: Mayan **F-W-S**

A study of the Maya culture as a distinctive mode and view of life, traced through time from prehispanic, to colonial, to present-day. Emphasis to be placed on the intellectual, artistic, literary, and moral aspects of Maya culture; on the functional interdependency between economic, social, and ideological factors; and on reactions to external influences.

1A-1B-1C. Cultural Traditions: India **F-W-S**

An introduction to the cultural diversity of India, past and present, through a study of the different units which integrate this diversity into particular civilizational patterns.

EARTH SCIENCES

Office: Provost, Revelle College

Developments in the discipline of the Earth Sciences suggest that the most effective means for undergraduates to enter this fascinating field is for the University to enrich its course work for majors in the Departments of Chemistry, Mathematics, and Physics with contemporary and exciting courses in the Earth Sciences.

The program in Revelle College is one which is based on the premise that a thorough grounding in one of the above disciplines is necessary. Thus an entering student will elect to enter the Department of Chemistry, Mathematics, or Physics and for the first two years will take the Revelle core curriculum. At the beginning of his junior year, a student will select his courses in consultation with the Earth Sciences adviser in his department. In most instances he may be able to substitute Earth Sciences courses for major requirements or restricted electives.

The degree will be granted by the major department and will indicate that the student's education has been enriched in the Earth Sciences

(B.A. in Chemistry with specialization in Earth Sciences).

A student who plans to graduate with a specialization in Earth Sciences must complete ES 101, 102, 103, 120 as a minimum course requirement. Additional courses for the Earth Sciences specialization may be elected with the aid of the adviser.

There is no required progression of courses other than the dictates of common sense in a field of cumulative knowledge. This interdisciplinary program will provide the student with the information to make the choice of a graduate major with the freedom that an undergraduate major in a basic science provides. This program will not impede the progress in such a basic science and will provide a concrete example of such sciences applied to Earth problems.

COURSES

101. Introductory Geology F

The origin and evolution of the Earth, especially its crust, and the evolution of life as indicated by the fossil record. Emphasis is on the nature of rocks and minerals, their origin, reconstitution, and decay; the evolution of continents, ocean basins, and mountain belts; processes of vulcanism; and the work of wind, water, and glaciers in modifying the Earth's surface, with the aim of creating an awareness in the student of the geological environment in which we live. Three lectures; occasional field trips.

102. Introductory Geochemistry W

The chemistry of the Earth and the solar system, and the applications of physical chemistry and nuclear physics to the study of the origin and geological history of the earth. Cosmic and terrestrial abundances of elements; nucleosynthesis; origin of the earth; mineralogy and chemistry of the Earth's crust, mantle, and core; geochronology and the geological time scale; chemistry of the atmosphere and the oceans. Three lectures, one discussion period.

103. Introductory Geophysics S

Selected geophysical subjects are treated in some depth. The emphasis is on topics that involve the entire planet Earth; the propagation of elastic waves through the earth, oceans and atmosphere; gravity, isostasy and the shape of the Earth; oceanic, atmospheric, and bodily tides; mountains, earthquakes, and the movement of continents. Three lectures.

120. Mineralogy—Optical Mineralogy S

Lectures and laboratory work on symmetry, morphology, goniometry, crystal structure, elementary X-ray crystallography, physical and chemical properties of minerals and recognition of common rock-forming minerals. Use of the petrographic microscope in the study of rock-forming minerals. Two three-hour periods of laboratory and lecture. Prerequisites: Earth Sciences 102 or concurrent registration.

122. Igneous and Metamorphic Petrology **F**
Physical, chemical, and mineralogical properties of igneous and metamorphic rocks. Emphasis is on the origin and genetic relationships as interpreted from field occurrences, theoretical studies, and experimental data. Laboratory studies include use of the petrographic microscope and X-ray diffraction equipment. Two three-hour periods of laboratory and lecture. Prerequisites: Earth Sciences 101, 102, 120 or consent of the instructor.

123. Sedimentary Petrology **W**
An introduction to the study of the physical, chemical, and mineralogical properties and the history of sediments and sedimentary rocks; stratigraphic principles and their application to the study of sedimentary rocks; and techniques of sedimentary petrography. Prerequisites: Earth Sciences 101, 102, 120 or consent of the instructor.

129A-129B-129C. Topics in Geology **F-W-S**
Reading course, with preparation of written reports, dealing with basic subjects and problems in Earth Sciences.

150. Field Geology **S**
Mapping of a field area and preparation of a geologic report. Principles of stratigraphy and descriptive structural geology are outlined in the lecture room and in the field. Field work is done on weekends in a local area. Prerequisites: Earth Sciences 101 and consent of the instructor. Earth Sciences 122 and 123 are recommended.

160. Geological History **S**
A series of lectures on current problems and directions of research in the field. At least half the lecturers will be guests and will be in residence for discussion with students. Open to undergraduate students only.

199. Independent Study for Undergraduates **F-W-S**
Independent reading or research on a problem by special arrangement with a faculty member. Prerequisite: consent of the instructor.

FRONTIERS OF SCIENCE

Office: Provost, Revelle College

This sequence of courses is designed to be used as a noncontiguous minor by Revelle College students who are not majoring in the sciences. However, inasmuch as the sequence (except for Frontiers of Science 2C) will be given at the upper-division level, a knowledge of the material covered in a Revelle College lower-division sequence in the natural sciences will be presupposed. (See *Natural Sciences*, this section.)

COURSES

2C. Frontiers of Science: Physics **F**
Mr. Teller
Presentation of current concepts in modern physics by the distinguished University Professor at Large, Edward Teller. (Same as Science 2C.)

101. Frontiers of Science: Contemporary Problems in Cosmology **W**

Mrs. Burbidge

The origin of the universe, quasars, radio astronomy, and other frontiers in astronomy and astrophysics.

102. Frontiers of Science: Scientific and Economic Problems Relating to Important Public Issues **S**

Mr. Penner

A course of lectures designed to acquaint undergraduates with factual information on important contemporary issues. (Same as AMES 160. See *Departments of Instruction.*)

HUMANITIES

Office: 1564 Humanities-Library Building

This sequence of courses is to be used by Revelle College students in fulfilling the humanities requirement of the college. It is offered jointly by the Departments of Literature, Philosophy and History, and has the purpose of introducing the student to the Western cultural tradition. He will learn to interpret major literary, historical and philosophical documents through lectures and discussions, as well as through the writing of themes. One aim of the course is to develop the student's ability to write clear and well-ordered expository prose.

A student may not graduate from Revelle College with a major in humanities. Students interested in the area of humanities must choose a specific major within the humanities, i.e., literature, philosophy, etc. See *Subject A* (this section) for explanation of the Subject A course in Revelle College.

COURSES

1. The Present Age **F**

Analysis of some major twentieth-century books and cultural trends. Two lectures, one discussion, regular assignments in expository writing.

2. Jews and Greeks **W**

Readings from the Bible, Homer and the Greek dramatists, historians and philosophers. Two lectures, one discussion, regular assignments in expository writing.

3. Rome and the Middle Ages **S**

Documents in the literature, philosophy and history of Rome and Medieval Europe. Two lectures, one discussion, regular assignments in expository writing.

4. The Renaissance **F**

Documents in the literature, philosophy and history of the Renaissance. Two lectures, one discussion, regular assignments in expository writing.

5. Classicism and Enlightenment W

Documents in the literature, philosophy and history of the seventeenth and eighteenth centuries. Two lectures, one discussion, regular assignments in expository writing.

6. The West after the French Revolution S

Documents in the literature, philosophy and history of the nineteenth century. Two lectures, one discussion, regular assignments in expository writing.

LANGUAGE

Office: Language Center, 445 Humanities-Library Building

Language proficiency requirements are established for undergraduate students by the Colleges and for graduate students by the Graduate Council. The language courses numbered 1A-1B-1C and 2A,2B,2C are designed primarily to aid the undergraduate student in attaining basic conversational and reading ability in a modern foreign language, but partly also to increase his general understanding of the nature of language itself and of the civilization in which that language is used. Many students who begin their study of the language at UCSD will be able to achieve required proficiency levels at the end of the 1A-1B-1C sequence; a student who has not done so may take Language 2A,2B,2C for as many quarters (up to a maximum of three) as he requires. A student who has studied the language for two or more years in high school (or the equivalent elsewhere) will not earn credit for 1A-1B-1C and is advised not to enrol in the sequence; instead, he is advised to enrol in Language 2 (for one to three quarters) until he reaches the required level of proficiency.

Every course numbered 1A-1B-1C or 2A,2B,2C includes, each week, 3-4 hours of small tutorial classes with a native speaker of the language, 3 hours of laboratory, 1-2 hours of conference classes with a linguist, and 3-6 hours of assigned homework. A student's tutorial section is reassigned to him weekly on the basis of his relative progress through the course; his assignment to a conference class is determined by his section assignment.

The courses numbered 11 and 12A,12B,12C are intended for students whose primary concern is to learn to read a language—for example, graduate students preparing to fulfil their graduate reading examination requirements, or undergraduate students who have already passed their college oral (conversational) proficiency requirements in another language. Courses numbered 12A,12B,12C need not be taken in sequence.

The language laboratory and language library at UCSD contain a strong collection of self-instructional materials, including recordings and "programmed learning" textbooks, in languages not normally offered in regular courses of instruction at UCSD. To encourage students to take advantage of these materials, credit will be granted to undergraduate students who

have passed their proficiency requirements in one language and wish to study another on a self-instructional basis. Such students should enrol in Language 19. They will be assigned an adviser from the Department of Linguistics, who will establish a program of study for them and arrange for a final examination. Subject to the availability of materials at a suitable level of advancement, Language 19 may be repeated for credit.

The facilities and materials in the language laboratory and language library are available to all students and faculty of the University, whether or not they are formally enrolled in the Language Program.

COURSES

Lang/Fr 1A-1B-1C. Elementary French **F-W-S**
Must be taken in sequence. See general description above.

Lang/Ge 1A-1B-1C. Elementary German **F-W-S**
Must be taken in sequence. See general description above.

Lang/It 1A-1B-1C. Elementary Italian **F-W-S**
Must be taken in sequence. Four hours tutorial, 3 hours laboratory, 1 hour conference with linguist. Class limited to 20 students. (Not offered 1968–69.)

Lang/Ru 1A-1B-1C. Elementary Russian **F-W-S**
Must be taken in sequence. See general description above.

Lang/Sp 1A-1B-1C. Elementary Spanish **F-W-S**
Must be taken in sequence. See general description above.

Lang/En 2A,2B,2C. Intermediate English as a Foreign Language **F,W,S**
Need not be taken in sequence. Open to undergraduate and graduate students whose native language is not English.

Lang/Fr 2A,2B,2C. Intermediate French **F,W,S**
Need not be taken in sequence. See general description above. Prerequisite: two or more years of high school instruction in the language or equivalent, or French 1C.

Lang/Ge 2A,2B,2C. Intermediate German **F,W,S**
Need not be taken in sequence. See general description above. Prerequisite: two or more years of high school instruction in the language or equivalent, or German 1C.

Lang/It 2A,2B,2C. Intermediate Italian **F,W,S**
Need not be taken in sequence. See general description above. Prerequisite: two or more years of high school instruction in the language or equivalent, or Italian 1C.
(Not offered 1968–69.)

Lang/Ru 2A,2B,2C. Intermediate Russian **F,W,S**
Need not be taken in sequence. See general description above. Prerequi-

site: two or more years of high school instruction in the language or equivalent, or Russian 1C.

Lang/Sp 2A,2B,2C. Intermediate Spanish **F,W,S,**
Need not be taken in sequence. See general description above. Prerequisite: two or more years of high school instruction in the language or equivalent, or Spanish 1C.

Lang/Ch 11. Elementary Chinese Reading* **F,W,S**
See general description above. (Offered only when staffing and budget permit.)

Lang/Du 11. Elementary Dutch Reading* **F,W,S**
See general description above. (Offered only when staffing and budget permit.)

Lang/Fr 11. Elementary French Reading* **F,W,S**
A course designed to prepare students for graduate reading examination.

Lang/Ge 11. Elementary German Reading* **F,W,S**
A course designed to prepare students for graduate reading examination.

Lang/Gr 11. Elementary Greek Reading* **F**
Introduction to the classical Greek language; preparatory to Lit/Gr 11.

Lang/Lat 11. Elementary Latin Reading* **F**
Introduction to the Latin language; preparatory to Lit/Lat 11.

Lang/Ru 11. Elementary Russian Reading* **F,W,S**
A course designed to prepare students for graduate reading examination.

Lang/Sp 11. Elementary Spanish Reading* **F,W,S,**
A course designed to prepare students for graduate reading examination. (Offered only when staffing and budget permit.)

Lang/Ch 12A,12B,12C. Intermediate Chinese Reading* **F,W,S,**
Need not be taken in sequence. See general description above. (Offered only when staffing and budget permit.)

Lang/Du 12A,12B,12C. Intermediate Dutch Reading* **F,W,S**
Need not be taken in sequence. See general description above. (Offered only when staffing and budget permit.)

Lang/Fr 12A,12B,12C. Intermediate French Reading* **F,W,S**
Need not be taken in sequence. A course designed to prepare students for graduate reading examination.

Lang/Ge 12A,12B,12C. Intermediate German Reading* **F,W,S**
Need not be taken in sequence. A course designed to prepare students for graduate reading examination.

Lang/Ru 12A,12B,12C. Intermediate Russian Reading* **F,W,S**
Need not be taken in sequence. A course designed to prepare students for graduate reading examination.

Lang/Sp 12A,12B,12C. Intermediate Spanish Reading* **F,W,S**
Need not be taken in sequence. A course designed to prepare students for graduate reading examination. (Offered only when staffing and budget permit.)

Language 19. Directed Study* **F,W,S**
See general description above. Self-instructional materials are available at present in Afrikaans, Arabic (Egyptian), Arabic (Iraqi), Bengali, Burmese, Chinese (Mandarin), Czech, Danish, Dutch, Efik, Finnish, French, German, Modern Greek, Hausa, Modern Hebrew, Hindustani, Hungarian, Icelandic, Igbo, Irish, Italian, Japanese, Korean, Luganda, Malay, Norwegian, Persian, Polish, Portuguese, Russian, Serbo-Croatian, Spanish, Swahili, Swedish, Thai, Turkish, Vietnamese, and Yoruba.

*CREDIT EARNED IN LANGUAGE COURSES WHICH DUPLICATES CREDIT GAINED IN PREVIOUS COURSES WILL NOT BE COUNTED TOWARDS GRADUATION. THUS A STUDENT WHO HAS STUDIED A LANGUAGE FOR TWO YEARS OR MORE IN HIGH SCHOOL OR ONE YEAR IN COLLEGE OR THE EQUIVALENT WILL NOT RECEIVE DUPLICATE CREDIT FOR COURSES IN THAT LANGUAGE NUMBERED 1A-1B-1C, 11, 12A, 12B, 12C AND 19.

NATURAL SCIENCES

Office: Provost, Revelle College

The two sequences of courses described below are given jointly by the Departments of Physics, Chemistry, and Biology. They are to be used by Revelle College students in fulfilling the natural science requirement of the college. The courses contain material equivalent to traditional lower-division chemistry, biology, and physics courses, but are organized in such a way as to eliminate unnecessary overlap of content.

The sequence Natural Science 1A-1B-1C-1D-1E is intended for students whose mathematics proficiency is at the level of the Mathematics 1 sequence. The material of this sequence is presented in a manner which minimizes the dependence on mathematics in the early quarters. Students who are enrolled in Mathematics 2 or have advanced standing will usually take the sequence Natural Science 2A-2B-2C-2D-2E. In either case, the courses are intended to be taken in the given order. Individual departments may recommend that the above sequences be supplemented with Natural Science 2F or 2FL.

Students who intend to major or minor in science or engineering are strongly advised to enrol in the sequence numbered 2. The more extensive use of mathematics and the deductive presentation enable the student to progress efficiently and in a natural manner to advanced work in science.

If warranted by enrolment and the numbers of students with advanced mathematics placement, an honors option may be offered within the Natural Science 2 sequence.

COURSES

1A. Natural Science: Chemistry **F**
The rudiments of chemistry including the chemical bond are covered from

the point of view of atomic structure and the periodic table. Three hours lecture, one hour recitation.

1B. Natural Science: Chemistry W
Thermochemistry and electrochemistry are developed on a descriptive level. An introduction to organic chemistry is provided in order to form a basis for the biology taught in Natural Science 1C. Three hours lecture, one three-hour laboratory.

1C. Natural Science: Biology S
An introduction to the general principles of biology with emphasis on the cell, heredity, and the chemical and physical bases of living processes. Three hours lecture, one hour recitation.

1D. Natural Science: Physics F
Basic physical concepts such as energy, momentum, and angular momentum are studied, and are applied in order to understand motion in space and the behavior of ideal gases. Three hours lecture, two hours recitation.

1E. Natural Science: Physics W
Basic electricity and simple quantum ideas are used in gaining an understanding of the physical basis for atomic structure and chemical binding. Three hours lecture, two hours recitation.

2A. Natural Science: Physics W
Introductory lectures on the range of natural phenomena which can be understood in terms of the physical sciences are followed by the study of particle motion. Applications are made to astronomy and to the structure of matter. Three hours lecture, one hour recitation, three hours problem session.

2B. Natural Science: Physics S
A continuation of Natural Science 2A to the electrical effects of stationary and moving charges, time dependent fields, and waves. Three hours lecture, one hour recitation, two hours problem session.

2C. Natural Science: Physical Chemistry F
The study of waves is followed by an introduction to the quantum theory as applied to atoms and their radiation. The exclusion principle is used to study the chemistry and physics of covalent and ionic binding in molecules and solids. Three hours lecture, one hour recitation, three hours laboratory.

2D. Natural Science: Chemistry W
The interactions of atoms and bulk properties of matter are further explored. Elementary thermodynamics, kinetic theory of gases, states of matter, ionic and covalent bonding are developed in more detail, with emphasis on systems of biological interest. Three hours lecture, one hour recitation, one three-hour laboratory.

2DL. Natural Science: Chemistry W
Recommended for students intending to major in chemistry and others

who wish to acquire some proficiency in the experimental methods of modern chemistry. Students in this course attend the same lecture and classroom sessions as those in Natural Science 2D. The laboratory will include work in qualitative and quantitative analysis, including instrumental methods. Three lectures, one recitation, two three-hour laboratory sessions.

2E. Natural Science: Biology S
An introduction to the general principles of biology, with emphasis on the cell, heredity, and the chemical and physical bases of living processes. Three hours lecture, one hour recitation.

2F. Natural Science: Chemistry S
A further development of the chemical properties of matter; acids and bases; complex ions; oxidation-reduction; electrochemistry; rates of chemical reactions. Three lectures, one recitation, one three-hour laboratory.

2FL. Natural Science: Chemistry S
This course bears the same relation to 2F as 2DL does to 2D. The laboratory will include further analytical work, along with other physical measurements, including the study of kinetics. Emphasis will be on precision and accuracy of technique as well as on the theoretical basis of experimental design. Three lectures, one recitation, two three-hour laboratory sessions.

SCIENCE

Office: Building 412, Matthews Campus (Provost, Muir College)

These courses are to be used by Muir College students in fulfilling the science requirement of the college.

Students who do not plan to major in a science may take any four courses on a list which will be available at the time of enrolment in classes. Included are the courses cited below (with the exception of Science 1D), which are intended for students planning to major in applied electrophysics, biology, or other sciences. Though special in nature, they may appeal to some students who are not planning advanced work in the sciences. Ordinarily, however, students not planning to major in a science will wait until the junior and senior years to take four courses, especially designed for them, which emphasize the cultural and philosophical aspects of science as well as giving them some acquaintance with major problems and conceptions of our time. These upper-division courses are in the process of development and will not be offered in 1968–69. (Science 1D is being offered fall quarter only for those students who are then finishing the former Science 1 sequence.)

COURSES

1D. On the Nature of Science F
A study of the historical and philosophical background of modern science

as it relates to the modes of scientific thought and inquiry. Fall quarter 1968 only.

2A-2B-2C. Science **W-S-F**

An integrated sequence intended for students with a special interest in the sciences and those needing preparation for advanced courses in applied electrophysics and other physical sciences. Must be taken in sequence. Prerequisite: Mathematics 1A or 2A. (Science 2C same as Frontiers of Science 2C.)

2D-2E. Science **W-S**

Continuation of Science 2A-2B-2C. Must be taken in sequence. Prerequisite: completion of 2A-2B-2C.

3C. Science **F**

This course will be required of all Muir students majoring in biology. Thermodynamics, physical chemistry, and chemical reactions will be studied, with occasional reference to reactions of biological interest. Emphasis will be on general principles and problem solving. Three lectures, one hour discussion. Prerequisites: Natural Sciences 1A-1B (Science 3A-3B not offered 1968–69.)

3D. Science **W**

Organic chemistry: an introduction to the structure, properties, and reactions of organic compounds. This course is intended primarily for biology majors and may not be taken by chemistry majors as a substitute for Chemistry 140A. Three lectures, one recitation. Prerequisite: Science 3C.

3E. Science **S**

Continuation of Science 3D with added laboratory work on the isolation of organic compounds and the measurement of physical properties. Three lectures, two three-hour laboratories. Prerequisite: Science 3D.

SUBJECT A

Office: 1017 Humanities-Library Building

REVELLE COLLEGE

The first quarter of Subject A in Revelle College is taught in conjunction with Humanities 1. The sections for Humanities 1/Subject A are constituted so as to allow more individual attention and more writing. A fee of $45 is charged for the additional instruction given in these sections. A student must receive a grade of *Satisfactory* for his written work in Humanities 1/Subject A to satisfy the Subject A requirement. Students who do not satisfy the Subject A requirement by the end of the first quarter in residence may not continue in the Humanities Sequence until they satisfactorily complete the following non-credit course:

Subject A (Fee $45) **F,W,S**

English Composition. Training in correct and competent writing. Must be completed with a mark of *Satisfactory* before further courses involving English composition (including courses in the Humanities Sequence) can be taken. Students whose work is of superior quality may, on recommendation of the Committee on Subject A, be permitted to withdraw from the course at a date to be determined by the Committee. Such students are regarded as having satisfied the Subject A requirement. A student who does not complete the course with a mark of *Satisfactory* must repeat the course each term while he is regularly enrolled until a mark of *Satisfactory* is given him.

MUIR COLLEGE

Subject A (Fee $45)

English Composition. Training in correct and competent writing. Must be completed with a mark of *Satisfactory* before further courses can be taken in which the writing of themes or papers forms a substantial part of the work. Students whose work is of superior quality may, on recommendation of the Committee on Subject A, be permitted to withdraw from the course at a date to be determined by the Committee. Such students are regarded as having satisfied the Subject A requirement. A student who does not complete the course with a mark of *Satisfactory* must repeat the course each term while he is regularly enrolled until a mark of *Satisfactory* is given him.

Departments of Instruction

AEROSPACE AND MECHANICAL ENGINEERING SCIENCES (INCLUDING BIOENGINEERING)

Office: 5202 Urey Hall

H. Bradner, *Ph.D., Professor of Engineering Physics and Geophysics* (Vice Chairman of the Department)

A. T. Ellis, *Ph.D., Professor of Applied Mechanics*

Y. C. Fung, *Ph.D., Professor of Bioengineering and Applied Mechanics*

P. A. Libby, *Ph.D., Professor of Aerospace Engineering* (Associate Dean of Graduate Studies)

S. C. Lin, *Ph.D., Professor of Engineering Physics*

*J. W. Miles, *Ph.D., Professor of Applied Mechanics and Geophysics*

W. Nachbar, *Ph.D., Professor of Applied Mechanics*

S. S. Penner, *Ph.D., Professor of Engineering Physics* (Chairman of the Department and Director, Institute for Pure and Applied Physical Sciences)

W. Prager, *Eng.D., Sc.D., Professor of Applied Mechanics*

R. E. Roberson, *Ph.D., Professor of Aerospace Engineering*

F. A. Williams, *Ph.D., Professor of Aerospace Engineering*

Alan M. Schneider, *Sc.D., Professor of Aerospace Engineering*

B. W. Zweifach, *Ph.D., Professor of Bioengineering*

A. Fronek, *M.D., C.Sc., Associate Professor of Bioengineering*

D. B. Olfe, *Ph.D., Associate Professor of Aerospace Engineering*

S. Rand, *Ph.D., Associate Professor of Engineering Physics*

R. L. Burton, *Ph.D., Assistant Professor of Engineering Physics*

C. H. Gibson, *Ph.D., Assistant Professor of Aerospace Engineering*

G. A. Hegemier, *Ph.D., Assistant Professor of Applied Mechanics*

N. C. Huang, *Ph.D., Assistant Professor of Applied Mechanics*

M. Intaglietta, *Ph.D., Assistant Professor of Bioengineering*

D. R. Miller, *Ph.D., Assistant Professor of Engineering Physics*

S. Nemat-Nasser, *Ph.D., Assistant Professor of Applied Mechanics*
R. F. Pawula, *Ph.D., Assistant Professor of Aerospace Engineering*
H. W. Sorenson, *Ph.D., Assistant Professor of Aerospace Engineering*
C. W. Van Atta, *Ph.D., Assistant Professor of Aerospace Engineering*

* * *

D. R. Kassoy, *Ph.D., Assistant Professor in Residence*
**E. Reissner, *Ph.D., Professor of Applied Mechanics in Residence*
†R. E. Stickney, *Ph.D., Visiting Associate Professor*
K. G. P. Sulzmann, *Research Engineer*
K. Fronek, *Associate Research Bioengineer*
J. Waugh, *Research Engineering Physicist*
T. J. Hendricks, *Assistant Research Engineer*
L. A. Kennedy, *Ph.D., Visiting Associate Research Engineer*
J. Lee, *Assistant Research Engineer*
H. S. Lew, *Assistant Research Engineer*
J. E. Prussing, *Assistant Research Engineer*
R. C. Shieh, *Assistant Research Engineer*
G. R. Stegen, *Assistant Research Engineer*
J. L. Way, *Assistant Research Engineer*

*On leave 1968–69.
**Winter quarter 1969.
†Winter and spring quarters 1969.

The current instructional and research programs emphasize high-temperature gas dynamics, fluid mechanics, bioengineering, solid mechanics and structures, and vehicle guidance and control. The graduate program is characterized by strong interdisciplinary relationships with the Departments of Physics, Mathematics, Biology, and Chemistry, with the Medical School, and with associated University institutes such as the Institute for Geophysics and Planetary Physics, the Institute for Pure and Applied Physical Sciences, and the Space Sciences Laboratory.

The Undergraduate Program

The Department of Aerospace and Mechanical Engineering Sciences offers three programs of study at the undergraduate level, each leading to the degree Bachelor of Arts (Applied Science). The three programs have common required courses in the junior year so that a student may delay his final choice of program to the end of the junior year. The *applied mechanics program* prepares the student for graduate studies in aerospace and mechanical engineering; the *electromechanics program* does the same in those areas of aeronautical and electrical engineering related to guidance, control and systems analysis; the *bioengineering program* prepares the student either for graduate studies in bioengineering or for professional training in the medical school. Students considering a major in applied mechanics or bioengineering are advised to take Mathematics 100 and Natural Science 2F in their sophomore year, and those considering a major in electromechanics are advised to take Mathematics 100, 101, and 102 in their sophomore year. The courses required by the Department are to be supplemented by electives in contiguous and noncontiguous areas chosen in consultation with departmental major

advisers. Students with superior records are expected to take courses beyond the minimum number—with special emphasis on mathematics, biology, chemistry, physics, and applied electrophysics.

Students who plan industrial careers and do not intend to go on to the Ph.D. are encouraged to take courses leading to the master's degree.

All students in AMES are required to take, in their junior year, courses in continuum mechanics, fluids and solids, dynamics, electromechanical systems, and thermodynamics, represented by AMES 100, 101A, 110, 120A, 120B, and 130A. Those students who have completed Mathematics 100 in their sophomore year are required to complete Mathematics 120, 121, and 122 in their junior year; those who have not done so are required to complete Mathematics 100 in the first quarter of the junior year.

Senior Year (Applied Mechanics Program)

A student electing to follow the applied mechanics program is required during his senior year to complete his studies of fluid mechanics with AMES 101B and 101C and of solid mechanics with AMES 130B. In special cases the adviser may recommend a different program.

It is recommended that students complete the noncontiguous minor (Revelle College) during their senior year. Electives necessary to fulfil minimum graduation requirements are generally chosen in physics, and are to be selected in consultation with departmental major advisers. Superior students are encouraged to supplement a minimum program with courses in AMES, mathematics, physical chemistry, and physics.

Senior Year (Electromechanics Program)

A student electing to follow the electromechanics programs is required, during his senior year, to complete his studies of dynamics with AMES 156 and to complete a sequence of courses devoted to systems theory—AMES 140A-140B-140C. It is recommended that students complete the noncontiguous minor (Revelle College) during their senior year. Electives necessary to fulfil minimum graduation requirements are generally chosen in either mathematics, physics, or applied electrophysics. Electives are to be selected in consultation with the major advisers. In special cases the adviser may recommend a different program.

Senior Year (Bioengineering Program)

A student electing to follow the bioengineering program is required, during his senior year, to take a series of courses in biology, Biology 101A, 101B, 101C, and in chemistry, either Chemistry 100A, 100B, or 140A, 140B. In addition, he is required to take three AMES courses, in fluid mechanics or solid mechanics, to be selected in consultation with his major adviser. In special cases the adviser may recommend a different program.

It is recommended that students complete the noncontiguous minor (Revelle College) during their senior year. Electives necessary to fulfil graduation requirements are to be selected in consultation with the major advisers.

Recommended Schedule for the Junior Year

	Fall	Winter	Spring
All Majors	AMES 100 AMES 120A Math 121 *	AMES 130A AMES 120B Math 120	AMES 101A AMES 110 Math 122

Recommended Schedule for the Senior Year

	Fall	Winter	Spring
Major in Applied Mechanics	AMES 101C **	AMES 130A	AMES 130B
Major in Electro-mechanics	AMES 140A	AMES 140B AMES 156	AMES 140C
Major in Bioengi-neering	Biology 101A Chemistry 100A or Chemistry 140A ***	Biology 101B Chemistry 101B or Chemistry 140B ***	Biology 101C ***

*Math 100, if not completed in the sophomore year.

**AMES 111 is recommended as an elective for students majoring in fluid mechanics.

***AMES 101B, 101C, 130B are recommended.

The Graduate Program

Admission will be in accordance with the general requirements of the Graduate Division. Candidates with bachelor's or master's degrees in mathematics, the physical sciences, or any branch of engineering are invited to apply.

The Department of the Aerospace and Mechanical Engineering Sciences offers graduate instruction leading to the master's and Ph.D. degrees in Engineering Sciences with specialization in Aerospace Engineering, Applied Mechanics, or Engineering Physics. Programs leading to the master's and Ph.D. degrees in Engineering Sciences with specialization in Bioengineering are being planned, as is a Ph.D. program in Engineering Sciences with specialization in Applied Marine Sciences. Graduate stu-

dents should acquire some background over the full range of activities of the Department. Suitable courses for this purpose are AMES 101A, 130A, 140A, and any one of the following: 271A, 272, 273. The adviser may recommend other ways of satisfying breadth requirement.

The instructional and research programs are characterized by strong interdisciplinary relationships with the Departments of Mathematics, Physics, and Chemistry, and with associated campus institutes such as the Institute for Pure and Applied Physical Sciences, the Institute of Geophysics and Planetary Physics, and the Space Sciences Laboratory.

Master's Degree Program

The Department will award master's degrees (M.S.) in Engineering Sciences with specialization in Aerospace Engineering, Applied Mechanics, and Engineering Physics. (A master's degree in Engineering Sciences with specialization in Bioengineering is anticipated.) Both Plan I and Plan II are offered. (See *Graduate Division: The Master's Degree.*) The Department's specific requirements are as follows:

1. The course of study must be approved by the student's adviser. The courses should generally include six (for Plan I) or nine (for Plan II) quarter courses (numbered 200) offered by the AMES faculty. In special situations, where the departmental adviser is satisfied that the candidate has adequate proficiency in areas to be covered by these courses, other graduate courses may be elected as substitutes.
2. Students must have an average grade of B or higher in the courses taken in fulfilment of requirements for the master's degree.
3. The thesis under Plan I is reviewed by a thesis adviser and two other faculty members nominated by the department chairman.

Doctor's Degree Program

A departmental examination will be given to all Ph.D. candidates prior to the regular Ph.D. qualifying examination. This departmental examination will normally be taken after the completion of three quarters of full-time graduate work. It will be administered by a committee consisting of four or more AMES faculty members, appointed by the Department Chairman on the basis of nominations made by the student's adviser.

Students who transfer to AMES from other departments, and who have passed unconditionally a departmental examination administered by another department, will not be required to pass a departmental examination administered by AMES. However, these transfer students must obtain certification from their advisers that they possess professional knowledge of fluid mechanics, solid mechanics, bioengineering, or vehicle guidance and control before taking the Ph.D. qualifying examination.

After satisfactory completion of the departmental examination, graduate students in AMES must pass the usual Ph.D. qualifying examination administered by the student's doctoral committee. See *Graduate Division: The Ph.D.*

Doctoral candidates in AMES will be required to demonstrate either (*a*) reading knowledge of two languages: the first must be Russian,

German, or French; the second may be any language other than English (non-English–speaking aliens may use proficiency in their native tongue to meet this requirement), *or* (*b*) reading and speaking knowledge of Russian, German, or French. A minimum ETS score of 420 in the chosen languages will meet AMES departmental requirements for reading knowledge. (See *Graduate Division: Foreign Language Requirement.*)

Successful candidates will be awarded the Ph.D. degree in Engineering Sciences, with the special fields Aerospace Engineering, Engineering Physics, or Applied Mechanics designated. Degrees in Engineering Sciences with specialization in Bioengineering and in Applied Marine Sciences are anticipated.

COURSES

UPPER DIVISION

100. Continuum Mechanics F

Discussion of common foundations of fluid and solid mechanics; stress; instantaneous motion (rates of rotation and deformation); stress rate; constitutive equations (Newtonian fluid, elastic solid); conservation of mass; momentum and energy theorems. Four hours lecture, two hours laboratory. Prerequisites or co-registration: AMES 110, Mathematics 100.

101A. Fluid Mechanics S

Potential-flow theory with application to airfoils and wings; hydrostatics, atmospheric structure, and other aspects of geophysical fluid mechanics; equations for compressible flows and for viscous flows. Four hours lecture, two hours laboratory. Prerequisites: AMES 100, Mathematics 120, and prerequisite or co-registration in AMES 110.

101B. Fluid Mechanics F

Compressible-flow theory, including generalized one-dimensional flow and wave phenomena; theory of inviscid reacting flows. Four hours lecture, two hours laboratory. Prerequisites: AMES 101A, 110, Mathematics 121. (Not offered every year.)

101C. Fluid Mechanics F

Continuation of 101B. Viscous-flow theory, including boundary-layer theory; transport phenomena; applications in biophysics and in combustion and propulsion theory. Four hours lecture, two hours laboratory. Prerequisites: AMES 101B, Mathematics 122.

110. Thermodynamics S

First and second laws and selected applications, e.g. thermochemistry, heat capacities and heats of reaction, engine cycles, etc. Three hours lecture. Prerequisite: junior standing, or consent of the instructor.

111. Thermodynamics F

Extension of 110, topics selected from chemical thermodynamics; adiabatic flame temperatures; engine performance evaluation; fuel cells and

secondary power units; thermodynamic functions for ideal gases; low-temperature thermodynamics; information theory; irreversible thermodynamics; metallurgical applications. Three hours lecture. Prerequisite: AMES 110, and prerequisite or co-registration in AMES 101A. Not offered 1968-69.

120A. Dynamics F
Particle dynamics: conservation laws; work, energy, and power; collision; systems of particles; motion in a moving frame, Coriolis and centrifugal forces. Generalized coordinates; Lagrange's equations. Variable mass. Oscillations. Introduction to rigid-body dynamics; planar motion; three-dimensional motion of free symmetric bodies. Four hours lecture. Prerequisite or co-registration: Mathematics 120.

120B. Electromechanical Systems W
Linear systems theory. Classical circuit theory. State-variable and frequency domain analysis of linear systems with applications to electrical, mechanical, and thermal systems. Four hours lecture. Prerequisites or co-registration: AMES 120A, Mathematics 121.

130A. Solid Mechanics W
Discussion of elastic, plastic, viscoelastic and viscoplastic solids in connection with simple static and dynamic problems concerning structural elements and structures (rods, beams, rings, and frames). Four hours lecture, two hours laboratory. Prerequisite: AMES 100.

130B. Solid Mechanics S
Discussion of simple problems in two- and three-dimensional elasticity (torsion, flexure, stress concentration at circular holes; plane waves, Rayleigh waves, thermoelasticity). Simple illustrative problems in viscoelasticity and plasticity. Four hours lecture, two hours laboratory. Prerequisite: AMES 130A.

140A. Automatic Control Systems F
Multi-degree-of-freedom linear systems; eigenvalues, eigenvectors, normal coordinates. Classical procedures for automatic feedback control systems; transfer functions; stability; Bode, Nichols, Nyquist, and root locus plots. Examples from biological, electrical and mechanical systems. Brief over-view of field of systems dynamics and control. Prerequisite: AMES 120B or consent of instructor.

140B. Automatic Control Systems W
Generalized concepts of system performance analysis based on frequency, transient, and error coefficient methods; compensation with lead or lag networks; gain-phase and pole-zero plots. Linear sampled-data systems; Z-transforms. Associated laboratory involving analog and/or hybrid computer and automatic control devices. Prerequisite: AMES 140A.

140C. Automatic Control Systems S
Introduction to nonlinear systems; quasilinearization; describing functions; phase-plane analysis; Lyapunov functions. Introduction to random

processes for time-invariant linear systems. Introduction to state-space characterization of dynamic systems. Computer simulation of nonlinear systems. Prerequisite: AMES 140B.

156. Rigid Body Dynamics **W**
Three-dimensional rigid body dynamics with applications. Representation of rotations; angular velocity and kinematical differential equations; dynamical equations. Classical problems of free and heavy bodies; the libration problem; bodies with variable mass. Prerequisites: AMES 120A, 120B.

160. Scientific and Economic Problems Relating to Important Public Issues **S**
A course of lectures designed to acquaint undergraduates with factual information on important contemporary issues. Three hours lecture. Prerequisite: junior standing. (Same as Frontiers of Science 102.)

199. Independent Study for Undergraduates **F,W,S**
Independent reading or research by special arrangement with a faculty member.

GRADUATE

205. Graduate Seminar (1) **F,W,S**
The Staff
All graduate students in AMES are expected to attend the biweekly departmental research conference. On alternate weeks, all graduate students should attend a departmental seminar of their choice dealing with current topics in fluid mechanics, solid mechanics, bioengineering, or guidance and control. (Satisfactory/Unsatisfactory grades only.)

206. Physical Principles and Problems (1) **F,W,S**
Mr. Bradner
Principles of applied science illustrated by problems in mechanics, dynamics, electricity, optics, thermodynamics, etc. Presentation of individual research. Preparation of interdepartmental oral examination.

210A-210B-210C. Introductory Fluid Mechanics (3-3-3) **F,W,S**
Mr. Miller, Mr. Van Atta, Mr. Gibson
Physical properties of fluids; kinematics; potential flow; wing theory; surface waves; gas dynamics; shock waves; Navier-Stokes equations; boundary layers; turbulence. Prerequisites: undergraduate fluid mechanics and thermodynamics, or consent of the instructor.

211A. Propulsion: Air-breathing Engines (3) **F**
Mr. Williams
Propulsion of aircraft, missiles, and boosters by air-breathing engines, including cycle analysis; characteristics of engine components, and matching of engine components to produce an efficient engine. Prerequisites: undergraduate fluid mechanics and thermodynamics, or consent of the instructor.

211B. Propulsion: Chemical Rockets and Mission Analysis (3) **W**
Mr. Miller
Solid- and liquid-propellant rocket engines, combustion processes, motor design and performance; rocket configurations; mission analyses; optimization calculations. Prerequisite: AMES 211A, undergraduate fluid mechanics and thermodynamics, or consent of the instructor.

211C. Propulsion: Electric and Nuclear (3) **S**
Mr. Burton
Principles of thermal, electrothermal, electrostatic, and electromagnetic propulsion; selected electromagnetic theory and physics of ionized gases; plasma acceleration mechanisms; requirements for specific space missions. Prerequisites: undergraduate fluid mechanics, and electricity and magnetism, or consent of the instructor.

220A. Physical Gas Dynamics (3) **F**
Mr. Rand
Kinetic theory of neutral gases; transport properties; principles and applications of statistical mechanics. Prerequisites: AMES 210A-210B-210C, Mathematics 120-121-122, Physics 140, or consent of the instructor.

220B. Physical Gas Dynamics (3) **W**
Mr. Lin
Principles of electrodynamics and quantum mechanics; theories of atomic and molecular structure; perturbation method in quantum mechanics; semiclassical treatment of radiation; scattering phenomena; transition probabilities; vibrational relaxation; dissociation, ionization, and recombination. Prerequisites: AMES 210A-210B-210C, 220A, Physics 130A-130B, Mathematics 120-121-122, or consent of the instructor.

220C. Physical Gas Dynamics (3) **S**
Mr. Lin
Shock waves and detonation waves; explosions and hypersonic flow; experimental methods in high-temperature gases; shock tubes; atomic and molecular beams; selected topics such as chemical reactions and relaxation processes in turbulent flow interaction of radiation with ionized gases and gas lasers. Prerequisites: AMES 210A-210B-210C, 220A-220B, Physics 130A-130B, Mathematics 120-121-122, or consent of the instructor.

221A. Opacity Calculations (3) **F**
Mr. Penner
Basic laws for radiant-energy emission from gases, liquids, and solids; spectral absorption coefficients, line shapes, curves of growth; theoretical and experimental methods for estimating opacities of uniform and nonuniform gases. Prerequisites: consent of the instructor. (Not offered every year.)

221B. Radiative Transfer Theory (3) **W**
Mr. Penner, Mr. Olfe
Fundamental quantities and the equation of transfer; methods of solving

radiative transfer problems for gray and non-gray gases; nonstationary problems. Prerequisite: AMES 221A, or consent of the instructor. (Not offered every year.)

221C. Radiation Gas Dynamics (3) S
Mr. Olfe
Conservation equations of gas dynamics including a radiation field; the effect of radiative transfer on acoustic waves, shock-wave structure, and boundary layers; radiative cooling in the shock layers of high-velocity reentry vehicles; radiative transfer effects on convection and turbulence. Prerequisites: AMES 221A-221B, or consent of the instructor. (Not offered every year.)

222A-222B-222C. Advanced Fluid Mechanics (3,3,3) F-W-S
The Staff
Contemporary problems in broad areas of fluid mechanics, e.g., surface waves, hydrodynamic stability, boundary layers with mass and heat transfer, turbulent-flow theory, multiphase systems, hypersonic-flow theory, shock-wave structure, theory of reacting flows, etc. Prerequisites: AMES 210A-210B-210C, 211A-211B-211C, Mathematics 120-121-122, or consent of the instructor.

223. Applications of Plasmadynamics (3) S
Mr. Rand
Kinetic theory of ionized gases; plasma transport properties; moment equations; interactions of waves with plasma. Prerequisite: AMES 220A, Physics 100A, 100B, 100C, or consent of the instructor.

231A. Foundations of Solid Mechanics (3) F
Mr. Nemat-Nasser
Cartesian tensors; specification of stress, instantaneous motion, and infinitesimal strain; conservation principles; typical constitutive equations; specification of finite strain. Prerequisite: AMES 130B, or consent of the instructor.

231B. Elasticity (3) W
Mr. Huang
Basic field equations; typical boundary value problems; uniqueness of solutions; torsion, flexure, and other simple problems; variational principles. Prerequisite: AMES 231A, or consent of instructor.

231C. Anelasticity (3) S
Mr. Prager
Mechanical models of viscoelastic, plastic, and viscoplastic behavior in simple shear or uniaxial stress. Constitutive laws for three-dimensional states of stress and strain. Application to selected technological problems. Prerequisite: AMES 231B, or consent of instructor.

232. Matrix Methods in Structural Analysis (3) F
Mr. Prager
Elements of matrix algebra; application of transfer matrix and force and

displacement methods to linear and nonlinear problems. Application of finite elements techniques to elastic and anelastic problems. Prerequisite: AMES 231C, or consent of instructor.

233A. Advanced Elasticity (3) **W**
Mr. Nemat-Nasser
Two-dimensional problems and complex variable methods; fundamentals of plate theory; application of potential theory to some three-dimensional problems; elastic waves; problems involving finite deformations. Prerequisite: AMES 231B, or consent of instructor.

233B. Advanced Plasticity (3) **W**
Classification of plastic solids; behavior of plastic structures; limit analysis; plastic design and optimization; finite plastic deformation; application to technological forming processes; dynamic problems. Prerequisite: AMES 231C, or consent of instructor. (Not offered 1968–69.)

233C. Advanced Viscoelasticity (3) **S**
Stress analysis problems for mixed and moving boundary conditions; temperature effect and irreversible thermodynamics; creep buckling; wave propagation; nonlinear constitutive equations. Prerequisite: AMES 231C, or consent of instructor. (Not offered 1968–69.)

234. Experimental Stress Analysis (3) **F**
Mr. Ellis
Theory and technique of standard and newly developed methods; laboratory experience using modern instrumentation such as strain gages, capacitive piezoelectric and piezoresistive devices, and surface coatings; application of photoelasticity, laser interferometry, and holography to problems in static and dynamic elasticity and plasticity. Ultra-high-speed measurements will be emphasized. Prerequisite: AMES 231C, or consent of instructor.

235A-235B. Theory of Shells (3,3) **W-S**
Mr. Huang, Mr. Hegemier
General mathematical formulation of the theory of thin elastic shells: linear membrane and bending theories; small strain and finite rotation theories; shells of revolution; shallow shells; selected static and dynamic problems; survey of recent advances. Prerequisite: AMES 231B, or consent of instructor.

236. Structural Stability (3) **S**
Mr. Nachbar
Stability analysis of structural elements under steady, oscillatory, and impulsive loadings. Elastic and anelastic stability problems. Prerequisite: AMES 235A, or consent of instructor.

237. Vibrations of Structures (3) **F**
Free and forced vibration of structural elements; frequency analysis; aeroelasticity and flutter analyses of wings, panels, shells. Prerequisites:

AMES 210A and 233C, or consent of instructor. (Not offered 1968–69.)

250A. Astrodynamics and Rocket Navigation (3) F
Mr. Schneider
Practical application of celestial mechanics to vehicle analysis; elements of a two-body orbit; elliptical, parabolic, hyperbolic orbits. Coordinate systems; orbit transfer in single-force field and multiple-force field systems; optimal plane change; lunar flights; interplanetary flight; low-thrust vehicles. Prerequisites: basic mechanics, spherical trigonometry, vector and matrix methods, AMES 120A, 120B, 156, or consent of the instructor.

251A. Guidance of Aerospace Vehicles (3) W
Mr. Schneider
Survey of guidance problems; definitions, mission phases, guidance requirements, intercept (proportional navigation and homing), explicit and implicit guidance, rendezvous, methods of steering, steering control and stability, introduction to optimal steering laws. Prerequisites: AMES 140A-140B-140C, AMES 250A, or consent of the instructor.

251B. Gyrodynamics and Inertial Navigation Systems (3) S
Mr. Schneider
Behavior of gyros and accelerometers; inertial navigation system equations for cruise and orbiting vehicles; Schuler tuning, error analysis. Alignment; gyrocompassing on fixed and moving vehicles; four-gimbal, three-gimbal, and strapdown systems. Prerequisite: AMES 251A, or 256A. (Not offered 1968–69.)

253A. State-Space and Time-Domain Approach to Control Theory (3) F
Mr. Pawula
Utility of time-domain methods in control system analysis and design. Matrix polynomials, functions of matrices, matrix differential equations, transfer function matrices, the fundamental (state-transition) matrix, canonical representation of dynamic systems. Controllability, observability. Stability analysis. Prerequisites: AMES 140C, Mathematics 101.

255A. Theory of Optimal Control (3) W
Mr. Sorenson
Bounded controls. Sets of reachable states. Necessary and sufficient conditions for optimality. Calculus of variations. Pontryagin's maximum principle. Dynamic programming. Existence and uniqueness. Applications to minimum-time and minimum-fuel problems; design of optimal systems using switching curves and surfaces. Optimal linear regulators and tracking systems with quadratic performance criteria. Prerequisite: AMES 253A.

255B. Theory of Optimal Control (3) S
Mr. Sorenson
Computational techniques for determining optimal control policies. First-

order gradient and steepest-descent methods. Second-order gradient and Newton-Raphson algorithms. Invariant imbedding and dynamic programming. Neighboring extremals. Conjugate gradients. Topics on optimal stochastic control theory. Linear stochastic systems and the separation principle. Prerequisite: AMES 255A. (Not offered 1968–69.)

256A. Advanced Rotational Dynamics (3) S
Mr. Roberson
Dynamics of systems of rigid bodies, spinning and vibrating bodies, methods of averaging, stability, gyrostats and gyroscopic devices. Prerequisites: AMES 156, Math 101.

256B. Spacecraft Attitude Control (3) F
Mr. Roberson
The space environment and its role in attitude control of aerospace vehicles. Torques, including gravitational and magnetic. Inertial and optical sensors. Actuators. Design considerations in passive and active control. Prerequisite: AMES 256A. (Not offered 1968–69.)

264. Filtering and Random Processes in Automatic Control (3) W
Mr. Pawula
Statistical problems of importance to control engineers. Extensive treatment of random processes in linear feedback systems, including optimum design of such systems; estimation theory, Wiener filtering and Kalman filtering. Brief treatment of nonlinear systems in the presence of random noise. Prerequisites: basic feedback control theory and AMES 294A, or consent of the instructor. (Not offered 1968–69.)

271A. Bioengineering 1: Structure and Function of Tissues (3) F
Mr. Zweifach
A general survey will include examples of relationships between structure and function at the cell and tissue level. Emphasis will be placed on components of the vascular system and related structures such as endothelium, erythrocytes, leucocytes, cardiac, smooth, and skeletal muscle, connective tissue, basement membranes, and peripheral nerve cells. Prerequisite: consent of the instructor.

271B. Bioengineering 1: Circulatory System (3) W
Mr. Fronek, Mr. Zweifach
Morphology and physics of heart, large blood vessels, vascular beds in major organs, and the microcirculation. Included will be the physical principles of blood flow, work of heart, electrophysiology of heart, pulse waves, descriptions of particular vascular beds and their biological and hemodynamic importance. Integration of separate components through nervous and humoral controls will be analyzed. Prerequisite: consent of the instructor.

271C. Bioengineering 1: Respiration and Cardio-pulmonary Reflexes (3) S
Mr. Fronek
General concepts and principles of morphology of lung structures, pulmonary gas exchange, cardio-pulmonary reflexes, and integrative action

of nervous system on the pulmonary and respiratory system. Prerequisite: consent of the instructor.

272. Bioengineering 2: Biomechanics and Systems Analysis (3) W
Mr. Fung.
Applications of continuum mechanics and systems analysis to specific problems such as wave propagation in blood vessels, stability theory, pressure-flow relationships, autoregulation, elasticity of red blood cells, mechanics of flow in small blood vessels, and geometry of vessels in relation to their behavior. Prerequisite: consent of the instructor.

273. Bioengineering 3: Transport Phenomena (3) S
Mr. Intaglietta
Microscopic and macroscopic transport phenomena occurring in biological systems treated from the viewpoint of statistical mechanics and fluid dynamics. Exchange at the blood capillary level. Diffusion through biological structures. The mechanisms of membrane action. The application of non-equilibrium thermodynamics to the analysis of biological transport phenomena. Prerequisite: consent of the instructor.

274. Advanced Cell Physiology (3) W
Mr. Zweifach
An advanced course in selected areas of cell physiology for bioengineering, medical, and biology students. Discussion of several special types of cells: endothelium, smooth-muscle cells, lymphocytes, neutrophiles, platelets, macrophages, etc. The ultrastructure and biochemical characteristics of these cell types will be considered. Emphasis will be placed on quantitative measurements and analyses based on mathematical and physical principles. Prerequisite: consent of the instructor.

275. Selected Topics in Bioengineering (3) W
The Staff
Discussion of research areas under current investigation in the bioengineering group. Visiting scientists will be invited to cover topics of current interest. Prerequisite: consent of the instructor.

276. Laboratory Projects in Bioengineering (3) F
Mr. Intaglietta
Theory of statistical inference, analysis, and design of experiments; data handling by digital computers, video tape recording, etc. Theory and application of optical and electronic instrumentation. The course will consist of lectures, conferences, and demonstrations, as well as the student's own selected laboratory project for study in depth. Prerequisite: consent of the instructor.

294A. Methods in Applied Mechanics (3) F
Mr. Pawula
Probability distribution functions; statistical independence; functions of random variables; characteristic functions; correlation functions; time averages; sampling; the central limit theorem; spectral analysis; the

Gaussian random process; narrow-band processes, linear systems; random walks, the Fokker-Planck-Kolmogorov equations and Brownian motion. Prerequisites: Mathematics 120-121-122, or consent of the instructor. (Not offered 1968–69.)

294B. Methods in Applied Mechanics (3) **W**

Motion of discrete and continuous conservative systems; boundary-value problems of dynamics; eigenfunctions and eigenvalues; applications of integral transform methods, Green's functions, and calculus of variations. Stability of continuous systems. Prerequisites: Mathematics 120-121-122, or consent of the instructor. (Not offered 1968–69.)

294C. Methods in Applied Mechanics (3) **S**

Continuation of 294B. Diffusion processes and transport phenomena (elliptic and parabolic equations, integral equations). Application of asymptotic expansions and singular perturbation techniques. Prerequisite: AMES 294B, or consent of the instructor. (Not offered 1968–69.)

296. Independent Study (3, 3, 3) **F,W,S**

The Staff

299. Graduate Research (1-12, 1-12, 1-12) **F,W,S**

The Staff

ANTHROPOLOGY

Office: Building 412, Matthews Campus

Robert M. Carmack, *Ph.D., Assistant Professor of Anthropology*
Joseph W. Michels, *Ph.D., Assistant Professor of Anthropology*

The Department of Anthropology is being formed. At the moment it is too small to offer a major. As courses and a major program are added, they will be announced. Meanwhile, the following are available.

COURSES

LOWER DIVISION

1. Introduction to Physical Anthropology **F**

The evolution of man and the races as revealed through paleontology, primatology, genetics, and archaeology. The development of the Hominids is traced from Proconsuloid forms to modern races of *Homo sapiens*, with emphasis on evolutionary processes of adaptation. Three lectures, one discussion.

2. Prehistory: Introduction to Old World Archaeology **W**

Old World cultural history as revealed by archaeology and related studies. The development of culture is traced from the early Stone Age through the development of agriculture. Three lectures, one discussion.

3. Introduction to Cultural Anthropology S

The concept and variations of culture. On a cross-cultural basis, the following kinds of component cultural systems are analyzed: technology, economics, family, corporations, personality, language, art, and religion.

10. Social Anthropology F

An introduction to the methods, theories, and data of social anthropology. Topics that might be explored in addition to the general principles of the field are: the organization of production, distribution, and consumption; systems of kinship and marriage; political systems; legal systems and social control; stratification; the social basis of culture; the organization of ritual; social change and evolution. Three lectures. Prerequisite: Anthropology 3 or consent of the instructor.

UPPER DIVISION

100. Social Institutions of Prehistoric Mesoamerica S

The prehistoric culture of Mesoamerica, from the Lithic to the post-Classic stages, with particular attention to Mesoamerica on the eve of the Spanish conquest and the social institutions of the Aztecs of Mexico and the Maya of Yucatan.

110. Social Anthropology F

For description see Anthropology 10 above (advanced work required). Three lectures. Prerequisite: Anthropology 3 or consent of the instructor.

199. Independent Study F,W,S

Independent study or research under the direction of a member of the staff. Prerequisite: special permission of the Department.

APPLIED ELECTROPHYSICS

Office: 7104 Urey Hall

W. Ian Axford, *Ph.D., Professor of Applied Electrophysics*

Henry G. Booker, *Ph.D., Professor of Applied Electrophysics* (Chairman of the Department)

Kenneth L. Bowles, *Ph.D., Professor of Applied Electrophysics* (Director of the Computer Center)

Jules A. Fejer, *D.Sc., Professor of Applied Electrophysics*

Carl W. Helstrom, *Ph.D., Professor of Applied Electrophysics*

Adolf W. Lohmann, *Ph.D., Professor of Applied Electrophysics*

Victor H. Rumsey, *B.A., Professor of Applied Electrophysics*

Irwin M. Jacobs, *Sc.D., Associate Professor of Information and Computer Science*

Manuel Rotenberg, *Ph.D., Associate Professor of Applied Electrophysics*

Peter M. Banks, *Ph.D., Assistant Professor of Applied Electrophysics*

George J. Lewak, *Ph.D., Assistant Professor of Applied Electrophysics*

Huey-Lin Luo, *Ph.D., Assistant Professor of Applied Electrophysics*

Elias Masry, *Ph.D., Assistant Professor of Information and Computer Science*

Robert D. Moore, *Ph.D., Assistant Professor of Applied Electrophysics*

Johan Pieter Schalkwijk, *Ph.D., Assistant Professor of Information and Computer Sciences*

* * *

*Hannes Alfvén, *Ph.D., Senior Lecturer in Applied Electrophysics*

Gustaf O. S. Arrhenius, *D.Sc., Ph.D., Professor, Scripps Institution of Oceanography*

Marshall H. Cohen, *Ph.D., Professor of Radio Astronomy in Residence*

Seibert Q. Duntley, *Sc.D., Professor, Scripps Institution of Oceanography*

James F. McKenzie, *Ph.D., Lecturer in Applied Electrophysics*

*Fall and winter quarters.

The Major Program

The major in Applied Electrophysics is an introductory program designed for students interested in applying physics and mathematics to the electrical and electronic aspects of science and engineering. Electronic engineering is an area that has undergone and will continue to undergo dramatic changes. Future developments may have little to do with present technology, but will certainly be based on well-established laws of physics and mathematics. In order to understand and exploit future technological breakthroughs, students must have an extensive education in physics and mathematics. The major in Applied Electrophysics is designed to launch students on an educational program that will equip them to handle new developments as they occur.

The Department provides two options: an applied physics program for students interested primarily in applications of physics, and an information and computer science program for students interested primarily in applications of mathematics.

The recommended schedules for students in the two options are shown in the tables below. They necessitate students taking Mathematics 100 and 101 in the sophomore year. Students in the information and computer science option should take Mathematics 130A in either the sophomore or the junior year. Muir College students who intend to major in Applied Electrophysics should take Science 2A-2B-2C-2D-2E in their first two years; Revelle College students should take Natural Sciences 2A-2B-2C-2D-2E.

The Department intends to maintain a flexible curriculum, and a student may, with approval, deviate from the tabulated program. A student majoring in Applied Electrophysics is not required to take more than eighteen upper-division courses in Applied Electrophysics, Physics, and Mathematics.

Major Program in Applied Physics
(Recommended Schedule)

	Fall	Winter	Spring
Junior Year	Math 120	Math 121	Math 122
	AEP 101A	AEP 101B	AEP 101C
	AEP 171A	AEP 171B	AEP 171C
	*	*	*
Senior Year	AEP 164A	AEP 164B	AEP 164C
	AEP 174A	AEP 174B	AEP 174C
	**	**	**
	*	*	*

Major Program in Information and Computer Science
(Recommended Schedule)

	Fall	Winter	Spring
Junior Year	Math 120	Math 121	Math 122
	AEP 101A	AEP 101B	AEP 101C
	AEP 161A	AEP 161B	AEP 161C
	*	*	*
Senior Year	AEP 162A	AEP 162B	AEP 162C
	AEP 164A	AEP 164B	AEP 164C
	**	**	**
	*	*	*

* Spaces marked thus are for Math 130A (information and computer science option), for completion of College requirements, including Science 2F, and for electives. The following electives are recommended for consideration: AEP 180, 182, 184, 199; AMES 140A-140B-140C; Economics 120A-120B-120C; Linquistics 101A-101B-101C, 231A-231B; Physics 110A-110B, 130A-130B-130C, 140, 141; Philosophy 110. Students in one Applied Electrophysics option may select electives from the other. Graduate courses in Applied Electrophysics may also be selected with special permission. A student may take one or more of the courses AEP 174A-174B-174C in the junior year with the consent of the instructor.

** Spaces marked thus may be used for mathematics courses. The following are recommended for consideration: Math 110A-110B-110C, 126A-126B-126C, 130B-130C, 141A-141B-141C, 144.

Computer Science for Non-Majors

An early introduction to the structure, programming, and general usefulness of the digital computer and to its social, business, and technical implications is provided in AEP 10, a fall-quarter elective designed for both humanities and science freshmen.

Upper-division students who desire a more extensive treatment may elect one or more of the courses AEP 161A-161B-161C, which together

form a broad introduction to computer science. Prerequisites are purposely kept to a minimum to make this sequence accessible to a wide range of students.

The Graduate Program

There are three main divisions of study:

1. Information and Computer Science.
This involves the study of information-bearing symbols and their encoding, communication, and transformations; digital computer structure and applications, including design and implementation of programming languages, automata theory and artificial intelligence, and the theory of computation; systems theory and data processing; and electromagnetic and quantum signal detection. The program is concerned with both the fundamental characteristics and the broad implications of these subjects. The Department has access to several high-speed electronic computers.

2. Radiophysics.
This involves the study of planetary surfaces, atmospheres, ionospheres, and magnetospheres by radio techniques, including the study of the solar wind, corona, chromosphere, and photosphere. The Department has available the facilities of several radio astronomical observatories in California and elsewhere. An observatory for studying interplanetary scintillations is under construction in the San Diego area.

3. Applied Physics.
This involves the study of solid state physics and quantum electronics. It includes the study of superconductors, ferroelectric and ferromagnetic materials. In addition, transistors, masers and lasers, and the propagation of coherent light through solids, liquids, and gases are covered, including applications such as holography.

Preparation

Applications will be considered from students who have taken undergraduate majors in one of the following disciplines: physics, applied physics, applied electrophysics, mathematics, applied mathematics, engineering physics, engineering science, electrical engineering, computer science. In special circumstances alternative undergraduate preparation will be accepted, such as that of a biology major who is interested in the application of information and computer science to biological problems. In appropriate cases provision will be made for graduate students to take, without credit, undergraduate courses required to make up deficiencies.

Language Requirements

Entering graduate students are expected to have satisfied the equivalent of the undergraduate foreign language requirements of any one of the UCSD colleges. Students who have studied a foreign language in college beyond an introductory program, or who have learned a foreign

language as the result of residence abroad, will normally be considered to have satisfied the foreign language requirements. Other students will be required to take a departmental examination which lasts about one hour and involves translation of a technical paper. (These are departmental language requirements and are separate from any *Graduate Division* requirements for advanced degrees.)

Departmental Graduate Examination

A student entering without a master's degree should, before he has completed twenty-four units, acquire a faculty research adviser under whom he will write a predoctoral thesis for presentation to the Department. Such a thesis will involve at least six units of work and should be of the kind required in Plan I for the master's degree. This thesis must be presented at a departmental graduate oral examination before the student has completed fifty-four graduate units; it may be used for the M.S. degree or may serve as a starting point for the Ph.D. thesis.

A student entering with a master's degree should consult the chairman of the Department in order to obtain a faculty research adviser immediately. He must present a predoctoral thesis at a departmental oral examination to be held before he has completed twenty-seven graduate units. An entering student who has recently written a master's thesis may elect to use it as his predoctoral thesis. If he does so, the departmental graduate examination must be held before the end of his first quarter of residence.

The predoctoral thesis will be presented at a departmental graduate oral examination conducted by three faculty members who will also inquire into the student's general knowledge. The examiners may require a written examination in addition to the thesis.

Dissertation

In order to be admitted to the qualifying examination a student must have passed the departmental graduate examination and have been accepted by a faculty member as a Ph.D. thesis candidate. A candidate for the Ph.D. will write a dissertation and defend it in a final oral examination conducted by the doctoral committee.

Programs of Study

Graduate students are expected to take part in the teaching and research programs of the department. In addition, a student usually attends several courses each week during his first year or two.

For a student entering with a bachelor's degree and interested in information and computer science, a typical first-year program would involve the sequences of courses on information and detection theory (AEP 262A, 262B, 262C) and on information systems (AEP 264A, 264B, 264C), together with electives. The following electives are suggested: AEP 201, 205A, 205B, 205C, 225, 271A, 271B, 281, 296, 299; AMES 140A, 140B, 140C, 253A, 264; Economics 120A, 120B, 120C; Linguistics 101A, 101B, 101C, 231A, 231B; Mathematics 200A, 200B, 200C, 212A, 212B, 212C, 215A, 215B, 270A, 270B, 270C, 280A, 280B, 280C; Physics 110A, 110B, 130A, 130B, 130C, 140, 141; Philosophy 110; Psychology 220. It is also

possible for students to elect courses in biology, neurosciences and oceanography.

For a student entering with a bachelor's degree and interested in radiophysics, a typical first-year program would involve electromagnetic theory (AEP 201), plasma physics (AEP 212), and quantum theory (AEP 231A, 231B), together with electives. Electives might be chosen from the following: AEP 203A, 203B, 204, 205A, 205B, 205C, 211, 213, 214, 221, 222, 223, 224, 225, 228, 241A, 241B, 241C, 271A, 271B, 290, 296, 299; AMES 210A, 210B, 210C, 220A, 220B, 220C, 221A, 221B, 221C, 222A, 222B, 222C, 223; Chemistry 200A, 200B, 202A, 202B, 203, 204; SIO 211B, 212B, 220, 222A, 222B, 223, 225, 228, 241, 252, 262, 264; Mathematics 212A, 212B, 212C; Physics 200A, 200B, 203A, 203B, 210A, 210B, 212A, 212B, 212C, 212D, 217A, 217B, 217C, 232A, 232B.

For a student entering with a bachelor's degree and interested in applied physics the following courses are available, and additional courses will become available in the department in 1969-70: AEP 171A, 171B, 171C, 174A, 174B, 174C, 180, 201, 203A, 203B, 205A, 205B, 205C, 211, 212, 213, 214, 221, 222, 223, 224, 225, 228, 231A, 231B, 241A, 241B, 241C, 271A, 271B. The courses in other departments listed in the previous paragraph are also available as electives.

Financial Aids

Financial support is available to qualified graduate students in the form of fellowships, traineeships, loans, and assistantships. Stipends for half-time assistantships are about $280 per month, with the possibility of full-time employment during the summer months. Requests for application forms for admission and financial support should be directed to the Department of Applied Electrophysics.

COURSES

LOWER DIVISION

The Department of Applied Electrophysics cooperates in the teaching and administration of the Science *2* sequence for Muir College students. (See *Interdisciplinary Courses: Science.*)

10. Digital Computers: Their Use and Prospects F

Introduction to computers for humanities and science freshmen. Lectures on computer organization and operation, algorithms, flow charts, FORTRAN programming. Recitations review assigned FORTRAN programs. Elective one-week seminars on social implications and topics from medicine, librarianship, mathematics, linguistics, automation, psychology. Two hours lecture, two hours recitation.

UPPER DIVISION

101A-101B-101C. Electromagnetic Theory F-W-S

Electrostatics, dielectrics, conductors, magnetostatics, boundary condi-

tions, field energy density; Maxwell's equations, wave equation, transmission lines, plane waves, oblique reflection; radiation from sources, energy flow; applications to optics and microwaves; waves in isotropic plasmas; special relativity. Engineering applications will be emphasized. Four hours lecture. Prerequisites: Mathematics 101; Science 2E or equivalent.

161A-161B. Introduction to Computer Science F-W

Boolean algebra and switching theory; combinatorial networks; analysis and synthesis of sequential circuits; logical design of general purpose processors; introduction to automata theory. Prerequisite: AEP 10 or consent of the instructor.

161C. Introduction to Computer Science S

The programming languages ALGOL and LISP; formal description of languages; data and program structures; memory management; recursive function calls; implementations of compilers. Prerequisite: knowledge of FORTRAN or equivalent language.

162A. Signal Processing F

Elements of linear continuous and discrete systems, convolution integrals, exponential transforms, singularity functions, transient response of filters, transfer functions. Four hours lecture. Prerequisite: Mathematics 122 or consent of the instructor.

162B-162C. Signal Processing W-S

Review of probability theory, introduction to random processes, correlation functions and spectral densities, minimum-mean-square filtering and prediction, the Gaussian process, response of linear systems to stochastic inputs. Four hours lecture. Prerequisite: AEP 162A, Mathematics 130A, or consent of the instructor.

164A. Electronic Circuits and Systems F

Semiconductor physics and physical electronics; chemical bonds, band theory, Boltzmann and Fermi-Dirac statistics, PN junctions, structure and properties of transistors. Four hours lecture. Prerequisite: concurrent registration in 162A or consent of the instructor.

164B. Electronic Circuits and Systems W

Analysis of active circuits; properties of active devices (transistors, vacuum tubes, photodetectors, etc.) in terms of equivalent circuits, methods of large- and small-signal active circuit analysis, examples of elementary digital and analog circuits. Four hours lecture. Prerequisite: AEP 164A or consent of the instructor.

164C. Electronic Circuits and Systems S

Design and analysis of practical analog and digital circuits with emphasis on the systems approach to the design of electronic devices. This part of the sequence will reflect the state of the art as much as possible. Four hours lecture. Prerequisite: AEP 164B or consent of the instructor.

171A-171B-171C. Structure and Properties of Solids **F-W-S**

Introductory concepts of wave mechanics. The electronic structure of atoms. Atomic bonding in molecules and crystals. Crystal structure and its determination by X-ray diffraction, the band theory of crystalline solids, thermodynamics, and physical properties of solids. Four hours lecture. Prerequisite: Science 2E or equivalent. (Offering in 1968–69 depends on availability of staff.)

174A-174B-174C. Advanced Applied Physics Laboratory **F-W-S**

A laboratory program in applied physics. Modern lab techniques, the experimental approach and the interpretation of data will be emphasized. Facilities are available for projects involving electronic instrumentation, optics, quantum electronics, radio physics and solid state physics. Six hours laboratory. Prerequisite: consent of the instructor. (Offering in 1968–69 depends on availability of staff.)

180. Optics **F**

The laws of geometrical optics, extracted from Maxwell's equations. Propagation of rays in optical instruments. Photometry. Interference. Diffraction. Light waves at boundaries of matter. Polarization. Image Formation. Emission. Dispersion. Absorption. Four hours lecture. Prerequisite: AEP 101A-101B-101C or equivalent. (Offering in 1968–69 depends on availability of staff.)

182. Solar System Physics **W**

Introduction to the physical structure of the solar atmosphere, solar wind, magnetosphere, and the Earth's upper atmosphere. Emphasis will be placed upon solar-terrestrial relations. Four hours lecture. Prerequisite: AEP 101A-101B-101C or equivalent. (Offering in 1968–69 depends on availability of staff.)

184. Introduction to Plasma Physics **S**

Occurrence of plasma in nature. Properties of the equilibrium plasma. Plasma oscillations. The transmission of radiation through a plasma. Elementary magnetohydrodynamics. Applications to the ionosphere and magnetosphere. Technological applications. Four hours lecture. Prerequisite: AEP 101A-101B-101C or equivalent. (Offering in 1968–69 depends on availability of staff.)

199. Independent Study for Undergraduates **F-W-S**

Independent reading or research by special arrangement with a faculty member.

GRADUATE

200. Teaching (1-6, 1-6, 1-6) **F,W,S**

Teaching and tutorial activities associated with courses and seminars. Prerequisite: permission of the Department chairman. (Satisfactory/Unsatisfactory grades permitted.)

201. Electromagnetic Theory (3) **F**

Mr. Lewak

Radiation from relativistic charged particles. Reciprocity and uniqueness theorems associated with Maxwell's equations, and application of Green's function method to radiation problems. Prerequisite: AEP 101A-101B-101C or equivalent.

203A-203B. Optical Systems (3-3) **W-S**

Mr. Duntley

Fundamentals of optical systems which provide visual information, including photographic and electronic imagery. Geometrical, physical, and physiological optics; radiometry, photometry, colorimetry, atmospheric optics, visibility; coherence, spatial frequency analysis, transfer functions, resolution, image evaluation, image reconstruction. Ultimate capabilities of optical systems. Prerequisite: consent of the instructor.

204. Antennas (3) **F**

Mr. Rumsey

Fundamentals of antenna theory based on Maxwell's equations; low frequency and high frequency approximations; multimode analysis, periodic structures and arrays; frequency-independent spiral and log-periodic structures; radio astronomy antennas for measurement of brightness distribution and polarization. Prerequisite: AEP 101A-101B-101C or equivalent. (Offered in 1968-69 and alternate years.)

205A. Optical Information Processing (3) **F**

Mr. Lohmann

Physical optics: diffraction, interference, image formation as a linear filter, coherence theory. Prerequisite: AEP 180 or equivalent.

205B. Optical Information Processing (3) **W**

Mr. Lohmann

Holography: fundamentals and limitations, applications in interferometry, spatial filtering, and display. Prerequisite: AEP 205A.

205C. Optical Information Processing (3) **S**

Mr. Lohmann

Optical data processing: spatial modulation, nonlinear and space-variant systems, character recognition, optical memories, optical logic. Prerequisite: consent of the instructor.

211. Elementary Plasma Waves (3) **W**

Mr. Booker

Linear theory of waves in magnetoplasmas, especially cold magnetoplasmas; propagation at any angle to magnetic field; quasi-longitudinal and quasi-transverse approximations; hydromagnetic, whistler, and radio waves; dispersion and group phenomena; applications to the ionosphere and magnetosphere. Prerequisite: AEP 101A-101B-101C or equivalent.

212. Plasma Physics (3) S

Mr. Fejer

Charged-particle motions in magnetic field. Fluid description; frozen-field concept. The Vlasov equation. Waves in a plasma. Excitation by a point source. Fluctuations in, and radio wave scattering by, a quiescent plasma. Elements of plasma kinetic theory. Prerequisite: AEP 101A-101B-101C or equivalent.

213. Kinetic Theory of Plasmas (3) W

Mr. Lewak

The Liouville equation, the BBGKY hierarchy, kinetic equations: Vlasov, Boltzmann, Fokker-Planck, Balescue-Lenard. Applications: plasma equilibrium solutions, transport properties, instabilities. Prerequisite: consent of the instructor.

214. Waves in the Upper Atmosphere and the Magnetosphere (3) W

Mr. Fejer

A study of wave phenomena in the upper atmosphere and the magnetosphere, including internal gravity waves, whistlers, VLF emissions and micropulsations. Plasma waves excited by satellite transmitters. Interaction between waves and energetic trapped particles. Prerequisite: AEP 212 or equivalent.

221. Solar Atmosphere and Solar Wind (3) F

Mr. Banks, Mr. Axford

The physical structure of the photosphere, chromosphere and corona; solar optical, radio, and particle emissions; the problems of radiative transfer, thermodynamic equilibrium, coronal heating, and the solar wind, with emphasis upon aspects of importance to solar-terrestrial relations. Prerequisite: Physics 130A-130B-130C or equivalent. (Offered 1969–70 and alternate years.)

222. The Magnetosphere (3) W

Mr. Banks, Mr. Axford

A review of current theories and experimental results on the formation of the magnetosphere. Related phenomena concerning plasma shock waves and instabilities, formation and structure of the trapped-particle belts, and charged-particle concentrations and temperature in the exosphere. Prerequisite: Physics 130A-130B-130C or equivalent. (Offered 1969–70 and alternate years.)

223. The Upper Atmosphere and Ionosphere (3) S

Mr. Banks, Mr. Axford

An introduction to the physical processes which determine the structures of the neutral and ionized components of the earth's upper atmosphere. Particle diffusion, heat conduction, chemical aeronomy, charged-particle reactions. Effect of solar radiations upon atmospheric composition and temperature. Prerequisite: Physics 130A-130B-130C or equivalent. (Offered 1969–70 and alternate years.)

224. Introduction to Radio Astronomy **F**
Mr. Rumsey
Radio telescopes. Antennas for measurement of celestial brightness distribution. Receivers for detection of stochastic signals. Effects of aperture size, band width and integration time. Radio continuum and line spectra. Partial coherence and Stokes polarization parameters. Interferometric methods and synthesis of sky maps. Prerequisite: consent of the instructor. (Offered 1969–70 and alternate years.)

225. Signal Processing in Radar and Radio Astronomy (3) **W**
The measurement of spectrum and correlation functions of observed wave forms; angular spectra; scattering by weak plasma fluctuations; radar signal design; analog and digital processing methods; synthetic antenna apertures and numerical filtering. Prerequisites: AEP 162A-162B-162C, 224, or consent of the instructor. (Not offered 1968–69.)

228. Cosmic Electrodynamics (3) **W**
Mr. Alfvén
Magnetic fields in cosmic physics. Motion of charged particles in cosmic magnetic fields. Cosmic aspects of magneto-hydrodynamics and plasma physics. Solar electrodynamics. Cosmogonic and cosmological problems. Cosmic rays. Origin of cosmic magnetic fields. Prerequisite: consent of the instructor.

231A. Introduction to Quantum Processes (3) **W**
Mr. Rotenberg, Mr. Banks
Review of experimental bases of the quantum theory: Introduction to wave mechanics, Schrödinger equation. Operators and eigenfunctions. One-dimensional models, stationary and time-dependent perturbation theory. Prerequisites: Mathematics 121 or equivalent and consent of the instructors. (Offered 1968–69 and alternate years.)

231B. Introduction to Quantum Processes (3) **S**
Mr. Banks, Mr. Rotenberg
Approximation methods. Atomic and molecular spectra. Theory of scattering and charge exchange. Absorption and emission of electromagnetic radiation. Applications to quantum electronics, ionospheric and astrophysical collision phenomena. Prerequisite: AEP 101A-101B-101C or equivalent. (Offered 1968–69 and alternate years.)

241A-241B-241C. Quantum Electronics (3-3-3) **F-W-S**
Quantization of electromagnetic radiation. Interaction of radiation and matter. Optical resonators. Masers and Lasers. Electro-optic effects. Nonlinear optics. Stimulated Raman and Brillouin emission. Prerequisite: Physics 130A-130B-130C or equivalent. (Offering in 1968–69 depends on availability of staff.)

262A-262B. Information and Detection Theory (3-3) **F-W**
Mr. Helstrom
Narrowband signals and noise, hypothesis testing, detection of signals in

white and colored Gaussian noise, Karhunen-Loéve expansion, estimation of signal parameters, maximum-likelihood detection, resolution of signals, detection of stochastic signals. Prerequisites: AEP 162A-162B-162C or equivalent.

262C. Information and Detection Theory (3) S

Mr. Jacobs

Coding theorem of information theory, digital modulation, some algebraic and convolutional coding and decoding systems; source coding with a fidelity criterion. Prerequisite: AEP 262A or equivalent.

264A-264B-264C. Information Systems (3-3-3) F-W-S

Mr. Jacobs

Organization of computers and information-handling systems; resource allocation; aspects of switching and automata theory; computational models, algorithms, data structures; algebraic and symbolic programming languages; assemblers, macros, compilers, translator writing systems. Prerequisites: AEP 161A and 161C or equivalent.

271A. Experimental Instrumentation (Design and Use of Electronic Instrumentation) (3) W

Mr. Moore

Theory of random processes and physical noise sources (Johnson noise, shot noise, phase and amplitude fluctuations in light beams, etc.). Fundamental limit to measurement in given experiment, reaching this limit, examples. Prerequisite: consent of the instructor. (Not offered every year.)

271B. Experimental Instrumentation (3) S

Mr. Moore

Current experimental and signal-processing instrumentation; theory and applications. Examples of elegant applications of instrumentation and physical principles in experiments. This material will be changed each time the course is given to reflect the state of the art. Prerequisite: AEP 271A. (Not offered every year.)

281. Introduction to Automata (3) W

Applications of biological strategies to design of automata. Engineering approach: learning machines, adaptive systems, pattern recognition, self-reproducing and self-repairing systems, brain models, automatic language translation. Mathematical approach: neural nets, finite-state machines, Kleene's theorem, Turing machines, computability, Gödel's theorem. Prerequisite: consent of the instructor. (Offering in 1968–69 depends on availability of staff.)

290. Observatory Field Course (1-12, 1-12, 1-12, 1-12) F,W,S,Su

The Staff

Methods of measurement, observation, and sampling used at radio, radar,

and optical observatories in astronomy and solar system physics; establishment and use of equipment for a current research investigation at an observatory; analysis and interpretation of results with a report. Prerequisite: consent of the instructor: (Satisfactory/Unsatisfactory grades permitted.)

291. Graduate Seminar in Applied Electrophysics (1, 1, 1) **F,W,S**

Mr. Lewak and Staff

Weekly discussion of current research literature. (Satisfactory/Unsatisfactory grades permitted.)

292. Graduate Seminar in Radio Astronomy and Solar System Physics (1, 1, 1) **F,W,S**

Mr. Axford, Mr. Banks, Mr. Booker, Mr. Bowles, Mr. Fejer, Mr. Lewak

Research topics in radio astronomy and solar system physics. (Satisfactory/Unsatisfactory grades permitted.)

293. Graduate Seminar in Information and Computer Science (1, 1, 1) **F,W,S**

Mr. Bowles, Mr. Helstrom, Mr. Jacobs, Mr. Moore, Mr. Rotenberg

Research topics in information and computer science. (Satisfactory/Unsatisfactory grades permitted.)

294. Graduate Seminar in Applied Solid State Physics and Quantum Electronics (1, 1, 1) **F,W,S**

Mr. Lohmann, Mr. Luo

Research topics in applied solid state physics and quantum electronics. (Satisfactory/Unsatisfactory grades permitted.)

295. Graduate Seminar on the Evolution of the Solar System (1) **F**

Mr. Alfvén

Survey of different theories. Importance of plasma physics and celestial mechanics. Changes in the solar system since the time it originated. Tidal effects, resonances. Interaction between a rotating body and a surrounding plasma. Formation of planets, asteroids, and satellites. (Satisfactory/Unsatisfactory grades permitted.)

296. Independent Study (1-6, 1-6, 1-6, 1-6) **F,W,S,Su**

The Staff

Open to properly qualified graduate students who wish to pursue a problem through advanced study under the direction of a member of the staff. Prerequisite: consent of the instructor. (Satisfactory/Unsatisfactory grades permitted.)

299. Research (1-12, 1-12, 1-12, 1-12) **F,W,S,Su**

The Staff

(Satisfactory/Unsatisfactory grades permitted.)

BIOLOGY

Office: 2150 Bonner Hall

Warren L. Butler, *Ph.D., Professor of Biology*
Clifford Grobstein, *Ph.D., Professor of Biology* (Dean, School of Medicine)
John J. Holland, *Ph.D., Professor of Biology*
Dan L. Lindsley, *PhD., Professor of Biology*
Paul D. Saltman, *Ph.D., Professor of Biology* (Provost of Revelle College)
S. Jonathan Singer, *Ph.D., Professor of Biology*
Herbert Stern, *Ph.D., Professor of Biology* (Chairman of the Department)
John A. DeMoss, *Ph.D., Associate Professor of Biology*
Richard W. Dutton, *Ph.D., Associate Professor of Biology*
Melvin H. Green, *Ph.D., Associate Professor of Biology*
Donald R. Helinski, *Ph.D., Associate Professor of Biology*
Stanley E. Mills, *Ph.D., Associate Professor of Biology*
Silvio S. Varon, *M.D., Associate Professor of Biology*
Stuart Brody, *Ph.D., Assistant Professor of Biology*
Maarten J. Chrispeels, *Ph.D., Assistant Professor of Biology*
Gary L. Freeman, *Ph.D., Assistant Professor of Biology*
Masaki Hayashi, *Ph.D., Assistant Professor of Biology*
Tom D. Humphreys, II, *Ph.D., Assistant Professor of Biology*
William F. Loomis, Jr., *Ph.D., Assistant Professor of Biology*
Paul A. Price, *Ph.D., Assistant Professor of Biology*
Thomas F. Roth, *Ph.D., Assistant Professor of Biology*
Herbert M. Schulman, *Ph.D., Assistant Professor of Biology*
Melvin I. Simon, *Ph.D., Assistant Professor of Biology*
Michael Soulé, *Ph.D., Assistant Professor of Biology*

* * *

Melvin Cohn, *Ph.D., Professor of Biology in Residence*
Renato Dulbecco, *M.D., Professor of Biology in Residence*
Frank M. Huennekens, *Ph.D., Professor of Biology in Residence*
Edwin Lennox, *Ph.D., Professor of Biology in Residence*
Robert A. Nelson, Jr., *M.D., Professor of Biology in Residence*
John Spizizen, *Ph.D., Professor of Biology in Residence*
William O. Weigle, *Ph.D., Professor of Biology in Residence*
Frank E. Young, *M.D., Ph.D., Associate Professor of Biology in Residence*
Yasuo Hotta, *Ph.D., Associate Research Biologist*

The Major Program

The undergraduate program leading to a Bachelor of Arts in biology reflects the need to integrate the whole of the biological world, and to understand it in terms of the common principles which control living things. The program reflects the striking advances made in biology in recent years and the prospects of revolutionary developments in the

future. It emphasizes the basic mechanisms which help to correlate into an integrated whole the enormous diversity of living things.

To aid the student in understanding contemporary biology as a whole, regardless of his chosen field of specialization, a core program is offered. All majors in biology, whether they go on to graduate study (implies all fields of biology and fields of specialization), medicine, teaching or agriculture, take the same basic sequence of courses. The sequence begins in the sophomore year—after an introduction to physics, chemistry, and mathematics—with a general consideration of the nature of the living world and its special characteristics and problems as viewed particularly from the cellular level. There follows a two-year program in which living phenomena are examined at their various levels of complexity—molecular, cellular, organismal, and populational. Beyond this, certain advanced and graduate courses in biology and such allied fields as physics and chemistry are available for election by the qualified student in his senior year.

Students who have completed either the Natural Sciences *1* or *2* sequence are qualified for the major program. In addition, Biology majors are strongly advised to take Natural Sciences 2FL and Mathematics 40 or 100 as electives in their lower-division program.

Biology majors are required to take the courses listed in the recommended schedule for the upper-division years. They are not required to take the laboratory part of Chemistry 140B. In addition to the courses listed, students must elect two other courses in consultation with their adviser in order to complete the requirements for the Biology major.

Noncontiguous Minor in Biology (Revelle College)

Students majoring in a field outside the natural sciences may complete a noncontiguous minor in biology by taking some such combination as: Natural Sciences 2F or 2FL, Biology 101A-101B, 113, 121 and 199. Additional upper-division biology courses will be available, and any six biology courses will complete the minor.

Major Program in Biology (Recommended Schedule)

	Fall	Winter	Spring
Junior Year	Biology 101A Chemistry 100A Chemistry 140A	Biology 101B Chemistry 100B Chemistry 140B	Biology 101C Biology 102
Senior Year	Biology 111A	Biology 111B Biology 112	Biology 111C

The Graduate Program

Graduate studies for a Ph.D. degree in the Department of Biology (no

master's degree is offered) are oriented mainly to the development of the capacity for independent, imaginative and self-critical research.

There are no inflexible requirements for entrance to graduate study in the Department of Biology, but it is recommended that the student's undergraduate preparation include at least a year of calculus, elementary organic chemistry, and elementary physical chemistry.

Doctor's Degree Program

During his first two years, the student may take any of the formal courses listed in the Biology and Chemistry Departments, or other departments of the University. Although no formal course requirements exist, a program of study will be arranged through consultation with the faculty, according to the background and interests of the individual student. In the first year, students will participate in a laboratory rotation program in which independent research projects are carried out by each student in various faculty members' laboratories. Much reliance is placed on informal instruction through early and close association of the student with the faculty and research staff, and through regular seminars. After becoming familiar with the research activities of the faculty through the laboratory rotation program, the student will begin work on a thesis research problem of his choice, no later than the end of the first year. At the end of the second year, the student will be required to take a two-part oral examination in order to be admitted to candidacy for the Ph.D. degree. The purpose of these examinations is to have the student demonstrate competence in the field of his major interest and in related fields of biology. The major remaining requirement for the Ph.D. degree will be the satisfactory completion of a dissertation consisting of original research carried out under the guidance of a faculty member. (See *Graduate Division: The Ph.D.*)

Close collaboration with several members of the Departments of Chemistry and Physics is a vital and stimulating aspect of the biology program. Russell F. Doolittle, Martin D. Kamen, Stanley L. Miller, T. G. Traylor and Bruno H. Zimm share many interests with the staff of the Department of Biology, and their physical proximity is a unique feature of this graduate school. Additional strength and breadth in biology is gained by collaboration with the Department of Marine Biology of the Scripps Institution of Oceanography, with the Scripps Clinic and Research Foundation, and with the Salk Institute for Biological Studies. Students may carry out their dissertation research in collaboration with members of these groups.

COURSES

LOWER DIVISION

The Department of Biology cooperates in the teaching and administration of the Natural Sciences sequences for Revelle College students. (See *Interdisciplinary Courses: Natural Sciences.*)

10. Introduction to Plant Biology F

Structure and function at the cellular and organ level; the role of hormones and environment in plant development. Three hours lecture.

11. Animal Biology W

The rich diversity of animal life will be exploited to illumine the fundamental biological principle of form and function. Evolutionary and ecological concepts will be examined. Three hours lecture.

12. Genetics S

A discussion of the principles of heredity. Topics will include Mendel's Law, linkage and karyotype analysis. Examples will be taken from the microbiological plant and animal kingdoms. Three hours lecture.

UPPER DIVISION

101A. Genetics F

An introduction to the principles of heredity, primarily in diploid organisms, including chromosome behavior in cell division, Mendelian inheritance, population genetics, linkage, sex determination, and behavior of chromosome aberrations. Three hours lecture and four hours laboratory-recitation.

101B. Developmental Physiology W

The development of organisms in relation to their functions and behavior, including the origins of multicellularity, cell-cell interactions, tissue interactions, fields and gradients, hormonal integration, neural integration and regeneration. Three hours lecture and four hours laboratory-recitation.

101C. Metabolism and Biochemistry S

The metabolism of organisms with respect to energetics, biosynthesis and nutrition. Three hours lecture and two hours recitation. Prerequisites: Chemistry 140A-140B.

102. Biochemical Techniques S

A laboratory-lecture course in the application of biochemical methods to biological problems. Eight hours laboratory, one hour lecture and one hour recitation. Prerequisite: Biology 101C (may be taken concurrently).

111A. Molecular Biology F

Molecular analyses of biological phenomena with special emphasis on genetics and metabolic regulation. Three hours lecture, two hours recitation. Prerequisites: Biology 101C, Chemistry 100A-100B.

111B. Cell Biology W

The structural and functional organization of cells, the control of their proliferation and differentiation. Three hours lecture, two hours recitation. Prerequisite: Biology 111A.

111C. Population Biology and Evolution S

The behavior and flux within groups of organisms, particularly in relation to ecology and evolution. Three hours lecture, four hours laboratory-recitation. Prerequisites: Biology 101A-101B.

112. Techniques in Cell Biology W

A laboratory-lecture course in methods of studying cell organization and behavior. Eight hours laboratory, one hour lecture, one hour recitation. Prerequisite: Biology 111A (may be taken concurrently).

121. Introduction to the Nervous System W

Survey of anatomy and physiology of invertebrate and vertebrate nervous integration; methods of study and modern developments in the system aspects of neural function. Three hours lecture. Prerequisite: general biology or general psychology.

123. Analysis of Development S

A study of the fundamental problems in developmental biology. Three hours lecture. Prerequisite: Biology 111B.

125. Cytogenetics S

A review of the principles of transmission genetics, cytogenetics, and chromosome structure. Discussion of current problems in these areas. Three hours lecture. Prerequisite: Biology 101A; Biology 111B or equivalent.

127. Virology W

Molecular aspects of viral structure and development. Three hours lecture. Prerequisite: Biology 111A.

129. Structure and Function of Tissues F

This course corresponds exactly to AMES 271. For description, see *Departments of Instruction:* AMES.

190. Current Issues in Biology F

A special course of invited lectures by prominent biologists to familiarize students with some of the contemporary problems in biology. Two hours lecture. Prerequisite: senior standing in the major program and consent of the instructor.

199. Independent Study for Undergraduates F,W,S

Independent reading or research on a problem by special arrangement with a faculty member. Prerequisite: consent of the instructor.

GRADUATE

203A-203B-203C. Laboratory Projects in Biology (3-3-3) F-W-S

The Staff

An introduction to contemporary laboratory techniques and research interests through independent, original projects under the direction of

individual faculty members. Prerequisite: consent of the instructor. (Satisfactory/Unsatisfactory grades permitted.)

210. Seminar in Biochemistry (1, 1, 1) **F,W,S**
The Staff
Seminars presented by graduate students which will explore topics in specialized areas of biochemistry and provide opportunities for students to gain experience on the organization, critical evaluation, and oral presentation of information for the literature. Same as Chemistry 210. Prerequisite: consent of the instructor. (Satisfactory/Unsatisfactory grades permitted.)

211. Biochemical Mechanisms of Energy Storage and Conversion (3) **F**
Mr. Kamen, Mr. Butler
Thermodynamic and kinetic analysis of energy transformation in biochemical processes basic to catabolism, photosynthesis, respiration and fermentation. Same as Chemistry 211. Prerequisite: elementary physical chemistry.

212. Biosynthetic Mechanisms (3) **W**
The Staff
A discussion of the pathways and mechanisms involved in the biosynthesis of cell components and their integration into the intermediary metabolism of the cell. Same as Chemistry 212. Prerequisite: elementary biochemistry.

213. Chemistry of Macromolecules (3) **S**
Mr. Singer, Mr. Zimm
A quantitative discussion of the structure of biologically important macromolecules and the techniques used in their study. Same as Chemistry 213. Prerequisite: elementary physical chemistry.

220. Seminar in Genetics (1, 1, 1) **F,W,S**
The Staff
Seminars presented by graduate students which will explore topics in specialized areas of genetics and provide opportunities for students to gain experience in the organization, critical evaluation and oral presentation of information for the literature. Prerequisite: consent of the instructor. (Satisfactory/Unsatisfactory grades permitted.)

221. Genetics (3) **W**
Mr. Lindsley, Mr. Stern
A review of the principles of transmission genetics, cytogenetics and chromosome structure. Discussion of current problems in these areas. Prerequisites: Biology 101A; Biology 111B or equivalent. (Not offered 1968.)

222. Microbial Genetics (3) **S**
Mr. Green, Mr. Helinski
Description of bacterial and viral genetic systems, including the nature

of the processes involved in gene duplication, recombination of lysogeny. Prerequisites: Biology 101A; Biology 111A or equivalent.

223. Molecular Genetics (3) F
Mr. Hayashi, Mr. Simon
Discussion of the molecular mechanisms involved in the transcription, translation and integration of genetic information. Prerequisites: Biology 101A; Biology 111A or equivalent.

230. Seminar in Developmental Biology (1, 1, 1) F,W,S
The Staff
Seminars presented by graduate students which will explore topics in specialized areas of developmental biology and provide opportunities for students to gain experience on the organization, critical evaluation and oral presentation of information for the literature. Prerequisite: consent of the instructor. (Satisfactory/Unsatisfactory grades permitted.)

231. Regulation in Higher Organisms (3) F
Mr. Schulman, Mr. Loomis
A discussion of the molecular basis of control mechanisms in the function of specialized tissues of higher organisms. Prerequisite: Biology 123 or equivalent.

232. Cellular Aspects of Development (3) W
Mr. Humphreys, Mr. Stern
The behavior of cells in developing systems with special emphasis on mechanisms of regulation at the subcellular and molecular level. Prerequisite: Biology 123 or equivalent.

233. Morphogenesis and Tissue Interactions (3) S
The Staff
Nature and significance of formative processes in relation to cytodifferentiation, with particular emphasis on cell-cell and tissue-tissue interactions and their mechanisms. Prerequisites: Biology 101A; Biology 101B or equivalent.

290. Special Topics in Biology (2)
The Staff
A course to be given at the discretion of the faculty in which integrative or interdisciplinary topics of biological interest will be presented by visiting or resident faculty members.

299. Research in Biology (1-12, 1-12, 1-12) F,W,S
The Staff

CHEMISTRY

Office: 4422 Physics-Chemistry Building

James R. Arnold, *Ph.D., Professor of Chemistry*
Martin D. Kamen, *Ph.D., Professor of Biochemistry*

Nathan O. Kaplan, *Ph.D., Professor of Chemistry*
Joseph Kraut, *Ph.D., Professor of Chemistry*
Joseph E. Mayer, *Ph.D., Professor of Chemistry*
Stanley L. Miller, *Ph.D., Professor of Chemistry*
G. N. Schrauzer, *Ph.D., Professor of Chemistry*
Kurt E. Shuler, *Ph.D., Professor of Chemistry* (Chairman of the Department)
Hans E. Suess, *Ph.D., Professor of Geochemistry*
Teddy G. Traylor, *Ph.D., Professor of Chemistry*
Harold C. Urey, *Ph.D., Professor at Large, Department of Chemistry*
Frederick T. Wall, *Ph.D., Professor of Chemistry* (Dean of Graduate Studies)
Bruno H. Zimm, *Ph.D., Professor of Chemistry*
Russell F. Doolittle, *Ph.D., Associate Professor of Biochemistry*
John Abelson, *Ph.D., Assistant Professor of Chemistry*
Alan J. Bearden, *Ph.D., Assistant Professor of Chemistry*
F. Thomas Bond, *Ph.D., Assistant Professor of Chemistry*
Leigh B. Clark, *Ph.D., Assistant Professor of Chemistry*
Robert C. Fahey, *Ph.D., Assistant Professor of Chemistry*
Robert G. Linck, *Ph.D., Assistant Professor of Chemistry*
Charles L. Perrin, *Ph.D., Assistant Professor of Chemistry*
Robert L. Vold, *Ph.D., Assistant Professor of Chemistry*
Joseph W. Watson, *Ph.D., Assistant Professor of Chemistry*
Kent Wilson, *Ph.D., Assistant Professor of Chemistry*

* * *

Leslie Orgel, *Ph.D., Professor of Chemistry in Residence*
Linus Pauling, *Ph.D., Professor of Chemistry in Residence*
Robert Bartsch, *Ph.D., Associate Research Chemist*
Karl Dus, *Ph.D., Associate Research Chemist*
Bartholomew Nagy, *Ph.D., Associate Research Chemist*

The Undergraduate Program

The undergraduate major in chemistry is intended to enable a student to pursue further studies in chemistry or in related fields of science, engineering, or medicine. The program combines a thorough preparation in the fundamentals of chemistry and related fields with an opportunity for more advanced work in particular areas of chemistry.

The student who is considering a chemistry major in Revelle College is strongly advised to take Natural Science 2DL and 2FL. It is desirable also that the student complete Mathematics 100 or its equivalent before the junior year, but the student may take this course in the first or second quarter of that year.

Transfer students should note that in the first two years of the Revelle College curriculum students take calculus and physics, and that the sophomore chemistry course is concerned with thermodynamics and quantum theory; organic chemistry is deferred until the junior year. Transfer

students should have had a laboratory course equivalent to Natural Science 2DL or 2FL, usually approximated by quantitative analysis.

The departmental course requirements for the Bachelor of Arts degree in chemistry are: Chemistry 100A-100B-100C; Chemistry 120A-120B; Chemistry 140A-140B-140C; five additional upper-division or graduate courses, designated with an asterisk in the schedule below, in chemistry or related fields. The minimum passing grade in these courses is D and a minimum of a C average in the major is required for the degree. Exceptions to these requirements may be made, with written permission of the Department Chairman, for students who wish to pursue programs oriented toward biochemistry, geochemistry or chemical physics. Opportunities for independent work and for research are available to qualified students through enrolment in Chemistry 199.

Major Program in Chemistry (Recommended Schedule)

	Fall	Winter	Spring
Junior Year	Chemistry 100A	Chemistry 100B	Chemistry 100C
	Chemistry 140A	Chemistry 140B	Chemistry 140C
	_____	Chemistry 120A	Chemistry 120B
	_____	_____	_____
Senior Year	*	*	*
	*	*	*
	_____	_____	_____
	_____	_____	_____

*Upper-division course in chemistry or related field.

The Graduate Program

The Department accepts students for study toward the M.S. or the Ph.D. The Department usually recommends financial support only for students who are seeking the Ph.D. The doctoral program is designed to encourage initiative on the part of the student and to develop habits of independent study. Advanced courses in the Department are handled in part by the tutorial system. Students with normal preparation start research early.

In order that he may participate effectively in this program, the entering graduate student will be required to have a mastery of the subjects usually presented in an undergraduate chemistry curriculum: physical, organic, and inorganic (descriptive) chemistry. So that the student may be properly advised, his mastery of these undergraduate subjects will be tested by written examination on his arrival. Deficiencies in undergraduate preparation must be remedied during the first year of graduate study. Physical chemists will be expected to present the equivalent of two years of physics, and mathematics at least through integral calculus.

The appropriate background courses in biology or geology are highly desirable for students interested in biochemistry and geochemistry, respectively, but will sometimes be taken after arrival.

In the first year the student will usually take several of the graduate courses listed below. He may also take upper-division undergraduate courses and be assigned 4 units of credit per course. In Chemistry 100B and 100C, however, the credit will be reduced to 3 units if the student does not participate in the laboratory. Depending on his special interests, he may also take courses in other departments. The student will normally select his thesis adviser by the end of the first year of study and begin his thesis research. In the second year he will usually carry a lighter load of formal courses, but will continue to participate in seminars and informal study groups.

A reading knowledge of two foreign languages is required for the Ph.D. The student must demonstrate high ability in one foreign language, which may be French, German, Russian, or Japanese, and a reasonable level of ability in a second language — French, German, Russian, Japanese, or Italian. Reading ability is tested by examinations (see *Graduate Division: Foreign Language Requirement*); the language requirements must be fulfilled before the qualifying examination is taken, usually in the second year of study.

The qualifying examination for admission to candidacy must be taken before the end of the fifth quarter of graduate study and will be conducted as follows:

The candidate will present a major and a minor proposition, the former consisting of a statement summarizing an original research problem or scientific idea not closely connected to his thesis. He should be prepared to discuss both the theory and the experimental techniques involved, as well as the significance of the proposition and its relation to previous knowledge.

The minor proposition may be similar to the major one, or it may consist of a critical survey of literature in some field of chemistry outside the student's main interest. This is intended to reveal the ability of the candidate to make a critical survey and adequate presentation and to provide him with the incentive to broaden his understanding of chemistry.

In special circumstances the doctoral committee may modify the examination at its discretion. For University requirements, see *Graduate Division*.

Successful passing of the qualifying examination advances the student to candidacy for the Ph.D. He then devotes most of his time to his thesis research and study. A final examination, conducted by the student's doctoral committee, is given upon completion of the dissertation. The examination is oral and deals with the dissertation and its relation to the general field of study.

The Department requires teaching experience for the Ph.D. This requirement is usually met by assisting in the teaching of undergraduate courses for one quarter during each year of the student's residence.

The interdisciplinary tradition is strong on the San Diego campus. The chemistry faculty has close ties with the Departments of Aerospace and Mechanical Engineering Sciences, Biology, and Physics, as well as with the Scripps Institution of Oceanography and the Institute for Pure and Applied Physical Sciences. Opportunities and facilities are thus available to the graduate student for study and research in a wide variety of interdisciplinary fields. A high-speed computer is available for use by graduate students.

Joint Doctoral Program with San Diego State College

The Department of Chemistry at UCSD cooperates with the Department of Chemistry in the Division of the Physical Sciences, San Diego State College, in offering a joint program of graduate study leading to the Ph.D. degree in chemistry.

An applicant for admission to the joint doctoral program must first be admitted to regular graduate standing in the Graduate Division of the University of California, San Diego, and to classified graduate standing in the Graduate Division of San Diego State College. In seeking admission to the two Graduate Divisions, the applicant must pay all fees required by each institution and comply with the admission procedures stated in this catalog and in the current edition of the Bulletin of the Graduate Division of San Diego State College, where the program is more fully described.

COURSES

LOWER DIVISION

The Department of Chemistry cooperates in the teaching and administration of the Natural Sciences sequences for Revelle College students. (See *Interdisciplinary Courses: Natural Sciences.*)

UPPER DIVISION

(See also *Interdisciplinary Courses: Earth Sciences.*)

100A. Physical Chemistry F

The Staff

Nuclear chemistry; atomic structure; quantum theory of atoms and molecules; molecular structure and molecular spectroscopy; macroscopic properties of molecules; behavior of ideal and real gases. Three lectures, one hour discussion, two hours computer laboratory. Prerequisites: Natural Science 2D (formerly Physical Science 2D), Mathematics 2C, or consent of the instructor. At the level of *Physical Chemistry*, W. J. Moore, Prentice-Hall (3d edition).

100B. Physical Chemistry (Lecture and Laboratory) W

The Staff

Statistical mechanics; thermodynamics; properties of liquids; properties of solutions; electrochemistry; physical biochemistry. Three lectures, one

hour discussion, six hours laboratory. Prerequisites: Natural Science 2FL (formerly Physical Science 2EL), Chemistry 100A, or consent of the instructor. At the level of *Physical Chemistry*, W. J. Moore, Prentice-Hall (3d edition).

100C. Physical Chemistry (Lecture and Laboratory) **S**

The Staff

Solid state chemistry; interfaces; chemical kinetics; photochemistry; cosmochemistry; resonance techniques in physical chemistry; special topics in modern physical chemistry. Three lectures, six hours laboratory. Prerequisites: Chemistry 100B, Mathematics 100, or consent of the instructor.

102A-102B. Classical and Statistical Thermodynamics **F-W**

Mr. Wall

Thermodynamics of chemical systems; first, second, and third laws; chemical equilibria; solutions; non-ideal gases; statistical theory; derivation of thermodynamic quantities through partition functions. Three lectures. Prerequisite: Chemistry 100C.

113. Natural and Synthetic Macromolecules **S**

Mr. Zimm

The physical chemistry of high polymers, proteins, and nucleic acids, with emphasis on structure, characterization, and properties. Three lectures. Prerequisites: Chemistry 100B, 140B.

120A-120B. Inorganic Chemistry **W-S**

Mr. Linck, Mr. Orgel

The chemistry of the elements of the periodic table is presented in terms of unifying concepts. The structure of atoms, the influence of atomic properties on the structure of compounds, synthesis of compounds, and the kinetics and mechanisms of chemical reactions are discussed. Thermodynamic aspects of inorganic chemistry and spectral and magnetic properties of compounds are treated. Other topics include: solids, ions in solution, complex ions, solution structure, organometallic compounds. Three lectures, one recitation. Prerequisites: Chemistry 100A and Chemistry 140A, or consent of the instructor.

140A-140B-140C. Organic Chemistry **F-W-S**

Mr. Fahey

Lecture and laboratory work for students majoring in chemistry and related fields such as biology. The lectures will be concerned with (1) structure and properties of covalent molecules, (2) classification of reactions of first-row elements, and (3) reactions of organic compounds, with an introduction to biochemistry. The laboratory will involve (1) separation and purification methods and measurements of physical properties, (2) organic syntheses and product analyses, and (3) qualitative organic analysis and special projects. Must be taken in sequence. Three lectures, one hour discussion, two three-hour laboratories. Prerequisite: Natural

Science 2FL (formerly Physical Science 2EL). At the level of *Organic Chemistry*, J. D. Roberts and M. C. Caserio, Benjamin (1964).

141A-141B-141C. Organic Chemistry **F-W-S**

Mr. Fahey

This sequence is Chemistry 140A-140B-140C without laboratory. Students will attend 140A-140B-140C lectures and instead of laboratory work will meet in two one-hour recitations per week and carry out special outside projects. This course is not acceptable as a requirement for chemistry majors. Prerequisite: the equivalent of Natural Science 2F or 2FL (formerly Physical Science 2E, 2EL).

145. Structure and Properties of Organic Molecules **F**

Mr. Watson

Introduction to the measurement and theoretical correlation of the physical properties of organic molecules. Topics to be covered include simple molecular orbital theory, bond lengths, bond energies, dipole moments, ionization potentials, infrared and ultraviolet spectra, nuclear magnetic resonance and electron spin resonance. Three lectures. Prerequisites: Chemistry 100B, 140B.

146. Kinetics and Mechanism of Organic Reactions **W**

Mr. Watson

Methodology of mechanistic organic chemistry: integration of rate expressions, determination of rate constants, transition state theory; catalysis, kinetic orders; isotope effects, substituent effects, solvent effects; linear free energy relationships; product studies; stereochemistry; reactive intermediates; rapid reactions. Three lectures. Prerequisite: Chemistry 140C.

147. Mechanisms of Organic Reactions **S**

Mr. Watson

A detailed study of the mechanisms of various organic reactions; carbonium ion reactions (substitutions, displacements, eliminations, additions, hydrolyses); carbanion reactions (eliminations, substitutions, hydrolyses, condensations); carbene reactions; rearrangements; multicenter reactions; free radical processes. The topics emphasized will vary from year to year. Three lectures. Prerequisite: Chemistry 140C.

150A-150B-150C. Advanced Projects Laboratory **F-W-S**

The Staff

This course is designed to provide the chemistry major with an introduction to chemical research. Various original projects dealing with synthetic, structural, and mechanistic aspects of chemistry and biochemistry will be available to the student. The student will be allowed flexibility to choose and pursue those projects of most interest to him. Need not be taken in sequence. One lecture, three three-hour laboratories. Prerequisites: Chemistry 100C, 140C.

160A-160B. General Biochemistry **W-S**
Mr. Abelson
This course is intended for chemistry majors in their senior year. The course will deal with the chemical aspects of living organisms, starting with structural considerations and proceeding through information and energy transfer systems. Must be taken in sequence. Although Biology 101A and 101B provide desirable preparation, neither are required. Three lectures. Prerequisites: Chemistry 100C, 140C.

170. Cosmochemistry **F**
Mr. Arnold, Mr. Suess
Composition of stars, of planets, of meteorites and the earth. Nuclear stability rules and isotopic composition of the elements. Chemical properties of solar matter. Origin of the elements and of the solar system. Three lectures. Prerequisite: Natural Science 2F or 2FL.

190. Mathematical Methods of Chemistry **F**
Mr. Perrin
Calculus, special functions, differential equations; probability and statistics; vectors, matrices and determinants; applications of computers; linear algebra. Three lectures. Prerequisites: Chemistry 100C, Mathematics 40.

195. Chemistry Instruction **W**
The Staff
Introduction to the teaching of elementary college chemistry. Each student will be responsible for and teach a class section of one of the lower-division chemistry courses. Limited to senior chemistry majors who have maintained a B average or better in their major course work. One meeting per week with instructor, one meeting per week with assigned class section, and attendance at lecture of the lower-division course in which they are participating. Prerequisites: Chemistry 100C, 140C; advanced standing, consent of the instructor.

199. Senior Reading and Research **F,W,S**
The Staff
Independent literature or laboratory research by arrangement with, and under the direction of, a member of the Chemistry faculty.

GRADUATE

200A-200B. Molecular Quantum Mechanics (4-4) **W-S**
Mr. Wilson
The fundamental concepts and techniques of quantum mechanics which are necessary for the treatment of problems of chemical interest are developed and applied.

202A-202B. Classical and Statistical Thermodynamics (3-3) **F-W**
Mr. Wall
Thermodynamics of chemical systems; first, second and third laws; chemical equilibria; solutions; non-ideal gases; statistical theory; derivation of thermodynamic quantities through partition functions.

203. Molecular Spectroscopy (4) **F**
Mr. Clark
The interaction of electromagnetic radiation with molecules will be treated both theoretically and experimentally. Topics to be covered include rotational, vibrational and electronic spectroscopy, electron spin resonance, nuclear magnetic resonance, and structural determination by x-ray diffraction. Prerequisite: Chemistry 200A, 200B, or equivalent.

204. Statistical Mechanics of Chemical Systems (4) **F**
Mr. Mayer
Fundamental derivation of equilibrium statistical mechanics and its use in chemical problems.

209. Special Topics in Physical Chemistry (1-3) **F,W,S**
The Staff
Topics of special interest will be presented by visiting or regular staff members.

210. Seminar in Biochemistry (1) **F,W,S**
The Staff
Seminars presented by graduate students which will explore topics in specialized areas of biochemistry and provide opportunities for students to gain experience on the organization, critical evaluation, and oral presentation of information from the literature. Same as Biology 210. Prerequisite: consent of the instructor.

211. Biochemical Mechanisms of Energy Storage and Conversion (3) **F**
Mr. Kamen, Mr. Butler
Thermodynamic and kinetic analysis of energy transformation in biochemical processes basic to catabolism, photosynthesis, respiration and fermentation. Same as Biology 211. Prerequisite: elementary physical chemistry.

212. Biosynthetic Mechanisms (3) **W**
The Staff
A discussion of the pathways and mechanisms involved in the biosynthesis of cell components and their integration into the intermediary metabolism of the cell. Same as Biology 212. Prerequisite: elementary biochemistry.

213. Chemistry of Macromolecules (3) **S**
Mr. Singer, Mr. Zimm
A quantitative discussion of the structure of biologically important macromolecules and the techniques used in their study. Same as Biology 213. Prerequisite: elementary physical chemistry.

220. Advanced Inorganic Chemistry (3) **W**
Mr. Schrauzer
Introduction to theoretical inorganic chemistry. Chemistry of typical main group and transition elements; coordination compounds; organo-metallic chemistry; experimental techniques.

229. Special Topics in Inorganic Chemistry (1-3) **F,W,S**
The Staff
Topics of current interest will be presented by visiting or regular staff members.

245. Structure and Properties of Organic Molecules (3) **F**
Mr. Watson
Introduction to the measurement and theoretical correlation of the physical properties of organic molecules. Topics to be covered include simple molecular orbital theory, bond lengths, bond energies, dipole moments, ionization potentials, infrared and ultraviolet spectra, nuclear magnetic resonance and electron spin resonance.

246. Kinetics and Mechanism of Organic Reactions (3) **W**
Mr. Watson
Methodology of mechanistic organic chemistry: integration of rate expressions, determination of rate constants, transition state theory; catalysis, kinetic orders; isotope effects, substituent effects, solvent effects; linear free energy relationships; product studies, stereochemistry; reactive intermediates; rapid reactions.

247. Mechanisms of Organic Reactions (3) **S**
Mr. Watson
A detailed study of the mechanisms of various organic reactions; carbonium ion reactions (substitutions, displacements, eliminations, additions, hydrolyses); carbanion reactions (eliminations, substitutions, hydrolyses, condensations); carbene reactions; rearrangements; multicenter reactions; free radical processes. The topics emphasized will vary from year to year.

249. Special Topics in Organic Chemistry (1-3,1-3,1-3) **F,W,S**
The Staff
Topics of special interest will be presented by visiting or regular staff members. In the spring quarter Mr. Bond will present special topics in natural product chemistry.

250. Seminar in Chemistry (1,1) **F,S**
The Staff
Regularly scheduled seminars by graduate students provide opportunities for practice in seminar delivery and for the exploration of topics of general interest. These seminars are also used to acquaint students with subjects too specialized for general courses.

251. Research Conference (1,1,1) **F,W,S**
The Staff
Group discussion of research activities and progress of the group members.

252. Advanced Seminar in Chemistry (1, 1, 1) **F,W,S**
The Staff
This seminar course is the same as Chemistry 250, except that it is for more advanced students than first-year students.

269. Special Topics in Biochemistry (1-3,1-3,1-3) **F,W,S**
The Staff
Topics of special interest will be presented by visiting or regular staff members.

295. Teaching in Chemistry (3,3,3) **F,W,S**
The Staff
Introduction to teaching elementary college chemistry. Each student will be responsible for, and teach a class section from, one of the undergraduate chemistry courses. One meeting per week with instructor and one or two meetings per week with assigned class section, and lecture of the undergraduate course in which they are participating.

298. Special Study in Chemistry (1-12, 1-12, 1-12) **F,W,S**
The Staff
Reading and laboratory study of special topics under the direction of a faculty member. Exact subject matter to be arranged in individual cases. (Satisfactory/Unsatisfactory grades permitted.)

299. Research in Chemistry (1-12, 1-12, 1-12) **F,W,S**
(Satisfactory/Unsatisfactory grades permitted.)

CONTEMPORARY ISSUES

See *Interdisciplinary Courses.*

DRAMA

Office: Building 251, Matthews Campus (Provost, Muir College)
Michael Langham, *LL.D., Professor of Drama* (Head of Program)

A program of courses in the drama is being developed. The three-course sequence described below will be offered in 1968–69 for students electing to study drama as a means of fulfilling the Humanities and Fine Arts requirement of Muir College. Other drama courses will also be offered. Though some of these will include technical study of stagecraft, drama will be studied as one of the liberal arts. Students will be encouraged to participate in presenting plays as a rewarding extracurricular activity, and the facilities of the drama program will, as far as possible, be made available to drama groups. Students who aspire to a professional career in drama are urged to take a general undergraduate program with emphasis on liberal education and to defer until after graduation intensive concentration on drama. The theatre being built by the University and the Theatre Arts Foundation of San Diego is scheduled to open in 1970 on a site just south of UCSD campus, and will probably offer opportunities for advanced technical training during the summer and after graduation.

COURSES

LOWER DIVISION

1A-1B-1C. The Nature of Drama **F-W-S**

A sequence of integrated courses on the fundamentals of drama. Study of the physical aspects of the theatre and dramatic action, and how they shape dramatic content; literary study of dramatic texts within a historical and critical orientation. Must be taken in sequence. (This sequence may be used in fulfilling the Muir College Humanities and Fine Arts requirement. Muir College students have priority.)

EARTH SCIENCES

For undergraduate courses, see *Interdisciplinary Courses: Earth Sciences.*

For graduate courses, see *Departments of Instruction: Scripps Institution of Oceanography.*

ECONOMICS

Office: 3412 Humanities-Library Building

Seymour E. Harris, *Ph.D., Professor of Economics*

John W. Hooper, *Ph.D., Professor of Economics* (Chairman of the Department)

Daniel Orr, *Ph.D., Professor of Economics* (Director of Graduate Studies in Economics)

Richard E. Attiyeh, *Ph.D., Associate Professor of Economics* (Director of Undergraduate Studies in Economics)

Donald V. T. Bear, *Ph.D., Associate Professor of Economics*

John Conlisk, *Ph.D., Associate Professor of Economics*

George R. Morrison, *Ph.D., Associate Professor of Economics*

William P. Travis, *Ph.D., Associate Professor of Economics*

Ramachandra Ramanathan, *Ph.D., Assistant Professor of Economics*

Larry E. Ruff, *Ph.D., Assistant Professor of Economics*

The Major Program

Each student majoring in Economics will be required to take Economics 1A-1B-1C and at least twelve upper-division courses. Unless special permission is granted by the Director of Undergraduate Studies, these courses must include the Economics 100 and Economics 110 sequences and one quarter of the 190 sequence. The remainder of the twelve courses must include two other complete upper-division sequences.

A Revelle College student majoring in Economics can meet the requirements for a noncontiguous minor by taking courses in the humanities, in

mathematics, or in the sciences. A noncontiguous minor must be approved by the minor adviser in the department in which the noncontiguous minor is concentrated.

With regard to elective courses, the Economics major is encouraged to take courses in related fields such as political science, history, and mathematics. Because mathematics and mathematical statistics are important in advanced economic study and in economic research, the student should consider the need for adequate background in these subjects. The courses most appropriate for this purpose are Mathematics 101, 110A-110B, 130A, and 133A-133B. The economics major may substitute Mathematics 130A and 133A for Economics 120A.

In planning his upper-division program, the prospective Economics major should consult with the Director of Undergraduate Studies as soon as possible—preferably during the sophomore year. At that time, a tentative program can be formulated which will include courses in economics and electives.

Major Program in Economics (Recommended Schedule)

	Fall	Winter	Spring
Junior Year	Economics 100A	Economics 100B	Economics 100C
	Economics 110A	Economics 110B	Economics 110C
	Minor	Minor	Minor
	Elective	Elective	Elective
Senior Year	Two-quarter Economics Sequence		Economics 190C
	Economics Elective	Two-quarter Economics Sequence	
	Minor	Minor	Minor
	Elective	Elective	Elective

The Honors Program

Students electing the honors program in Economics must have a 3.5 average in their upper-division Economics courses (including seminars) and must take three quarters of the seminar (190A-190B-190C). The honors student may choose to devote one or two of his seminars to the study of the relation of his minor field to economics. For example, he might write a seminar paper on mathematical economic theory, the relation of scientific research or education to technological change and growth, or American literature in the last generation as it reflects American economic developments.

The Noncontiguous Minor (Revelle College)

Students majoring in mathematics, humanities, or the sciences who elect Economics as a noncontiguous minor field have two options, depending on the use to which they put Economics 1A-1B-1C:

1. If the 1A-1B-1C sequence is used to satisfy the Revelle College social

science requirement, the Economics minor must include six upper-division courses. Of these, three must be from the Economics 100 and 110 sequences.

2. If some sequence other than Economics 1A-1B-1C is used to satisfy the Revelle College social science requirement, the noncontiguous minor in Economics must include Economics 1A-1B-1C and any three upper-division courses.

The Department of Economics is also willing to cooperate with other departments in the formulation of an integrated project minor for which the work is done in two or more related disciplines. (See *Revelle College: Noncontiguous Minor.*)

Students who wish to pursue a noncontiguous minor involving the Department of Economics should consult with the Director of Undergraduate Studies (minor adviser) as early as possible.

The Graduate Program

The program of study for the Ph.D. degree normally will entail eighteen courses during two years, prior to departmental qualifying examinations. The program assumes Economics 1A-1B-1C and Mathematics 2A-2B-2C or equivalent courses as part of the background of every entering student.

A program will typically be structured as follows:

	Fall	Winter	Spring
Year I	Mathematics 101 Economics 210A Mathematics 130A	Economics 200A Economics 210B Mathematics 133A	Economics 200B Economics 210C Economics 220
Year II	Economics 200C Economics 230A Elective	Elective Economics 230B Elective	Economics 269 Economics 230C Elective

The course sequences 200, 210, and 230 constitute the background material for the written portion of the departmental qualifying examination. In addition, there is an oral examination which to a large degree is devoted to the candidate's dissertation research specialty. Elective courses and the dissertation seminar (Economics 269) are the developing ground for a research specialty.

No foreign language proficiency examination is prerequisite to candidacy. However, students electing some research specialties for which foreign language sources are important will find it necessary to convince their doctoral committees of adequate command of the relevant languages. Residence and other university-wide requirements are stipulated in the Graduate Division section (see *Graduate Division: The Ph.D*).

A fuller description of the Ph.D. program can be obtained from the Department office. No program for the Master's Degree is contemplated.

COURSES

LOWER DIVISION

1A-1B-1C. Elements of Economics **F-W-S**

The objective of this survey course is to give students who will not specialize in economics an understanding of how the economy functions. Elementary theories of resource allocation and income determination are used to analyze policy issues of major significance. Required of all majors and minors in economics. Must be taken in sequence. Two or three lectures, one recitation. (May be used in fulfilling the Revelle College social science requirement.)

UPPER DIVISION

100A-100B-100C. Microeconomic Theory and Policy **F-W-S**

The theory of consumer behavior and the theory of the firm as foundations of demand and supply. Market structure, distribution theory, and welfare economics. Three lectures. Prerequisites: Economics 1A-1B-1C. (100C not offered 1969.)

110A-110B-110C. Macroeconomic Theory and Policy **F-W-S**

The theory of national income determination as the basis for explaining fluctuations in income, employment, and the price level. Analysis of monetary and fiscal policy as a means of stabilizing the economy. Three lectures. Prerequisites: Economics 1A-1B-1C.

111A-111B. Financial Institutions and Monetary Policy **W-S**

A study of the financial structure of the United States economy including analysis of bank behavior and the techniques of central bank monetary control. Three lectures. Prerequisites: Economics 110A-110B-110C. (Not offered 1968–69.)

115A-115B. The Evolution of Economic Theory and Policy **F-W**

An examination of the evolution of economic theory and policy in western Europe and Great Britain during the eighteenth and nineteenth centuries. While attention is given to the works of such individuals as A. Smith, D. Ricardo, T. R. Malthus, J. S. Mill, K. Marx, J. E. Cairnes, and others, the primary emphasis is on the development of economic analysis as a response to the economic problems of the times. Three lectures. Prerequisites: Economics 1A-1B-1C.

120A-120B-120C. Quantitative Economics **F-W-S**

Mathematical statistics and econometrics; the elements of the formulation and verification of economic models. Examples will be taken from both the micro and macro areas. Three lectures. Prerequisites: Economics 1A-1B-1C and Mathematics 1C or their equivalents. Students who have taken or are taking Mathematics 130A or 133A-133B will not be admitted to Economics 120A, but may take 120B-120C.

130A-130B-130C. Public Policy **F-W-S**
The application of macroeconomic and microeconomic theory to issues of public policy, such as economic stabilization, public expenditure and taxation, and public control of private industry. The student will be required to study one problem intensively. Three lectures. Prerequisites: Economics 1A-1B-1C for 130A; Economics 110A-110B for 130B; and Economics 100A-100B for 130C.

140A-140B. Economic History **F-W**
A survey of economic history in both Europe and the United States. Three lectures. Prerequisites: Economics 1A-1B-1C. (140A offered spring quarter; 140B not offered 1968–69.)

190A-190B-190C. Seminars and Independent Work **F,W,S**
Seminars which will encourage the student to work on a particular problem intensively, culminating in at least one major paper. (190B offered spring; 190C not offered 1968–69.)

199. Independent Study **F,W,S**
Individual study. After consultation with the faculty, the student will write a substantial paper. Prerequisites: consent of the staff; to be arranged with department chairman and instructor.

GRADUATE

200A-200B-200C. Price and Allocation Theory (3-3-3) **W-S-F**
The role of theory in economics; demand analysis; the traditional theory of the firm; market structure and welfare; activity analysis and linear programming; dynamic models of the firm; market stability under uncertainty; capital theory and asset management.

201A-201B. International Trade **W-S**
Theory of international trade, finance, and monetary relations. Growth, disturbances, and balance of payments adjustment. International economic policy and welfare. (201B not offered 1969.)

210A-210B-210C. Aggregate Economic Analysis (3-3-3) **F-W-S**
The theory of income determination; consumption and investment; money, the general price level and the rate of interest; fluctuations in income and employment.

212. Optimal Economic Growth **S**
The concepts of efficiency and optimality in dynamic models; interpretation and application of dynamic programming, calculus of variations, and control theory in problems of economic growth; the performance of markets in intertemporal resource allocation. Prerequisites: Economics 200A-200B, 210A-210B-210C or equivalent.

213A-213B. Topics in Economic Theory **W-S**
An intensive examination of the literature on selected topics of current importance in economic theory. In 1969 the course will be solution methods

for three simultaneous difference equations; equilibrium and stability; effects of lag rearrangements on convergence; applications to conventional economic models. (213B not offered 1969.)

220. Techniques of Economic Research (3) S
The construction and application of stochastic models in economics. This includes both single and simultaneous equation models. Prerequisites: Mathematics 130A, 133A.

230A-230B-230C. Public Policy (3-3-3) F-W-S
The application of macroeconomic and microeconomic theory to issues of public policy. In 1968–69 the topics offered are: an examination of the empirical results of dynamic macroeconomic models (fall); monetary theory and policy (winter); and inflation (spring).

240A-240B. Economic History (3-3) W-S
An intensive survey of the economic history of both Europe (240A) and the United States (240B). Prerequisites: Economics 200C, 210C, and 220. (Not offered 1969.)

250A-250B. Public Finance
Analysis of the impact of the government budget upon resource allocation and income distribution; social choice and political processes; tax and transfer policies and inter-temporal income distribution; the problem of public goods in a private market. (250B not offered 1968–69.)

269. Dissertation Seminar (3) S
A program of regular reports by second-year students on their progress toward the definition of their dissertation problems, and reports by degree candidates on their research progress. All students are expected to participate during their second year, and during at least one year of their doctoral candidacy. (Satisfactory/Unsatisfactory grades permitted.)

290A-290B-290C. Teaching Methods in Economics
The study and development of effective pedagogical materials and techniques in economics. Students who hold appointments as teaching assistants must enrol in this course, but it is open to other students as well. (Satisfactory/Unsatisfactory grades only.)

297. Independent Study (1-6, 1-6, 1-6) F,W,S

299. Research (1-12, 1-12, 1-12) F,W,S
(Satisfactory/Unsatisfactory grades permitted.)

HISTORY

Office: Building 402, Matthews Campus
Samuel Baron, *Ph.D., Professor of History*
Guillermo Céspedes, *Ph.D., Professor of History*

Gabriel Jackson, *Ph.D., Professor of History*
Armin Rappaport, *Ph.D., Professor of History* (Provost of Third College, Chairman of the Department)
Curtis Wilson, *Ph.D., Professor of History*
Roger de Laix, *Ph.D., Assistant Professor of History*
Michael Parrish, *Ph.D., Assistant Professor of History*

* * *

Stanley Chodorow, *B.A., Acting Assistant Professor of History*
John G. Leonard, *M.A., Acting Assistant Professor of History*
Franz Nauen, *B.A., Acting Assistant Professor of History*

The Major Program

Students majoring in the Department of History are required to take a minimum of twelve upper-division courses in history. Beginning in the fall quarter, 1968, these courses must be selected from four groups:

I. Lecture and discussion courses in European history
II. Lecture-discussion courses in western-hemisphere history
III. Lecture and discussion courses in non-western history
IV. Proseminar courses divided between (*a*) historiography, and (*b*) research, as follows: five quarter courses from one of the first three groups (to be designated the student's primary field); three quarter courses from a group other than the primary field; two quarter courses from a third group; and two quarter courses from Group IV (related to the student's primary field) one to be in historiography and one in research. With the consent of the student's adviser, a student may substitute courses in Group IV for lecture-discussion courses in Groups I, II, and III, not to exceed one substitution in each group. Such students must also gain the consent of the instructor of the course and must have an average of 3.0 in history courses.

History majors are urged to take courses in related disciplines to enhance their understanding of the historical process and to strengthen their preparation in the major. Such courses should be selected in consultation with the adviser.

The Graduate Program

The Department currently offers graduate work leading to the Ph.D. degree. Students seeking the Ph.D. in history should have a strong background not only in history but in related studies within the humanities and social sciences. Candidates must demonstrate a reading knowledge of one foreign language at the beginning of their first quarter of residence; and by the opening of their second year they are required to pass a reading examination in a second language. (These are departmental language requirements and are separate from any *Graduate Division* requirements for the degree.)

All students admitted to the program will be expected to be full-time

students. A full-time program consists of twelve units per quarter; students holding a teaching appointment will take fewer, but not less than nine. The units will be distributed among three types of courses, as follows: research seminars (4 units per quarter), readings in the literature of the several fields (4 units per quarter), directed reading courses. Students will normally take two research seminars (each is a two-quarter sequence); at least three reading courses in the literature of the several fields (each is a one-quarter course); and the remaining units in directed reading. The research seminars must be taken under two different instructors. At present, students may choose among the following fields:

Greece
Rome
Western Europe, 325–1250
Western Europe, 1250–1648
Western Europe, 1648–1815
Western Europe, 1815–Present
Russia and Eastern Europe since 1613
The United States, Colonial Period
The United States, National Period
Latin America, Pre-Colonial
Latin America, Colonial and National
History of Science
India

Each candidate will be expected to pass a departmental written examination in each of his three chosen fields and the oral qualifying examination before beginning work on the doctoral dissertation. These examinations may not be taken before the end of the second year and normally will be taken by the end of the third year. The dissertation must be completed not later than six years from the time of admission to the program, preferably sooner. It normally will not exceed two hundred fifty pages, notes included. A final oral examination on the dissertation will be conducted by the student's doctoral committee.

The various requirements noted above apply to students who have done no previous graduate work in history. If a candidate has completed some graduate work before entering UCSD, there may be appropriate adjustments in the course work. Nevertheless, all candidates will be required to demonstrate reading knowledge of two foreign languages, to pass the departmental and qualifying examinations, to write a dissertation, and to pass the final oral examination.

COURSES

LOWER DIVISION

The Department of History cooperates in the teaching and administration of the Humanities sequence for Revelle College students. (See *Interdisciplinary Courses.*) Completion of this sequence or the Muir College lower-division requirements is normally prerequisite to enrolling in upper-division courses in the Department of History. (Transfer students

with credit for a two-semester, lower-division history sequence may be admitted to the upper-division courses.)

10A. Introduction to History W
Mr. Baron
The nature and uses of history will be explored through the study of the historian's craft, and the critical analysis of historical sources and historical literature. (Recommended for prospective history majors.)

30A-30B-30C. United States History F-W-S
Mr. Parrish
The development of American society from the pre-Civil-War period to the First World War. The rise of sectionalism and movements for reform, the impact of immigration and industrialization. (May be used by Muir College students in fulfilling the humanities requirement of the College.)

UPPER DIVISION

104A-104B. Greece in the Classical Age F,W
Mr. De Laix
The political, economic and intellectual history of Greece from the birth of the city-states to the death of Alexander the Great. Three hours lecture and discussion.

105A-105B. The Roman Republic and Empire F,W
Mr. De Laix
The political, economic and intellectual history of the Roman world from the foundation of Rome to the death of Constantine. Three hours lecture and discussion. (Not offered 1968–69.)

111A-111B-111C. The Rise of Europe F-W-S
Mr. Chodorow
The development of European society from the decline of the Roman Empire to 1250. Three hours lecture.

113. Renaissance Europe: 1348–1517 F
The intellectual, political, and economic transformation of late-medieval Europe from the crisis of the Italian civic spirit to the flowering of the Renaissance monarchies. The concurrent evolution of diplomacy, warfare, and political behavior. Three hours lecture. (Not offered 1968–69.)

114. Early Modern Europe: 1517–1688 W
The religious crisis, the decline of the Holy Roman Empire and the rise of national states. Intellectual developments, political theory, and problems of government and citizenship in the seventeenth century. Three hours lecture. (Not offered 1968–69.)

131A-131B-131C. The British Empire Since 1783 F-W-S
The political and economic development of the British Empire, including the evolution of colonial nationalism. The development of the common-

wealth idea, a survey of Canada, and changes in British colonial policy. Three hours lecture. (Not offered 1968–69.)

135A-135B. Germany: 1815–1919 **F-W**
Emphasis on the political unification and cultural flowering of nineteenth-century Germany; the era of Bismarck, of William II, and the "catastrophe" of 1914–18. Three hours lecture. (Not offered 1968–69.)

140. The Expansion of Europe, Fifteenth to Seventeenth Centuries **S**
Mr. Céspedes
The techniques, economic organization, and institutional evolution of European colonizations in Africa, the Far East, and the Americas. The great geographical discoveries and the beginnings of world trade. With emphasis in comparative aspects.

145A. Russia: 1533–1800 **F**
Mr. Baron
A survey of the development of Russian society and thought from Ivan the Terrible to Alexander I. Emphasis will be on the westernization of Russia. Three hours discussion.

145B. Russia: 1800–1914 **W**
Mr. Baron
An examination of Imperial Russia's last century, with special emphasis on currents of social thought and the revolutionary movement. Three hours discussion.

145C. Russia: 1914 to the Present **S**
Mr. Baron
The Russian Revolution and the transformation of Russia under the Soviet Regime. Domestic and foreign policies will be considered. Three hours discussion.

150A-150B. Europe: 1789–1914 **F-W**
Mr. Nauen
The impact of industrialization and the entry of new classes into politics. Effects of political, social, and economic change on both the domestic and the international order of the European states. Three hours lecture.

151A-151B-151C. World History of the Last Century **F,W,S**
The origins of the contemporary world with emphasis on non-European, as well as Western history. Three hours lecture. (Not offered 1968–69.)

152A-152B. Europe in the Twentieth Century **F-W**
Lecture and discussion course on the political, social, economic, intellectual, and diplomatic history of Europe from 1900 to the present, with emphasis on the coming of the two great wars.

155A-155B-155C. History of Science **F-W-S**
Mr. Wilson
Selected topics in the history of science down to 1900, including the

development of planetary theory, mechanics, the atomic hypothesis and structural chemistry, energetics, field theory of biological evolution.

164. American Intellectual History to 1860 W

From colonial times through the pre-Civil-War period; European origins and the development of political, social, economic, and religious thought in the American context. Three hours discussion.

165. American Intellectual History from 1860 S

American thought in the post-Civil-War period, and some major trends in social, economic, political, and religious thought in the twentieth century. Three hours discussion.

167A-167B. United States in the Twentieth Century W-S

Mr. Parrish

A lecture-discussion course on American society from 1890 to the present. Emphasis will be placed upon the domestic sources of public policy: including haphazard industrial growth, urbanization, and demographic change upon the social structure and politics of a rural, democratic, entrepreneurial culture. Close attention will be given to the origins and strategies of local, state, and national reform movements, the role of private interest groups, the effects of war, and the Negro revolution.

168. American Social History W

This course deals with American social history and institutions in the nineteenth and twentieth centuries. Emphasis will fall upon the evolution of the social welfare system; specifically, attitudes toward poverty and dependency, the reform process, the role of public and voluntary institutions in social action and social work.

170. The Spanish Civil War W

Mr. Jackson

The cultural renaissance of twentieth-century Spain, the political and economic background, the Spanish Republic of 1931–36, the Civil War seen as both a domestic and an international crisis. Three hours discussion.

172A-172B-172C. History of Latin America F-W-S

Mr. Céspedes

A survey of the evolution of Latin America, covering aboriginal civilizations, Iberian colonizations and development of the modern nations, from prehistory to the present. Emphasis on demographic, economic and social problems. Three hours lecture. (Not offered 1968–69.)

175. History of India, 1885 to the Present F

Mr. Leonard

Political history of modern India, with emphasis on the growth of the Indian National Congress, Muslim separatism, Gandhian leadership, and political and economic development after independence.

176. Social and Cultural History of India **W**

Mr. Leonard

The transformation of Indian society and culture in the nineteenth and twentieth centuries examined through case studies of institutions, groups, and individuals.

180. China **W**

An introduction to the civilization of China and a survey of China's response to the West in modern times. (Not offered 1968–69.)

181. History of South Africa

(Not offered 1968–69.)

198. Undergraduate Seminars: Historiography **F,W,S**

The Staff

Advanced studies in selected historical topics. To be offered in different fields, as schedule and staff allow. Prerequisite: upper-division standing and approval of instructor.

199. Undergraduate Research **F-W-S**

The Staff

Program to be arranged between student and instructor, depending on the student's needs and the instructor's advice in terms of these needs. Prerequisite: upper-division standing and approval of the instructor.

GRADUATE

200. Teaching in the Humanities

(Satisfactory/Unsatisfactory grades only.)

201. The Literature of the Several Fields of History

(Precise descriptions of the courses below will be provided at the beginning of each quarter.)

201A. Greece **S**

Mr. De Laix

201B. Rome

Mr. De Laix

(Not offered 1968–69.)

201D. Western Europe, 325–1250

Mr. Chodorow

201E. Western Europe, 1250–1648

(Not offered 1968–69.)

201F. Western Europe, 1648–1815

(Not offered 1968–69.)

201G. Western Europe, 1815–Present **F**

Mr. Nauen

201H. Russia and Eastern Europe since 1613 S
Mr. Baron

201I. British Empire
(Not offered 1968–69.)

201J. United States, Colonial Period

201K. United States, National Period F,W

201L. Latin America, Pre-Colonial
(Not offered 1968–69.)

201M. Latin America, Colonial and National S
Mr. Céspedes
(Not offered 1968–69.)

201O. History of Science W
Mr. Wilson

202. Research Seminars in the Several Fields of History
(Precise descriptions of the courses below will be provided at the beginning of each quarter.)

202A. Greece
Mr. De Laix
(Not offered 1968–69.)

202B. Rome
Mr. De Laix
(Not offered 1968–69.)

202C. Byzantium and Eastern Europe, 330–1250
(Not offered 1968–69.)

202D. Western Europe, 325–1250
(Not offered 1968–69.)

202E. Western Europe, 1250–1648
(Not offered 1968–69.)

202F. Western Europe, 1648–1815
(Not offered 1968–69.)

202G. Western Europe, 1815–Present F,W
Mr. Jackson

202H. Russia and Eastern Europe since 1613
(Not offered 1968–69.)

202I. British Empire
(Not offered 1968–69.)

202J. United States, Colonial Period
(Not offered 1968–69.)

202K. United States, National Period **W,S**
Mr. Rappaport

202L. Latin America, Pre-Colonial
(Not offered 1968–69.)

202M. Latin America, Colonial and National **F,W**
Mr. Céspedes

202O. History of Science
Mr. Wilson
(Not offered 1968–69.)

298. Directed Reading **F,W,S**
The Staff
(Satisfactory/Unsatisfactory grades permitted.)

299. Thesis Direction (1-12, 1-12, 1-12) **F,W,S**
The Staff
(Satisfactory/Unsatisfactory grades permitted.)

HUMANITIES

See *Interdisciplinary Courses.*

LANGUAGE

See *Interdisciplinary Courses.*

LINGUISTICS

Office: 1512 Humanities-Library Building

Edward Klima, *Ph.D., Professor of Linguistics*
Leonard Newmark, *Ph.D., Professor of Linguistics*
(Chairman of the Department)
Paul Chapin, *Ph.D., Assistant Professor of Linguistics*
*Sige-Yuki Kuroda, *Ph.D., Associate Professor of Linguistics*
Sanford Schane, *Ph.D., Associate Professor of Linguistics*
Ronald W. Langacker, *Ph.D., Assistant Professor of Linguistics*
Margaret H. Langdon, *Ph.D., Assistant Professor of Linguistics*

*On leave 1968-69.

Broadly speaking, linguistics is simply the study of language *as* language. Like other rapidly developing fields, linguistics resists simple classification into one of the traditional categories of academic disciplines. Considered as one of the humanities, linguistics concentrates on the historical development of a particular language or language family, or on the relation between a language and the literature composed in that language. Considered as a social science, linguistics may be related to anthropology, in describing language as a part of culture; or it may be related to psychology, in describing language as a kind of behavior.

One branch of linguistics, phonetics, may even be considered a natural science, related to the physical science of acoustics and the biological sciences of anatomy and physiology. Considered as an engineering science, linguistics has found many applications in fields as far apart as language pedagogy and mechanical translation. Finally, linguistics may be considered a formal science in its own right, related to mathematics and formal logic.

(The Department of Linguistics supervises the teaching of foreign languages. See *Interdisciplinary Courses: Language.*)

The Major Program

An undergraduate major in linguistics is intended to give a student the background that will best prepare him for graduate work in this field. Because linguistics shares its object matter—language—with so many other disciplines, this major is unlike many others in that it requires relatively few courses in the major department itself. The major in linguistics will consist of twelve courses: six basic courses in the Department of Linguistics, comp'emented by six other courses directly related to the study of language.

All linguistics majors are required to take the following courses in the Department of Linguistics: 100, 101A, 101B, 102, and two quarters of 199. Linguistics 100 may be taken by lower-division students. Linguistics 101A and 101B must be taken sequentially.

The foreign language proficiency requirements for linguistics majors exceed those set by the undergraduate colleges in both breadth and depth. In terms of depth, the student must pass an upper-division reading proficiency examination in the language in which he has satisfied his college's proficiency requirement. In terms of breadth, the student must achieve competence in at least one additional foreign language. Competence is defined as the successful completion of three one-quarter courses or the equivalent. These courses may be taken as part of the major program. The remaining courses of the linguistics major must be relevant to the study of language but may be taken in departments other than Linguistics: for instance, Mathematics, Applied Electrophysics, Philosophy, Psychology, Anthropology, or Literature. These courses need not all be taken in the same department, but they must form a coherent program of study in conjunction with the required core of linguistics courses. The courses to complete the major are selected in consultation with the departmental undergraduate adviser.

The Noncontiguous Minor (Revelle College)

Because of the great flexibility of the linguistics major, the classification of this major as humanities, natural science, or social science must be determined for each student on the basis of his specific program. The classification of his major program will in turn determine what areas will be acceptable for the student's noncontiguous minor.

Major Program in Linguistics (Recommended Schedule)

	Fall	Winter	Spring
Junior Year	Linguistics 100 or 102 Language	Linguistics 101A Language	Linguistics 101B Language
Senior Year	Linguistics 102 or Elective *	Linguistics 199 *	Linguistics 199 *

*Courses relevant to the study of language selected from Linguistics or other departments.

The Graduate Program

In order to develop scholars capable of original research and effective teaching, the Linguistics faculty has planned a graduate program aimed at imparting: (*a*) a thorough understanding of contemporary linguistic theory and linguistic analysis, (*b*) a broad knowledge of the major achievements of descriptive and historical linguistics, and (*c*) intensive training in a specialized area of linguistic study, within linguistics itself or in conjunction with related disciplines.

Preparation

Since linguistics is a highly technical and analytic field, linguistics students will find their undergraduate training in mathematics and the natural sciences especially valuable. Undergraduate work in certain of the social sciences and humanities, particularly psychology, anthropology, philosophy, and literature, is also good preparation for linguistics. All applicants are expected to have substantial experience with foreign languages, but since few institutions offer serious linguistics courses for undergraduates, the student may begin his graduate program here with no previous course work in linguistics proper. Because the basic graduate courses offered by the Department of Linguistics are three-quarter sequences, new graduate students will normally be admitted only in the fall quarter of any academic year. Applicants for admission to graduate status in Linguistics are normally required to submit scores on the Graduate Record Examinations Aptitude Test given by the Educational Testing Service of Princeton, New Jersey.

Program of Study

The graduate program is aimed essentially towards the Ph.D. in Linguistics, with a provision for granting the M.A. (Plan II) upon

completion of the basic graduate requirements. In the student's first year of graduate study, his basic courses will stress linguistic theory and the structure of English, particularly from the point of view of generative grammar. For his advanced work, a student will broaden his knowledge of general linguistics and field techniques. In addition he will choose, subject to the approval of the Department's Graduate Committee, an area of specialization based on his individual interests; for example, linguistic theory, Romance linguistics, English linguistics, physcholinguistics, language acquisition, or anthropological linguistics.

Language Requirements

A candidate for the M.A. degree must demonstrate (1) his ability to read French, German, or Russian by achieving a scaled score of at least 500 on the Social Science option of the Graduate School Foreign Language Test given by the Educational Testing Service of Princeton, New Jersey, and (2) his knowledge of the structure of an Indo-European language and of a non-Indo-European language, either through his performances in courses on the structure of the language or in a descriptive paper acceptable to the Department's Graduate Committee.

A candidate for the Ph.D. degree, in addition to meeting language requirements (1) and (2) above, must demonstrate (3) reading knowledge of a second foreign language—French, if he has not used it in fulfilling the M.A. requirements, otherwise German and Russian, and (4) oral fluency in some language other than his native one. The language chosen for oral fluency may be one of those in which he has satisfied a reading requirement.

Departmental Examinations

Candidates for both the M.A. and Ph.D. degrees must pass the departmental comprehensive examination. This written examination gauges the student's general familiarity with modern descriptive and comparative linguistics. Normally, a student may take the examination no earlier than three quarters and no later than eight quarters after beginning graduate study. To be eligible to take the comprehensive examination, the student must have satisfied language requirement (1) above.

Candidates for the Ph.D. degree must also take a qualifying examination—a two-hour oral examination which tests the student's knowledge in his area of specialization. The qualifying examination, which normally requires from six to nine quarters of course preparation at the graduate level, may be taken only after the student has passed the departmental comprehensive examination and satisfied all language requirements.

Apprentice Teaching and Research

As part of his preparation for a future academic career, every linguistics student at UCSD is given special opportunities to participate in one of the Department's teaching and research programs under the supervision of a professor. Depending on his qualifications, the student may conduct conversation classes or analysis conferences in the Basic Lan-

guage Program administered by the Department, or he may be asked to assist a professor in the teaching of a graduate or undergraduate linguistics course, or he may do research in linguistics under the supervision of his doctoral committee chairman. Such apprentice training is an integral part of the linguistics graduate program at UCSD.

Dissertation

The candidate will write a substantial dissertation incorporating the results of original and independent research carried on under the supervision of his doctoral committee. He will be recommended for the Doctor of Philosophy degree after he has made a successful oral defense of his dissertation before the doctoral committee.

COURSES

UPPER DIVISION

100. General Linguistics **F,S**
An introduction to the study of language. The analytical and descriptive methods and devices of general linguistics; phonological, morphological and syntactic systems; comparative and historical linguistics, psycholinguistics, anthropological linguistics, and their relationships to general linguistics. Three hours lecture, nine hours reading and exercises. (Open to lower-division students.)

101A-101B. Linguistic Theory and Analysis **W-S**
Introduction to linguistic theory through a detailed study of syntactic and phonological patterns of English and other languages. Formal evaluation of grammars and the empirical justification of linguistic analyses. Linguistic universals. Recording and analysis of a language by direct elicitation from native informants. 101A: three hours lecture, nine hours reading and exercises. 101B: two hours lecture, two hours laboratory, eight hours reading and exercises. Prerequisite: Linguistics 100.

102. Phonology **F**
The structure of the sound systems of languages. Phonetic classification and its role within a theory of phonology. Types of phonological rules. Problems in phonological analysis drawn from natural languages. Three hours lecture, one hour discussion, eight hours reading and exercises. Prerequisite: Linguistics 100.

199. Advanced Study for Undergraduates **F,W,S**
Under the supervision of a Linguistics Department undergraduate adviser the student will undertake a program of research or advanced reading in linguistics. Under this course title advanced students will be allowed to attend certain courses offered by the Department in its 200-series of graduate courses. May be repeated for credit.

GRADUATE

201A-201B-201C. Linguistic Theory (3-3-3) **F-W-S**
Introduction to the theory of generative grammar; transformational rules

and other rule schemata. Models for syntactic description; formalization of grammars. Advanced problems in syntactic theory; deep and surface grammar; semantic considerations in syntax.

202A-202B-202C. Phonology (3-3-3) **F-W-S**
General problems in phonological analysis. Articulatory and acoustic phonetics; the relationship between the various phonetic parameters and their role in phonological theory. Distinctive features and notational conventions; types of phonological processes and universal constraints.

211A-211B-211C. Linguistic Analysis (3-3-3) **F-W-S**
The techniques of linguistic analysis (phonetics, phonemics, morphology, syntax). Application of these techniques under simulated field conditions to the recording and analysis of a language by direct elicitation from native informants. (Satisfactory/Unsatisfactory grades permitted.)

221A-221B. History and Structure of English (3-3) **F-W**
The phonological, morphological, syntactic, and lexical evolution of the English language. (Not offered 1968–69.)

224A-224B. Modern English (3-3) **W-S**
A detailed study of the syntax, phonology, and semantics of modern English, with particular emphasis on current research on the general theory of grammars, as developed through the study of English.

231A-231B. Formal Linguistics (3-3) **F-W**
Theory of formal grammars, with particular emphasis on context-free grammars. Aspects of theories of automata and computation related to grammatical systems. Relationship of the hierarchies of automata and grammars.

234. Computational Linguistics (3) **S**
Parsing algorithms for formalized grammars. Approaches to natural-language processing. The computer as a linguist's tool.

241. Romance Linguistics (3, 3, 3) **F,W,S**
The history and structure of the Romance languages in the context of generative grammar. Topics offered on a regular basis will include: historical French syntax, historical French phonology, modern French syntax, modern French phonology, historical Romance phonology, historical Romance syntax. Other Romance languages and Latin will be considered, according to student interest.

251. Historical Linguistics (3, 3, 3) **F,W,S**
Topics offered on a regular basis will include: Indo-European phonology and morphology; the techniques of linguistic reconstruction; theory of language change; advanced problems of historical linguistics.

264. Language Structures (3, 3, 3) **F,W,S**
Grammatical analysis of a specific language. Language considered in a given quarter may be Sanskrit, Japanese, Albanian, Diegueño, Hungarian, or Tongan.

271. **Anthropological Linguistics** (3, 3) **W,S**
In a given quarter the topic may be: language and culture; the interrelationships of language and other aspects of human behavior; Indian languages of North America; Oceanic languages; or advanced problems in anthropological linguistics.

281. **Psycholinguistics** (3, 3) **F,S**
The study of models of language and of language acquisition from the point of view of modern linguistics and psychology.

285. **Teaching Practicum** (3, 3, 3) **F,W,S**
(Satisfactory/Unsatisfactory grades permitted.)

290. **Issues in Contemporary Linguistics** (3, 3, 3) **F,W,S**
Discussion of a selected topic drawn from the history of linguistics and general linguistics. (Satisfactory/Unsatisfactory grades permitted.)

296. **Directed Research** (1-6, 1-6, 1-6) **F,W,S**
Individual research. (Satisfactory/Unsatisfactory grades permitted.)

298. **Special Studies** (2-6, 2-6, 2-6) **F,W,S**
Advanced seminars. (Satisfactory/Unsatisfactory grades permitted.)

299. **Doctoral Research** (1-12, 1-12, 1-12) **F,W,S**
(Satisfactory/Unsatisfactory grades permitted.)

LITERATURE

Office: 1003 Humanities-Library Building

*Ronald Berman, *Ph.D., Professor of English Literature*
Carlos Blanco, *Ph.D., Professor of Spanish Literature*
Bernhard Blume, *Ph.D., Professor of German Literature*
*Joaquín Casalduero, *Ph.D., Professor of Spanish Literature*
Robert C. Elliott, *Ph.D., Professor of English Literature* (Chairman of the Department)
Edwin Fussell, *Ph.D., Professor of American Literature*
Claudio Guillén, *Ph.D., Professor of Spanish and Comparative Literature*
Reinhard Lettau, *Ph.D., Professor of German Literature*
†Roy Harvey Pearce, *Ph.D., Professor of American Literature*
*Gian-Roberto Sarolli, *D.L., Professor of Romance Philology and Italian Literature*
John L. Stewart, *Ph.D., Professor of American Literature* (Provost of Muir College)
Andrew Wright, *Ph.D., Professor of English Literature*
Jaime Alazraki, *Ph.D., Acting Associate Professor of Spanish Literature*
Thomas K. Dunseath, *Ph.D., Associate Professor of English Literature*
Fredric Jameson, *Ph.D., Associate Professor of French Literature*
Jack Behar, *Ph.D., Assistant Professor of American Literature*
Sacvan Bercovitch, *Ph.D., Assistant Professor of American Literature*

David K. Crowne, *Ph.D., Assistant Professor of English and Comparative Literature*
Abraham Dijkstra, *Ph.D., Assistant Professor of American and Comparative Literature*
Edwin Dolin, *Ph.D., Assistant Professor of Classical and Comparative Literature*
**James T. Monroe, *Ph.D., Assistant Professor of Spanish and Arabic Literature*
Fred V. Randel, *Ph.D., Assistant Professor of English Literature*
George H. Szanto, *Ph.D., Assistant Professor of German and Comparative Literature*
Martin Wierschin, *Ph.D., Assistant Professor of German Literature and Germanic Philology*
Anthony Wilden, *Ph.D., Assistant Professor of French Literature*
Wai-lim Yip, *Ph.D., Assistant Professor of Chinese and Comparative Literature*

* * *

Alexandra Casalduero, *M.A., Lecturer in Literature*
Edward Baker, *M.A., Acting Assistant Professor of Spanish Literature*
Alain J. J. Cohen, *M.A., Acting Assistant Professor of French Literature*
Kenneth E. Lavender, *M.A., Acting Assistant Professor of English and Comparative Literature*
Keith D. Lowe, *M.A., Acting Assistant Professor of English Literature*
Jonathan Saville, *M.A., Acting Assistant Professor of French and Comparative Literature*

*On leave fall quarter, 1968
**On leave 1968–69
†On leave spring quarter, 1969

The Department of Literature has as its object instruction and research in the various national literatures, taken singly and also in relation to one another. Assuming that there are habits of mind and methods of inquiry peculiar to literary study, whatever the language, the department brings together teachers, scholars and students who would elsewhere be separated, not by their studies, but by the languages in which those studies are pursued. Thus, in both undergraduate and graduate studies, the emphasis is strongly comparatist.

Types of Courses Offered by the Department

The Department offers both general courses and courses in national literatures for lower-division, upper-division, and graduate students.

General courses (including the lower-division introductory sequences and "general" upper-division courses) taught in Muir and Revelle Colleges do not require proficiency in a foreign language: lectures and discussions are conducted in English, and works from languages other than English are read in translation.

Courses in the several national literatures are normally taught in the languages in which the works under study were written.

The lower-division courses numbered 11 are intermediate courses of readings and discussions in languages other than English. They are designed to develop language skills beyond the generally required level of proficiency and to introduce the student to the cultural context of the literature concerned. Except for Latin 11 and Greek 11, which require the completion of a beginning language course, lower-division language proficiency is a prerequisite for the Literature 11 courses. They are not prerequisite to each other; except for Latin 11 and Greek 11, which are offered in winter and spring only, one is given in each of the several languages each quarter.

Upper-division courses in the national literatures are of two chief kinds:

A. Intercollegiate lecture courses which are unlimited in enrolment and are open to students in both Muir and Revelle Colleges.

B. Intracollegiate seminars which are open only, except in special cases, to students in the college in which they are given. As part of their seminar work, students will undertake projects of independent study. They will accordingly be expected to have regular tutorial conferences with their instructors.

Variations from this plan include the Writing Workshop, seminar courses open to qualified students from both Muir and Revelle Colleges, and Literature 191, a lecture course required of all majors in literature in Revelle College but open to all qualified students. Upper-division standing or consent of the instructor is prerequisite to all upper-division courses. In addition, upper-division courses in literatures other than English require foreign-language proficiency equivalent to that normally attained by successful completion of studies in the 11-series; they are given in the language of the literature concerned. Graduate standing or consent of the instructor and, where appropriate, adequate foreign-language proficiency are prerequisite to all graduate courses.

Lower-Division Preparation

In both Muir and Revelle Colleges, the only prerequisite to upper-division literature courses is completion of the college freshman-sophomore requirements. However, literature majors who do not elect to take Literature 11 as part of their lower-division program may find that, before enrolling in upper-division courses in a foreign literature, they must bring their language proficiency up to the expected level by taking such lower-division courses during their junior year. Accelerated lower-division students may take advanced courses by permission of the Department.

Transfer students must demonstrate the same level of competence in a foreign language that is required of UCSD students. First-hand knowledge of some of the major documents of Western Civilization, such as is acquired in the Revelle College Humanities sequence, is assumed.

The Literature Curriculum: Muir College

The major in Literature in Muir College consists of a minimum of twelve courses. Of these, nine are to be in one literature (the "primary" literature) and the rest in another, or "secondary" literature. Minimum requirements are these: four Muir College seminars in the primary literature; one Muir College seminar in the secondary literature; four lecture courses from the Department's intercollegiate offerings. Credit toward the major will be granted for only one course of Literature 11. The remainder must be upper-division courses.

There is a very considerable range of freedom in this major program. It is possible to benefit from both lecture and seminar work, and to combine the study of literatures which have natural connections. Aside from the Muir College freshman and sophomore requirements, there are no prerequisites for the major in Literature. The student is, however, advised to prepare himself adequately in the foreign language he will use either in the primary or the secondary literature.

The Literature Curriculum: Revelle College

The Literature Department major in Revelle College consists of fourteen courses taken during the junior and senior years: nine upper-division courses in one literature (the primary literature); three upper-division courses in a secondary literature, taught in the language of that literature; and two elective courses in literature. The elective courses are normally upper division, but may, when necessary, include Literature 11.

In each primary literature the following courses are required: Literature 151 and the Senior Major Sequence (Literature 191 and Literature 192 in the student's primary literature). The Senior Major Sequence, taken by all majors during the senior year, is the culmination of the major in Literature. Students will explore various approaches to literary texts, then, meeting in small groups, focus for study on a well-defined problem in their respective primary literatures; the sequence ends with the presentation of the senior essay.

Noncontiguous Minor: Revelle College

Revelle College students who wish to pursue a noncontiguous minor involving Literature may consult with the Department's minor-program adviser.

Honors Program

A small group of students majoring in Literature will be admitted to the Department's Honors Program, which will be in accord with the Honors Programs of the students' colleges. In general, honor students will have special privileges and special responsibilities: some requirements will be waived so that they will have the time and energy to write a thesis of some length in their senior year. Students wishing to try for Honors should talk with the departmental major-program adviser early in their junior year.

The Graduate Program

Doctor's Degree Program

Doctoral programs are offered in English and American Literature, in Spanish Literature, and in Comparative Literature. The Department expects soon to present Ph.D. programs in French, German, and Classical Literature. The Department does not offer the M.A.

Preparation

The following are requirements for admission to graduate study in Literature:

1. A baccalaureate degree with a major in one of the literatures offered by the Department, or in another field approved by the departmental Committee on Graduate Studies.
2. Satisfactory scores on the Graduate Record Examination, including, when available, the advanced examination in the literature of the student's field.
3. A working knowledge of one foreign language, to be tested during the first quarter of residence.

Language Requirements

The Ph.D. program for English and American literatures requires either (*a*) demonstrated fluency in reading, writing, and speaking one language in addition to English, or (*b*) a working knowledge of two languages in addition to English. Students in this program are expected to take at least two courses (or the equivalent independent study) in philology or linguistics. (See *Graduate Division: Foreign Language Requirement.*)

The Ph.D. program for Spanish literature requires, in addition to the above, a reading knowledge of Latin, to be established by an examination conducted by the Department of Literature. A student in this program is expected to minor in another Romance literature and to choose a second minor (his comparatist project) in a non-Romance literature relevant to his field of specialization. (See *Graduate Division: Foreign Language Requirement.*)

The Ph.D. program in Comparative Literature requires (*a*) knowledge in depth of *two* foreign languages, (*b*) a reading ability in French, or German, or Italian, (*c*) when the student's field of concentration demands it, a reading ability in a classical language (Greek, Latin, Chinese, Arabic, etc.). A student in the program is expected to attend graduate seminars or undertake guided independent study in *three* literatures, one of which can be English or American. (See *Graduate Division: Foreign Language Requirement.*)

Departmental and Qualifying Examinations

There are two examinations. The first, which the student takes at the end of his first year, is a departmental examination intended to let the student demonstrate his fitness to proceed to further graduate study

in particular, to the guided independent study which the departmental graduate program emphasizes. The qualifying examination, which the student takes at the end of his third year, is general and comprehensive.

Course of Study

Although most students will concentrate in a national literature, there will necessarily be a distinctly comparatist emphasis in their studies. Each student will undertake a comparatist project—course work and guided independent study in a literature other than, but related to, the one in which he is specializing. The program of study makes explicit provision for a significant amount of independent work. Tutorial work and interdisciplinary study are encouraged; in addition, all graduate students work in close association with an adviser who directs their independent study preparatory to the departmental and qualifying examinations. There is no specified schedule of courses—on the contrary, graduate students take those seminars best suited to their individual needs and interests. Since topics change from year to year, all graduate courses are offered for repeated registration.

Teaching

Every student is required to do some apprentice teaching as an integral part of his training. Normally, he works as a Teaching Assistant in the lower-division courses in Humanities or Literature.

The Department invites inquiry for its "Program of Instruction" brochure, which sets forth the requirements in detail.

COURSES

General

LOWER DIVISION (MUIR COLLEGE)

(See also lower-division courses listed under the several national literatures.)

1A-1B-1C. The Interpretation of Literature **F-W-S**

Mr. Stewart, Mr. Lavender, Mr. Guillén, Mr. Lowe, Mr. Jameson

Taking as its premise the importance of close scrutiny, this sequence will emphasize problems of type and genre in the process of understanding and interpreting particular works and relating them to literary tradition. Two lectures and one discussion. Fall: Poetry and Perception; Winter: Narrative Forms; Spring: Themes in Modern Literature. Must be taken in sequence. (This sequence may be used in fulfilling the Muir College humanities requirement.)

LOWER DIVISION (REVELLE COLLEGE)

The Department of Literature cooperates in the teaching and administration of the Humanities Sequence for Revelle College students. (See *Interdisciplinary Courses: Humanities.*)

21, 22, 23. Introduction to Literature

The three courses, none of which is prerequisite to another and which need not be taken in sequence, will consider several important literary works as representatives of the major genres. Foreign texts will be read in translation. Lecture and discussion. Three meetings.

21.	Lyric Poetry.	Mr. Yip	F
22.	The Drama.	Mr. Szanto	W
23.	The Novel.	Mr. Lettau	S

UPPER DIVISION

(Upper-division standing or consent of the instructor is prerequisite to all upper-division courses. General courses in Literature do not require the completion of lower-division proficiency in a foreign language. Texts are read in translation when necessary and lectures are given in English.)

111, 112, 113, 114. Writing Workshop

A workshop for students seriously interested in writing. Intensive study of the means of expression provided by the different literary forms. Discussion and scrutiny of original works of students. Seminar, three hours.

111.	Fiction.	Mr. Lettau	F
112.	Exposition.	Mr. Lowe	F
113.	Drama.	Mr. Szanto	S
114.	Verse.	Mr. Dijkstra	W

Prerequisites: submission of original work already completed and consent of the instructor.

122. The Literature of Renaissance Humanism

The course will consider one or more essential figures of Renaissance humanism. The intent of the course will be to investigate the breadth of Renaissance culture: hence historical, aesthetic, philosophical, political, as well as literary readings will be included. Texts may be read in English translation. Three hours lecture.

1969: Niccolo Machiavelli. Mr. Sarolli S

The *Prince* and the *Mandragola* viewed as exemplifying Machiavelli's multiple eminence as a political thinker, a historical figure, and a literary artist.

123. The Classical Tradition

Greek and Roman literature in translation. The texts, varying from year to year, include works of Homer, Greek tragedy and comedy, Plato, Virgil, Ovid and Petronius. Three hours lecture. (Not offered 1968–69.)

Lit/Ch/Tr 151. Masterpieces of Chinese Literature in Translation S

Mr. Yip

The course will focus on a few representative masterpieces of Chinese literature in its classical age, with emphasis on the formal conventions and the social or intellectual presuppositions that are indispensable to their understanding. Three hours lecture.

Lit/It/Tr 151. Dante **W**

Mr. Fussell

An intensive study of the *Divine Comedy,* working from English translation to an understanding of the original in Italian. Three hours lecture.

152. The Man of Letters

The course will center on a single writer, of major literary, cultural, or ideological significance, covering all important aspects of his work and of his historical situation. Three hours lecture.

1968: Jean Paul Sartre. Mr. Jameson F

The major plays and novels, with special emphasis on Sartre's philosophy. Lectures will be given in English; texts may be read in either English or French.

161. The Forms of Folklore **W**

A survey of the range of folkloristic phenomena as exemplified by major and minor forms—narrative, legend, myth, superstition, speech, custom, games, and music. Examples will be considered both as artistic entities and as social documents. Three lectures.

191. The Study of Literature **W**

Mr. Pearce

A critical survey of the nature of literary understanding and interpretation. As the first element in the two-quarter Revelle Senior Major Sequence, this course is required of all Revelle College majors in literature and is prerequisite to Literature 192 as given in the several national literatures. It is open to students of all the Colleges, however. Three hours lecture.

UPPER DIVISION (MUIR COLLEGE)

131. Muir College Seminars

The Staff

These seminars, open to upper-division students in Muir College and to others with special permission, are devoted to a variety of topics, including the works of single authors, genre studies, problems in literary history, relations between literature and the other arts, literature and the history of ideas, literary criticism, literature and society, and the like. The student may enrol in more than one section in a single quarter. For the maximum number of seminars applicable to the major in Muir College, see text.

1969. Studies in Poetry. Mr. Yip W

Historical and critical problems in the art of poetry. A seminar focusing on the different kinds of poetry and critical directives that gave form to the modern tradition.

GRADUATE

200. Teaching in the Humanities (1-3, 1-3, 1-3) **F,W,S**
The Staff
Apprentice teaching in undergraduate courses given or participated in by the Department of Literature. (Satisfactory/Unsatisfactory grades only.)

201. General Philology (4)
Historical introduction to general philology, with emphasis on the Romance languages. Prerequisite: basic knowledge of Latin. (Not offered 1968–69.)

202. Textual Criticism (4)
Textual problems in medieval literature. Topic varies from year to year. Offered for repeated registration. (Not offered 1968–69.)

210. Classical Studies (4) **W**
Mr. Dolin
Analysis of significant works of the Greek and Roman tradition, with attention to their interest for later European literature. Texts may be read in English.
1969: Virgil, *Eclogues.*

211. Problems in Classical Arabic Literature (4)
A study of Arabic prose and poetry in translation into Western languages. Knowledge of Arabic is helpful but not required. (Not offered 1968–69.)

261. Comparative Prosody (4) **F**
Mr. Yip
The essentials or "universals" of versification on the basis of examples chosen from various literatures, including an Oriental one, as well as the methodological problems that such investigation raises.

271. Critical Theory (4, 4, 4)

1969: Freud and the Dialectics of Literature.	Mr. Wilden	F
1969: Sartre: *The Critique de la raison dialectique.*	Mr. Jameson	S
1969: Metaphor.	Mr. Lavender	S

274. Genre Studies (4)
(Not offered 1968–69.)

Comparative Literature

GRADUATE

(See also General Courses. Additional courses in Comparative Literature will be offered 1969–70.)

Lit/CL 215. Medieval Studies (4) **S**
Mr. Saville
1969: The Treatment of Love in Medieval Narrative.

Lit/CL 252. Modernism (4) W
Mr. Szanto
1969: The Theater and Modern Consciousness.

Lit/CL 253. The New Literature (4) F
Mr. Lowe
1968: Neo-African Literature.

Lit/CL 271. Art and Literature I and II (4, 4) F,W
Mr. Dijkstra
1968-69: Themes and Symbols in Gothic Fantasy and Art.

Lit/CL 275. Theory and Practice of Translation (4) W
Mr. Yip
Problems in translation as exemplified by English versions of classical and modern texts.

Lit/CL 297. Directed Studies (1-12, 1-12, 1-12) F,W,S
The Staff
Guided and supervised reading in a broad area of literature. Offered for repeated registration. (Satisfactory/Unsatisfactory grades only.)

Lit/CL 298. Special Projects (4, 4, 4) F,W,S
The Staff
Treatment of a special topic in literature. Offered for repeated registration.

Lit/CL 299. Thesis (1-12, 1-12, 1-12) F,W,S
The Staff
Research for the dissertation. Offered for repeated registration. Prerequisite: advancement to candidacy for the Ph.D. degree. (Satisfactory/Unsatisfactory grades only.)

English and American Literature

UPPER DIVISION (INTERCOLLEGIATE)

These courses are offered by the Department of Literature for students in all the Colleges and are unlimited in enrolment. College programs may set limits on the number of intercollegiate courses applicable to the major (see text). (Upper-division standing or consent of the instructor is prerequisite to all upper-division courses.)

Lit/En 101. English Literary Prose
The development of major forms and modes of English literary prose, including the novel, the essay, biography, and other genres. Three lectures. (Not offered 1968-69.)

Lit/En 102. English Dramatic Literature
The development of the drama in English. Three lectures. (Not offered 1968-69.)

Lit/En 103. English Poetry
The development of major forms and modes of English verse. Three lectures. (Not offered 1968–69.)

Lit/En. 121. The Medieval Period S
Mr. Crowne
Major English literary works of the Middle Ages as seen against the historical and intellectual background of the period. Three hours lecture.
1969: The Age of Chaucer.

Lit/En 122. The Renaissance W
Mr. Dunseath
Major literary works of the Renaissance as seen against the historical and intellectual background of the period. Three hours lecture.
1969: Spenser.

Lit/En 123. The Eighteenth Century S
Mr. Wright
Major literary works of the eighteenth century. Three hours lecture.
1969: Representative poets, including Pope, Thomson, Gray, Johnson, and Blake.

Lit/En 124. The Nineteenth Century F
Mr. Lavender
Readings in the Romantics and Victorians; the intellectual background of the age. Three hours lecture.
1968: The Byronic Hero.

Lit/En 125. American Literature of the Nineteenth Century F
Mr. Fussell
A critical study of major American writers of the nineteenth century. Three hours lecture.
1968: Melville and Hawthorne.

Lit/En 126. The Modern Period W
Mr. Behar
A critical study of major American and English writers of our period. Three hours lecture.
1969: Conrad and Lawrence.

Lit/En 151. Shakespeare W
Mr. Berman
A critical and historical study of selected plays. Three hours lecture.
1969: The Comedies.

Lit/En 199. Special Studies F,W,S
The Staff
Tutorial; individual guided reading in an area not normally covered in courses. May be repeated for credit.

UPPER DIVISION (MUIR COLLEGE)

Lit/En 131. Muir College Seminars
The Staff
These seminars, open to upper-division students in Muir College and to others with special permission, are devoted to a variety of topics, including the works of single authors, genre studies, problems in literary history, relations between literature and the other arts, literature and the history of ideas, literary criticism, literature and society, and the like. Three hours. The student may enrol in more than one section in a single quarter. For the maximum number of seminars applicable to the major in Muir College, see text.

1968: Milton and Puritanism in English and American Literature	Mr. Bercovitch	F
1969: Augustan to Victorian Literature: The Poet and Society	Mr. Lavender	W
1969: Hero and Anti-Hero in Modern Fiction	Mr. Lowe	S

UPPER DIVISION (REVELLE COLLEGE)

Lit/En 132. Revelle College Seminars
The Staff
These seminars, open to upper-division students in Revelle College and to others with special permission, are devoted to a variety of special topics, including the works of single authors, genre studies, problems in literary history, relations between literature and the other arts, literature and the history of ideas, literary criticism, literature and society, and the like. Three hours. The student may enrol in more than one section in a single quarter. For the maximum number of seminars applicable to the major in Revelle College, see text.

1968: Yeats	Mr. Behar	F
1968: Wordsworth	Mr. Randel	F
1969: Joyce and his Influence	Mr. Dijkstra	S
1969: D. H. Lawrence	Mr. Behar	S

Lit/En 192. Problems in Interpretation **S**
Mr. Wright
Studies of works, periods, or topics in the primary literature of the student's major. As the second element in the two-quarter Revelle Senior Major Sequence, this course is required of all Revelle College Literature majors whose primary literature is English. Three hours, seminar. Prerequisite: Literature 191.

GRADUATE

Lit/En 202. Bibliography and Methods of Research (4)
(Not offered 1968–69.)

Lit/En 211. Old English Literature (4)
(Not offered 1968–69.)

Lit/En 214. Middle English Literature (4) **F**
Mr. Crowne
1968: Chaucer.

Lit/En 221. Sixteenth-Century English Literature (4) **W**
Mr. Dunseath
1969: Spenser.

Lit/En 224. Seventeenth-Century English Literature (4) **F,S**
Mr. Dunseath, Mr. Berman
Fall: Milton; Spring: Political Satire.

Lit/En. 226. Shakespeare (4)
(Not offered 1968–69.)

Lit/En 231. Restoration and Eighteenth-Century English Literature (4) **F,S**
Mr. Wright, Mr. Elliott
Fall: The Early Novel; Spring: Jonathan Swift.

Lit/En 236. Later-Eighteenth-Century English Literature (4) **S**
Mr. Dunseath
1969: Blake.

Lit/En 241. English Literature of the Romantic Period (4) **S**
Mr. Randel
1969: Wordsworth and Keats.

Lit/En 244. Colonial American Studies (4) **W**
Mr. Bercovitch
1969: The Puritan Imagination.

Lit/En 245. Nineteenth-Century American Studies (4) **F,S**
Mr. Pearce, Mr. Fussell
Fall: Hawthorne; Spring: Whitman.

Lit/En 246. Victorian Literature (4)
(Not offered 1968–69.)

Lit/En 251. Twentieth-Century English Literature (4) **W**
Mr. Behar
1969: Conrad and Yeats.

Lit/En 252. Studies in Modern American Literature and Culture (4) **W**
Mr. Berman
1969: Literature and Ideology.

Lit/En 297. Directed Studies (1-12, 1-12, 1-12) **F,W,S**
The Staff
Guided, supervised reading in a broad area of English and American literature. Offered for repeated registration. (Satisfactory/Unsatisfactory grades only.)

Lit/En 298. Special Projects (4, 4, 4) F,W,S
The Staff
Treatment of a special topic in English and American literature. Offered for repeated registration.

Lit/En 299. Thesis (1-12, 1-12, 1-12) F,W,S
The Staff
Research for the dissertation. Offered for repeated registration. Prerequisite: advancement to candidacy for the Ph.D. degree. (Satisfactory/Unsatisfactory grades only.)

French Literature

LOWER DIVISION

Lit/Fr 11. Readings in French Literature and Culture F,W,S
The Staff
An introduction to French literature. French 11 may be taken for three quarters, starting with any quarter. The instructor will advise students when they have achieved sufficient proficiency to proceed to upper-division courses in which an ability to read extensive texts in French is called for. Prerequisite: completion of Revelle and Muir College requirement of proficiency in a foreign language, or, in special cases, permission of the instructor.

UPPER DIVISION (INTERCOLLEGIATE)

These courses are offered by the Department of Literature for students in all the Colleges and are unlimited in enrolment. College programs may set limits on the number of intercollegiate courses the student may take (see text). (Upper-division standing or consent of the instructor is prerequisite to all upper-division courses. The language of instruction is French.)

Lit/Fr 121. The Middle Ages and the Renaissance S
Mr. Saville
Major French literary works of the Middle Ages and Renaissance as seen against the historical and intellectual background of the period. Medieval texts in modern French translation. Three hours lecture.
1969: The Middle Ages.

Lit/Fr 122. The Seventeenth and Eighteenth Centuries F
Mr. Cohen
Major French literary works of the period as seen against the historical and intellectual background of their time. Three hours lecture.
1968: Classical tragedy: Corneille and Racine.

Lit/Fr 123. The Nineteenth and Twentieth Centuries S
Mr. Cohen
1969: *Le nouveau roman.* Three hours lecture

Lit/Fr 124A-124B-124C. Themes in French Intellectual and Literary History
The Staff
A three-quarter sequence designed as an introduction to French literature and literary history. Each quarter will center on a specific theme or problem, giving a chronological picture of French literature from the beginnings to modern times. Majors whose primary literature is French should take this sequence as early as possible.

1968: Methods of Literary Interpretation	Mr. Cohen	F
1969: The Analysis of the Self	Mr. Wilden	W
1969: Fantastic Literature and the Unconscious	Mr. Jameson	S

Lit/Fr. 199. Special Studies **F,W,S**
The Staff
Tutorial; individual guided reading in areas of French literature not normally covered in courses. May be repeated for credit.

UPPER DIVISION (MUIR COLLEGE)

Lit/Fr 131. Muir College Seminars
The Staff
These seminars, open to upper-division students in Muir College and to others with special permission, are devoted to a variety of special topics in French literature. The student may enrol in more than one section in a single quarter. Three hours. For the maximum number of seminars applicable to the major in Muir College, see text.

1969: Montaigne. The *Essays* and the Self	Mr. Wilden	S

GRADUATE

Lit/Fr 203. History of the French Language (4)
A study of the French language from its origins through the sixteenth century. Prerequisite: basic knowledge of French. (Not offered 1968–69.)

Lit/Fr 211. Old French Language and Literature (4) **F**
Mr. Saville
1968: Introduction to the language by means of a study of three important medieval texts.

Lit/Fr 231. Seventeenth-Century French Literature (4) **W**
Mr. Cohen
1969: Racine and modern criticism.

Lit/Fr 241. Nineteenth-Century French Literature (4)
(Not offered 1968–69.)

Lit/Fr 251. Twentieth-Century French Literature (4)
(Not offered 1968–69.)

Lit/Fr 297. Directed Studies (1-12, 1-12, 1-12) **F,W,S**
The Staff
Guided and supervised reading in a broad area of French literature.

Offered for repeated registration. (Satisfactory/Unsatisfactory grades only.)

Lit/Fr 298. Special Projects (4, 4, 4) **F,W,S**
The Staff
Treatment of a special topic in French literature. Offered for repeated registration.

German Literature

LOWER DIVISION

Lit/Ge 11. Readings in German Literature and Culture **F,W,S**
The Staff
An introduction to German literature. German 11 may be taken for three quarters, starting with any quarter. The instructor will advise students when they have achieved sufficient proficiency to proceed to upper-division courses in which an ability to read extensive texts in German is called for. Prerequisites: completion of Revelle or Muir College requirement of proficiency in a foreign language, or, in special cases, permission of the instructor.

UPPER DIVISION (INTERCOLLEGIATE)

These courses are offered by the Department of Literature for students in all the Colleges and are unlimited in enrolment. College programs may set limits on the number of intercollegiate courses applicable to the major (see text). (Upper-division standing or consent of the instructor is prerequisite to all upper-division courses. The language of instruction is German.)

Lit/Ge 101. German Dramatic Literature **F**
Mr. Wierschin
Three hours lecture. 1968: Goethe and Schiller: German Classical Drama.

Lit/Ge 102. German Literary Prose **W**
Mr. Blume
Three hours lecture. 1969: The German *Novelle* from Kleist to Kafka.

Lit/Ge 103. German Poetry **S**
Mr. Wierschin
Three hours lecture. 1969: Modern German Poetry: Rainer Maria Rilke.

Lit/Ge 151. Goethe
A study of some major works in the context of Goethe's life and milieu. Three hours lecture. Required of German majors in Revelle College. (Not offered 1968–69.)

Lit/Ge 199. Special Studies **F,W,S**
The Staff
Tutorial; individual guided reading in areas of German literature not normally covered in courses. May be repeated for credit.

UPPER DIVISION (REVELLE COLLEGE)

Lit/Ge 132. Revelle College Seminars
The Staff
These seminars, open to upper-division students in Revelle College and to others with special permission, are devoted to a variety of special topics in German literature. The student may enrol in more than one section in a single quarter. Three hours. For the maximum number of seminars applicable to the major in Revelle College, see text.

1968: German Literature after 1945, with Emphasis on Böll, Grass, Johnson.	Mr. Lettau	F
1969: A Study of the Medieval German Fabliau from Stricker to Folz.	Mr. Wierschin	W
1969: Brecht.	Mr. Blume	S

Lit/Ge 192. Problems in Interpretation **S**
Mr. Lettau
Studies of works, periods, or topics in the primary literature of the student's major. As the second element in the two-quarter Senior Major Sequence, required of all Revelle College Literature majors whose primary literature is German. Three hours. Prerequisite: Literature 191.

GRADUATE

Lit/Ge 297. Directed Studies (1-12, 1-12, 1-12) **F,W,S**
The Staff
Guided and supervised reading in a broad area of German literature. Offered for repeated registration. (Satisfactory/Unsatisfactory grades only.)

Lit/Ge 298. Special Projects (4, 4, 4) **F,W,S**
The Staff
Treatment of a special topic in German literature. Offered for repeated registration.

Greek Literature

LOWER DIVISION

Lit/Gr 11. Readings in Greek Literature and Culture **W,S**
Mr. Dolin, the Staff
Translation and interpretation of classic texts (Homer, drama, Thucydides, Plato). Prerequisite: Lang/Gr 11 or the equivalent.

Lit/Gr 199. Special Studies **F,W,S**
The Staff
Tutorial; individual guided reading in areas of Greek literature not normally covered in courses. May be repeated for credit.

Italian Literature

UPPER DIVISION

(Upper-division standing or consent of the instructor is prerequisite to all upper-division courses. The language of instruction is Italian.)

Lit/It 199. Special Studies **F,W,S**
The Staff
Tutorial; individual guided reading in areas of Italian literature not normally covered in courses. May be repeated for credit.

GRADUATE

Lit/It 215. Dante (4) **S**
Mr. Sarolli
A study of the poet, his cultural background and his political-historical mission. Prerequisite: basic knowledge of Italian.

Lit/It 297. Directed Studies (1-12, 1-12, 1-12) **F,W,S**
The Staff
Guided and supervised reading in a broad area of Italian literature. Offered for repeated registration. (Satisfactory/Unsatisfactory grades only.)

Lit/It 298. Special Projects (4, 4, 4) **F,W,S**
The Staff
Treatment of a special topic in Italian literature. Offered for repeated registration.

Latin Literature

LOWER DIVISION

Lit/La 11. Readings in Roman Literature and Culture **W,S**
Mr. Crowne, the Staff
Translation and interpretation of classic texts (Lucretius, Catullus, Virgil, Tacitus). Prerequisite: Lang/La 11 or the equivalent.

Lit/La 199. Special Studies **F,W,S**
The Staff
Tutorial; individual guided reading in areas of Roman literature not normally covered in courses. May be repeated for credit.

Russian Literature

LOWER DIVISION

Lit/Ru 11. Readings in Russian Literature and Culture **F,W,S**
The Staff
An introduction to Russian literature. Russian 11 may be taken for three quarters, starting with any quarter. The instructor will advise students

when they have achieved sufficient proficiency to proceed to upper-division courses in which an ability to read extensive texts in Russian is called for. Prerequisites: completion of Revelle or Muir College requirement of proficiency in a foreign language, or, in special cases, permission of the instructor.

UPPER DIVISION

(Upper-division standing or consent of the instructor is prerequisite to all upper-division courses. The language of instruction is Russian.)

Lit/Ru 199. Special Studies **F,W,S**
The Staff
Tutorial; individual guided reading in areas of Russian literature not normally covered in courses. May be repeated for credit.

Spanish Literature

LOWER DIVISION

Lit/Sp 11. Readings in Hispanic Literature and Culture **F,W,S**
The Staff
An introduction to Spanish and Spanish-American literature. Spanish 11 may be taken for three quarters, starting with any quarter. The instructor will advise students when they have achieved sufficient proficiency to proceed to upper-division courses in which an ability to read extensive texts in Spanish is called for. Prerequisites: completion of Revelle or Muir College requirement of proficiency in a foreign language, or, in special cases, permission of the instructor.

UPPER DIVISION (INTERCOLLEGIATE)

These courses are offered by the Department of Literature for students in all the Colleges and are unlimited in enrolment. College programs may set limits on the number of intercollegiate courses applicable to the major (see text). (Upper-division standing or consent of the instructor is prerequisite to all upper-division courses. The language of instruction is Spanish.)

Lit/Sp 101. Spanish Literary Prose **F**
Mr. Alazraki
Three hours lecture. 1968: The Spanish-American Essay.

Lit/Sp 102. Spanish Dramatic Literature
(Not offered 1968–69.)

Lit/Sp 103. Spanish Poetry **W**
Mr. Blanco
Three hours lecture. 1969: to be announced.

Lit/Sp 121. The Medieval Period
(Not offered 1968–69.)

Lit/Sp 122. Renaissance and Baroque W
Mr. Casalduerò
Three hours lecture. 1969: The Theatre of the Golden Age.

Lit/Sp 123. The Nineteenth Century
(Not offered 1968–69.)

Lit/Sp 124. The Modern Period
(Not offered 1968–69.)

Lit/Sp 125. Spanish-American Literature W
Mr. Alazraki
Three hours lecture. 1969: Twentieth-Century Poetry.

Lit/Sp 151. Cervantes W
Mr. Casalduerò
A critical reading of *Don Quijote*. Required of Revelle College majors whose primary literature is Spanish, but open to others. Three hours lecture.

Lit/Sp 199. Special Studies F,W,S
The Staff
Tutorial; individual guided reading in an area of Spanish literature not normally covered in courses. May be repeated for credit.

UPPER DIVISION (MUIR COLLEGE)

Lit/Sp 131. Muir College Seminars
The Staff
These seminars, open to upper-division students in Muir College and to others with special permission, are devoted to a variety of special topics in Spanish literature. The student may enrol in more than one section in a single quarter. For the maximum number of seminars applicable to a major in Muir College, see text.

1968: The Spanish-American Short Story.	Mr. Alazraki	F
1969: Cervantes' *Novelas Ejemplares*.	Mr. Guillén	S

UPPER DIVISION (REVELLE COLLEGE)

Lit/Sp 132. Revelle College Seminars
The Staff
These seminars, open to upper-division students in Revelle College and to others with special permission, are devoted to a variety of special topics in Spanish literature. The student may enrol in more than one section in a single quarter. Three hours. For the maximum number of seminars applicable to the major in Revelle College, see text.

1969: The Novels of Galdos.	Mr. Casalduerò	S

Lit/Sp 192. Problems in Interpretation S
Mr. Blanco
Studies of works, periods, or topics in the primary literature of the stu-

dent's major. As the second element in the two-quarter Senior Major Sequence, required of all Revelle College Literature majors whose primary literature is Spanish. Three hours, seminar. Prerequisite: Literature 191.

GRADUATE

Lit/Sp 203. History of the Spanish Language (4)
A study of Latin and its development into Vulgar Latin and ultimately into the Peninsular vernacular speech, tracing the differentiation of the major languages and dialects, concentrating on Castillian. Attention will be given to Sephardic, Andalusian and American Spanish. Prerequisites: elementary knowledge of Spanish and Latin. (Not offered 1968–69.)

Lit/Sp 212A-212B. Hispano-Arabic Prose and Poetry (4)
A close study of selected Hispano-Arabic texts. Prerequisite: knowledge of Arabic. 212A will focus on prose, 212B on poetry. Must be taken in sequence. (Not offered 1968–69.)

Lit/Sp 224. Golden Age Studies (4) **F**
Mr. Guillén
Consideration of one or more major figures, texts, trends, or problems in Spanish Golden Age studies. 1968: Renaissance Poetry.

Lit/Sp 226. Cervantes (4)
A critical reading of the *Quijote*. (Not offered 1968–69.)

Lit/Sp 241. Romanticism in Spain (4) **S**
Mr. Casalduero
A historical review of Spanish Romanticism, with special attention to certain basic works. 1969: Lyric Poetry and the Theatre.

Lit/Sp 248. Nineteenth-Century Theater (4)
The nineteenth-century dramatic vision will be studied, with emphasis on new characters, new environment, and new elements in the structure of society. (Not offered 1968–69.)

Lit/Sp 254. Modern Spanish Poetry (4) **S**
Mr. Alazraki
A historical approach to modern Spanish poetry with special attention to some of the major poets. 1969: Spanish-American Poetry after Modernism.

Lit/Sp 255. The Modern Spanish Novel (4) **W**
Mr. Blanco
1969: to be announced.

Lit/Sp 297. Directed Studies (1-12, 1-12, 1-12) **F,W,S**
The Staff
Guided and supervised reading in a broad area of Spanish literature. Offered for repeated registration. (Satisfactory/Unsatisfactory grades only.)

Lit/Sp 298. Special Projects (4) **F,W,S**
The Staff
Treatment of a special topic in Spanish literature. Offered for repeated registration.

Lit/Sp 299. Thesis (1-12, 1-12, 1-12) **F,W,S**
The Staff
Research for the dissertation. Offered for repeated registration. Prerequisite: advancement to candidacy for the Ph.D. degree. (Satisfactory/Unsatisfactory grades only.)

MARINE BIOLOGY

See *Departments of Instruction: Scripps Institution of Oceanography.*

MATHEMATICS

Office: 3234 Urey Hall

*Errett A. Bishop, *Ph.D., Professor of Mathematics*
Theodore T. Frankel, *Ph.D., Professor of Mathematics*
Adriano M. Garsia, *Ph.D., Professor of Mathematics*
Ronald K. Getoor, *Ph.D., Professor of Mathematics*
Jacob Korevaar, *Ph.D., Professor of Mathematics*
Helmut Röhrl, *Ph.D., Professor of Mathematics* (Chairman of the Department)
**Murray Rosenblatt, *Ph.D., Professor of Mathematics*
Stefan E. Warschawski, *Ph.D., Professor of Mathematics*
Hubert Halkin, *Ph.D., Associate Professor of Mathematics*
Burton Rodin, *Ph.D., Associate Professor of Mathematics*
Stephen A. Andrea, *Ph.D., Assistant Professor of Mathematics*
John D. Donald, *Ph.D., Assistant Professor of Mathematics*
Barry G. Eke, *Ph.D., Assistant Professor of Mathematics*
John W. Evans, *M.D., Ph.D., Assistant Professor of Mathematics*
Jay P. Fillmore, *Ph.D., Assistant Professor of Mathematics*
Carl H. FitzGerald, *Ph.D., Assistant Professor of Mathematics*
Francis J. Flanigan, *Ph.D., Assistant Professor of Mathematics*
William B. Gragg, Jr., *Ph.D., Assistant Professor of Mathematics*
John A. R. Holbrook, *Ph.D., Assistant Professor of Mathematics*
Patrick J. Ledden, *Ph.D., Assistant Professor of Mathematics*
Eugene Lee, *Ph.D., Assistant Professor of Mathematics*
Jon C. Luke, *Ph.D., Assistant Professor of Mathematics*
Alfred B. Manaster, *Ph.D., Assistant Professor of Mathematics*
Michael J. Sharpe, *Ph.D., Assistant Professor of Mathematics*
Norman Shenk, *Ph.D., Assistant Professor of Mathematics*
Donald R. Smith, *Ph.D., Assistant Professor of Mathematics*
Frank B. Thiess, *Ph.D., Assistant Professor of Mathematics*
†Stanley G. Williamson, *Ph.D., Assistant Professor of Mathematics*

* * *

Morton Brown, *Ph.D., Visiting Professor of Mathematics*
Roland Bulirsch, *Sc.D., Visiting Associate Professor of Mathematics*
Benton Jamison, *Ph.D., Visiting Associate Professor of Mathematics*
Josef Stoer, *Sc.D., Visiting Associate Professor of Mathematics*
Allen Altman, *M.A., Acting Assistant Professor of Mathematics*
John B. Ferebee, *M.A., Acting Assistant Professor of Mathematics*
Ludvig Khatchatooriantz, *M.A., Lecturer in Mathematics*

*On leave fall and winter quarters, 1968-69
**On leave fall quarter
†On leave 1968-69

The Undergraduate Program

The upper-division curriculum provides programs for mathematics majors as well as courses for students who will use mathematics as a tool in the physical and behavioral sciences and the humanities. A major is offered in Revelle and in Muir College.

The student majoring in mathematics will take, in addition to the basic calculus sequence (Mathematics 2A-2B-2C), at least fifteen one-quarter courses in the upper division. The program will normally include a basic course in differential equations and vector analysis (Mathematics 100), matrices and linear transformations (Mathematics 101), and an introduction to analysis (Mathematics 102), as well as a one-year sequence in linear algebra and group theory (Mathematics 110A-110B-110C). The remaining nine courses shall be chosen from areas in analysis, geometry, algebra and applied mathematics, fitted to the interests of the student, with the approval of the major adviser. The Department recommends that students include the "Functions of Several Variables" (Mathematics 150A-150B-150C) or the "Introduction to Analysis and Topology" (Mathematics 155A-155B) in their program.

In *Revelle College*, in accordance with the general requirements for the B.A. degree, the student will take six one-quarter courses in a noncontiguous minor field. In addition the student will take three one-quarter courses in an area in which mathematics plays a basic role (restricted elective). With a judicious choice of program the student will still have three (unrestricted) electives to choose in completing the requirements for the B.A. degree.

Foreign languages recommended for mathematics majors are German, French, and Russian.

Students who at the end of their freshman year expect to major in mathematics should use the three electives in the sophomore year to take Mathematics 100, 101, and 102. This will enable them to complete a strong major curriculum in the most orderly fashion as far as preparation and continuity are concerned.

Students who do not decide on a major until their junior year may satisfy one-half the requirements for the noncontiguous minor (Revelle College) by a proper choice of electives in the sophomore year. In this

way they can complete all of the above requirements for the B.A. degree in the normal period of four years.

In *Muir College* the student majoring in mathematics must comply with the general educational requirements of the College.

Students will be encouraged to progress at a rate commensurate with their abilities. They will be able to accelerate their work by independent study and special seminars and to demonstrate their progress by proficiency examination in place of taking courses.

Major Program in Mathematics (Recommended Schedule)

	Fall	Winter	Spring
Junior Year	Math 110A	Math 110B	Math 110C
	*	*	*
	**	**	**
Senior Year	*	*	*
	†	†	†

*Choices from: Mathematics 150A-150B-150C
Mathematics 155A-155B plus 160A or 166
Mathematics 120, 121, 122
Mathematics 123, 124A-124B
Mathematics 126A-126B-126C
Mathematics 130A-130B-130C
Mathematics 130A, 133A-133B
Mathematics 141A-141B-141C
Mathematics 160A-160B-160C

**Three electives in an area in which mathematics plays a major role.

†Any course sequence in the above list not previously taken, or a basic graduate course.

The Graduate Program

The Department of Mathematics offers a graduate program leading to the M.A. and Ph.D. degrees.

Admission to the graduate program is in accordance with the general requirements of the Graduate Division of the University of California. Students with a bachelor's degree and a background in mathematics comparable to the requirements for the undergraduate major in mathematics at this university may apply for admission.

Master's Degree Program

Requirements for the Master of Arts degree are to be met according to

Plan II (comprehensive examination). (See *Graduate Division: The Master's Degree.*) Students will be expected to have at least 18 units in graduate courses in mathematics, 9 units of graduate courses in mathematics or a related field approved by the Department, and 9 units of graduate or upper-division courses. The latter may be in mathematics or in a related field, subject to approval by the Department. No research units may be used in satisfying the requirements for the master's degree. The comprehensive examination will cover basic topics in two of the following six areas, to be selected by the candidate from two of the following three lists:

1. Algebra; topology
2. Real analysis; complex analysis
3. Any of the other subjects listed in the Ph.D. program below.

A detailed list of the depth requirements in each of these areas, with literature references and approved courses, is available in the office of the Mathematics Department.

A reading knowledge of one foreign language (French, German, or Russian) is required. In exceptional cases other languages may be substituted upon petition to the Graduate Division. (See *Graduate Division: Foreign Language Requirement.*)

Doctor's Degree Program

During the first two years the student will acquire a general background in mathematics and prepare himself for the departmental qualifying examinations. Written examinations must be taken in four of the following subjects: algebra, applied analysis, complex analysis, differential geometry, mathematical logic, numerical analysis and computer sciences, ordinary or partial differential equations, probability and mathematical statistics, real analysis, topology, an approved minor outside the Department.

Students preparing for a doctor's degree and concentrating in pure mathematics must include algebra, topology, and at least one of real and complex analysis. Students concentrating in applied mathematics must include at least one of algebra and topology and at least one of complex and real analysis.

The departmental examination must be passed before the student may take the qualifying examination.

A detailed list of the depth requirements in each of these areas, with literature references and approved courses, is available in the office of the Mathematics Department.

After satisfactory completion of the departmental examinations, a doctoral committee appointed by the Graduate Division will conduct the student's oral qualifying examination. Before taking the oral qualifying examination the student must demonstrate a satisfactory reading knowledge of two foreign languages (chosen from French, German, or Russian). In exceptional cases other languages may be substituted. (See *Graduate Division.*)

Successful passing of the oral qualifying examination advances the

student to candidacy for the doctor's degree. The student will subsequently devote himself to study and research for his doctoral dissertation. After completion of the dissertation he will take the final examination, which is conducted by his doctoral committee. The examination is oral and deals primarily with the dissertation and its relationship to the general field in which the subject lies.

COURSES

LOWER DIVISION

As part of the general program of the lower division in Revelle and Muir Colleges, all students take a one-year sequence of courses in mathematics.

1A. Elements of Mathematical Analysis F,W

Review of topics in algebra and trigonometry. Differentiation and integration of algebraic functions; applications; basic analytic geometry in the plane. Three lectures, two recitations. Prerequisite: two units of high school mathematics.

1B. Elements of Mathematical Analysis W,S

Differentiation and integration of trigonometric functions, the logarithm and the exponential function. Three lectures, one recitation. Prerequisite: Mathematics 1A.

1C. Elements of Mathematical Analysis S,F

Definite integral and its applications; partial derivatives, multiple integrals; elements of linear algebra. Three lectures, one recitation. Prerequisite: Mathematics 1B.

2A. Calculus and Analytic Geometry F,W

Differential and integral calculus of functions of one variable: limit, continuity; differentiation of algebraic and trigonometric functions; applications. Definite integral, primitive functions, fundamental theorem of the calculus. Elements of analytic geometry as needed in the development of the calculus. Three lectures, two recitations. Prerequisites: three or more units of high school mathematics; one-half unit of trigonometry is desirable.

2B. Calculus and Analytic Geometry W,S

Continuation of calculus of functions of one variable: differentiation and integration of logarithm, exponential functions, Taylor's formula. Parametric representation. Applications of integration. Elements of linear algebra; analytic geometry in three-space. Three lectures, one recitation. Prerequisite: Mathematics 2A.

2C. Calculus and Analytic Geometry S,F

Calculus of functions of several variables: partial differentiation; directional derivative; total differential. Maxima and minima of functions of several variables. Lagrange multipliers, multiple integration. Infinite

series, series with constant terms, power series. Three lectures, one recitation. Prerequisite: Mathematics 2B.

5A. Introduction to Mathematics F

Review of high school geometry. Topics in Euclidean geometry. Projective geometry. Three lectures, two recitations. Prerequisites: two units of high school mathematics.

5B. Introduction to Mathematics W

Sets and logic. Axiomatic method. Properties of real numbers. Coordinate geometry. Three lectures, one recitation. Prerequisite: Mathematics 5A.

5C. Introduction to Mathematics S

Basic notions of calculus: functions, differentiation of elementary functions, applications. Definite and indefinite integral and applications. Three lectures, one recitation. Prerequisite: Mathematics 5B.
(Mathematics 5A-5B-5C may be used in fulfilling the Muir College mathematics requirement.)

10. Topics in Mathematics

A series of one-quarter courses on various areas in mathematics (see below). Each course will cover a selection of the topics listed in its description. Three lectures, one recitation. Prerequisite: four units of high school mathematics, or permission of the Department. (Three "Topics" courses will fulfil the Muir College lower-division mathematics requirement.)

10A. Probability and Statistics F

Probability, random walk, sample surveys, simple random sampling, population sampling, finite state Markov chains, Monte Carlo. (Not offered 1968.)

10B. Elementary Topology W

Theory of graphs, bridge problems, knots, braids, polyhedra in three-space and Euler formula, orientability, Möbius strips, coloring problems, tiling problems for the plane, surfaces in three-space with self-intersections. (Not offered 1969.)

10C. Elementary Number Theory S

Division algorithm, greatest common divisor, least common multiple, primes, fundamental theorem, congruences and residues, Wilson's theorem, simultaneous linear congruences, polynomial congruences, primitive roots, quadratic residues, Legendre symbol, reciprocity law. (Not offered 1969.)

10D. Theory of Games F

Basic concepts, choosing strategies, solutions of 2×2 games and $2 \times n$ games; methods for solving $m \times n$ games, methods for solving infinite games; outline of linear programming, algebra of the simplex method, degeneracy, duality.

10E. Groups in Geometry **W**
Regular polygons, isometry in the plane, two-dimensional crystallography, similarity in the Euclidean plane, inversion on circles and spheres, isometry and similarity in the Euclidean space, finite groups of rotations and of isometrics, geometrical crystallography, discrete groups.

40. Topics in Elementary Analysis **F,W**
Partial derivatives, line integral. Differential equations: equations of first order, integrating factor, linear equations with constant coefficients. Elements of probability and statistics. A terminal course for students who desire training in mathematics beyond Mathematics 1A-1B-1C. Three lectures, one recitation. Prerequisite: Mathematics 1C.

UPPER DIVISION

(See also *Interdisciplinary Courses: Earth Sciences.*)

100. Differential Equations and Vector Analysis **F,W,S**
Linear differential equations, equations with constant coefficients, solutions by series. Line, surface, and volume integrals, theorems of Stokes and Green. Three lectures and one recitation. Prerequisite or co-registration: Mathematics 2C.

101. Matrices and Linear Transformations **F,W,S**
Linear equations, matrices, vector spaces, linear transformations, determinants, eigenvalues, orthogonal and unitary transformations, quadratic forms. Systems of differential equations, exponential of a matrix. Three lectures and one recitation. Prerequisite or co-registration: Mathematics 100.

102. Introductory Analysis **S**
The real number system, topology of Euclidean n-space, properties of continuous functions, Riemann integral. Uniform convergence. Three lectures. Prerequisite: Mathematics 100.

109. Undergraduate Seminar **F,W,S**
Reports by students on assigned reading material and/or discussion of assigned problems in areas compatible with the students' background. Designed to develop insight and originality as well as mathematical techniques. Three periods. Prerequisite: permission of the Department.

110A. Linear Algebra and Group Theory **F**
Fields, vector spaces, direct products and sums, basis theorems, homomorphisms and matrices, dual spaces, transpose, subspaces and quotient spaces, induced endomorphisms, isomorphism theorems, exact sequences and splitting, invariant subspaces, trace. Three lectures. Prerequisite: Mathematics 2C.

110B. Linear Algebra and Group Theory **W**
Multilinear mappings with symmetry properties; tensor, symmetric and alternating products of vector spaces and homomorphisms; splitting theo-

rems and basis theorems; determinants, forms. Three lectures. Prerequisite: Mathematics 110A.

110C. Linear Algebra and Group Theory S
Groups, homomorphisms, subgroups, quotients groups, homomorphism theorems, abelian groups, classification of finitely generated abelian groups, permutation groups. Groups operating on vector spaces, classical groups, tensor representation of classical groups. Three lectures. Prerequisite: Mathematics 110B.

120, 121, 122. Advanced Mathematics for Physical Science Majors
(See below.)

120. Complex Variables W
Complex numbers, complex valued functions, analytic functions. Cauchy-Riemann equations, elementary functions and conformal mapping, basic concepts of two-dimensional potential theory, complex integration, Cauchy's theorem, Cauchy's formula, power series, residue theory and applications. Ordinary differential equations in the complex plane. Four lectures. Prerequisite or co-registration: Mathematics 100.

121. Introduction to Ordinary and Partial Differential Equations F
Bessel, Hermite, Legendre and other special functions. Orthogonal expansions, eigenvalue problems, Sturm-Liouville theory. Some partial differential equations of mathematical physics. Boundary value problems, separation of variables. Four lectures. Prerequisite: Mathematics 100.

122. Integral Transforms S
Additional topics on Fourier series. Fourier, Laplace and other transforms. Applications to ordinary and partial differential equations. Three lectures. Prerequisites: Mathematics 120, 121.

123. Ordinary Differential Equations F
Existence and uniqueness of solutions of differential equations and of systems. Linear systems with constant and variable coefficients; solutions in matrix form. Local and global theorems of continuity and differentiability. Autonomous systems. Stability: Lyapounov's theorem. Three lectures. Prerequisites: Mathematics 100, 101. (Not offered 1968.)

126A. Elements of Partial Differential Equations and Integral Equations F
Basic concepts and classification of partial differential equations. First order equations, characteristics. Hamilton-Jacobi theory, Laplace's equation, wave equation, heat equation. Separation of variables, eigenfunction expansions, existence and uniqueness of solutions. Three lectures. Prerequisite: Mathematics 121.

126B. Elements of Partial Differential Equations and Integral Equations W
Relation between differential and integral equations, some classical inte-

gral equations, Volterra integral equations, integral equations of the second kind, degenerate kernels, Fredholm alternative, Neumann-Liouville series, the resolvent kernel. Three lectures. Prerequisite: Mathematics 126A.

126C. Elements of Partial Differential Equations and Integral Equations S

Maximum-minimum problems, method of Lagrange, classical problems in the calculus of variations, general formulation of a variational problem, special methods of solution. Euler-Lagrange equations, applications to physics: Fermat principle, Lagrangean and Hamiltonian formulation of mechanics, theorem of E. Noether. Three lectures. Prerequisite: Mathematics 126B.

130A. Introduction to Probability F

Probability spaces, independence and conditional probability, random variables, distributions, expectations, joint distributions, law of large numbers, central limit theorem. Three lectures. Prerequisite: Mathematics 2C.

130B. Introduction to Probability W

Random walk, generating functions, runs and recurrent events, discrete fluctuation theory; Markov chains with discrete state space. Three lectures. Prerequisite: Mathematics 130A.

130C. Introduction to Probability S

Markov chains with continuous state space, simple diffusion-processes, stationary processes, fluctuations and queuing theory. Three lectures. Prerequisite: Mathematics 130B.

133A. Introduction to Statistics W

Random samples, linear regression, least squares, testing hypotheses and estimation. Neyman-Pearson lemma, likelihood ratios. Three lectures. Prerequisite: Mathematics 130A.

133B. Introduction to Statistics S

Goodness of fit, special small sample distribution and use, nonparametric methods, Kolmogorov-Smirnov statistic, sequential analysis. Three lectures. Prerequisite: Mathematics 133A.

141A. Numerical Analysis F

Numerical approximations, interpolation, roots of equations and systems of linear equations, linear eigenvalue problems. Three lectures. Prerequisite: Mathematics 101.

141B. Numerical Analysis W

Difference equations, numerical differentiation and integration, numerical solution of ordinary differential equations, stability and error propagation. Three lectures. Prerequisite: Mathematics 141A.

141C. Numerical Analysis S

Selected special topics such as: extreme values, linear programming,

Monte Carlo methods, introduction to numerical analysis of partial differential equations. Three lectures. Prerequisite: Mathematics 141B.

144. Mathematical Programming **F**
Elementary topological properties of Euclidean spaces. Convex sets, separation theorems. Simplexes, Sperner lemma, Brouwer fixed-point theorem. Duality, linear programming. Constrained maxima, Kuhn-Tucker theorem, mathematical programming. Three lectures. Prerequisites: Mathematics 100, and 101 or 110A.

150A-150B-150C. Functions of Several Variables **F-W-S**
Differentiable functions, implicit and inverse function theorems. Integration in Euclidean n-space. Manifolds, exterior differential forms and their integrals, Stokes theorem. Three lectures. Prerequisites: Mathematics 101, 102.

155A. Introduction to Analysis and Topology **F**
Set theory, Zorn's lemma, metric spaces, continuous mappings, completions, fixed-point theorems, Baire's theorem, compactness, Lebesgue number, connectedness. Four lectures. Prerequisite: Mathematics 102.

155B. Introduction to Analysis and Topology **W**
Uniform convergence on subsets, function algebras, Ascoli's theorem, Stone-Weierstrass theorems, structure of function algebras. Four lectures. Prerequisite: Mathematics 155A.

160A. Introduction to Geometry **F or S**
Review of vector spaces, bilinear forms, inner-product geometry, affine geometry, projective geometry, quadrics. Grassmanians. Three lectures. Prerequisite or co-registration: Mathematics 110A. (Not offered 1968–69.)

160B. Introduction to Geometry **W**
Dilatations and translations, coordinates, affine geometry associated with a field, theorems of Desargue and Pappus, projective geometry. Three lectures. Prerequisite: Mathematics 160A. (Not offered 1969.)

160C. Introduction to Geometry **S**
Algebraic curves in the complex plane, regular and singular points, Bezout's theorem, local parametrization, Plücker's formulas, Lüroth's theorem. Three lectures. Prerequisite: Mathematics 160B. (Not offered 1969.)

166. Differential Geometry **F or S**
Curvature and torsion of space curves, Fenchel's theorem. Surfaces in space, Gaussian and mean curvature, minimal surfaces. Intrinsic geometry of surfaces, geodesics, parallel displacement, Jacobi fields, Gauss-Bonnet theorem. Prerequisites: some knowledge of matrices and quadratic forms, and consent of the instructor.

170A-170B. Elementary Mathematical Logic **W,S**
Propositional and predicate calculi. Interpretations and formal theories. Completeness theorems. Some decision procedures. An introduction to

recursive function theory. Undecidability of the predicate calculus. Incompleteness of elementary number theory. Prerequisite: Mathematics 2C.

199. Independent Study for Undergraduates **F,W,S**
Independent reading in advanced mathematics by individual students. Three periods. Prerequisite: permission of the Department.

GRADUATE

200A-200B-200C. Algebra (3-3-3) **F-W-S**
Mr. Donald
Algebraic structures, Jordan-Holder theorem, Sylow theorems, rings and ideals, principal ideal rings, algebraic field extensions, Galois theory, transcendental field extensions, simple and semi-simple modules, Wedderburn theory, representation of finite groups, places and valuations, polynomial and power series rings. Prerequisites: Mathematics 110A-110B-110C, or consent of the instructor.

202A-202B-202C. Commutative Algebra (3-3-3) **F-W-S**
Mr. Röhrl
Noetherian rings and modules; theory of multiplicity; local and semi-local rings; regular local rings; completions; spectrum of a ring; schemes. Prerequisites: Mathematics 110A-110B-110C, 200A-200B-200C, 290A. (Not offered 1968–69.)

203A-203B-203C. Algebraic Geometry (3-3-3) **F-W-S**
Mr. Fillmore
Places. Hilbert nullstellensatz. Varieties; product of varieties; correspondences; normal varieties. Divisors and linear systems; Riemann-Roch theorem; resolution of singularities of curves. Grothendieck schemes; cohomology. Hilbert schemes; Picard schemes. Prerequisites: Mathematics 110A-110B-110C, 160C, 200A-200B-200C.

204A-204B-204C. Categorical Algebra (3-3-3) **F-W-S**
Mr. Röhrl
Categories; functors; presentable functors; limits and continuous functors; adjoint functors; Abelian categories; homological algebra. Prerequisite: Mathematics 200A or consent of the instructor. (Not offered 1968–69.)

205A-205B-205C. Lie Algebras (3-3-3) **F-W-S**
The Staff
Universal enveloping algebra, cohomology, solvable and nilpotent Lie algebras, theorems of Engel and Lie, semi-simple Lie algebras, representations, Levi decomposition, reductive algebras, Cartan subalgebra, root space decomposition and Weyl group, classification. Prerequisites: Mathematics 110A-110B-110C or consent of the instructor. (Not offered 1968–69.)

208. Seminar in Algebra **F,W,S**
The Staff
Prerequisite: consent of the instructor. (Satisfactory/Unsatisfactory grades permitted.)

211A-211B-211C. Applied Complex Analysis and Special Functions (3-3-3) **F-W-S**
Mr. Thiess, Mr. Gragg
Complex function theory with special emphasis on applications: two-dimensional potential theory, dispersion relations, etc. Differential equations and special functions. Series expansion, generating functions, integral representations and asymptotic behavior. Prerequisite: Mathematics 102 or equivalent.

212A. Mathematical Methods in Physics and Engineering (4) **F**
Mr. Korevaar
Vector spaces and linear transformations, eigenvalue problems, tensor algebra. Metrics, norms, completeness, the spaces L^p and C, distributions, Delta sequences. Properties of Lebesgue integrals, Stieltjes integrals, line integrals. Prerequisites: Mathematics 100, 101, 102 or advanced calculus.

212B. Mathematical Methods in Physics and Engineering (4) **W**
Mr. Korevaar
Scalar products, orthogonal series in Hilbert space, best approximation. Compact symmetric operators, expansions in eigenvectors. Applications to matrices, quadratic forms, integral equations. Regular and singular Sturm-Liouville problems, Green's functions. Prerequisite: Mathematics 212A or consent of the instructor.

212C. Mathematical Methods in Physics and Engineering (3) **S**
Mr. Korevaar
Fourier transforms of functions and distributions, Laplace transforms, applications to boundary value problems. Simple second order elliptic, hyperbolic and parabolic partial differential equations. Uniqueness theorems, maximum principles. Spherical harmonics. Wave propagation. Prerequisite: Mathematics 212B or consent of the instructor.

214A. Asymptotic Methods in Analysis (3) **F**
Mr. Korevaar
Euler-MacLaurin sum formula; Poisson sum formula; Laplace method; saddle-point method; method of stationary phase; asymptotic expansions; asymptotic solution of differential equations. Prerequisites: Mathematics 212A-212B-212C, or consent of the instructor.

215A-215B. Mathematical Theory of Process Optimization (3-3) **F-W**
Mr. Halkin
Optimal control problems for systems described by nonlinear differential equations: necessary conditions, sufficient conditions; existence theorems; applications to classical calculus of variations and to problems in electrical and aerospace engineering. Optimal control problems for systems de-

scribed by nonlinear difference equations, applications to the theory of optimal economic growth. Prerequisites: Mathematics 240A-240B-240C or 210A-210B-210C, or consent of the instructor. (Not offered 1968–69.)

220A-220B-220C. Complex Analysis (3-3-3) **F-W-S**

Mr. Rodin

Complex numbers and functions. Cauchy theorem and its applications, calculus of residues, expansions of analytic functions, analytic continuation, conformal mapping and Riemann mapping theorem, harmonic functions, Dirichlet principle, Riemann surfaces. Prerequisites: Mathematics 155A-155B, or consent of the instructor.

221A-221B-221C. Several Complex Variables (3-3-3) **F-W-S**

The Staff

Formal and convergent power series, Weierstrass preparation theorem; Cartan-Rückert theorem; analytic sets; mapping theorems; domains of holomorphy; proper holomorphic mappings; complex manifolds; modifications. Prerequisites: Mathematics 200A, 220A-220B-220C, or consent of the instructor. (Not offered 1968–69.)

225A-225B-225C. Conformal Mapping (3-3-3) **F-W-S**

Mr. Warschawski

Riemann's mapping theorem; behavior of the mapping function at the boundary, including discussion of prime ends. Analytic functions of class H_p. Mapping of multiple connected domains onto canonical domains, variational techniques in conformal mapping; univalent functions; constructive methods; uniformization. Prerequisites: Mathematics 220A-220B-220C.

227A-227B-227C. Topics in Complex Analysis (3-3-3) **F-W-S**

Mr. Warschawski

Prerequisite: consent of the instructor. (Not offered 1968–69.)

228. Seminar in Complex Analysis **F,W,S**

Mr. Eke

(Satisfactory/Unsatisfactory grades permitted.)

230A-230B-230C. Ordinary Differential Equations (3-3-3) **F-W-S**

The Staff

Existence and uniqueness theorems. Linear systems with constant and periodic coefficients. Sturm-Liouville theory. Eigenfunction expansions. Stability and asymptotic behavior of nonlinear systems. Poincaré-Bendixon theorem. Linear systems in the complex domain and their singularities. Control theory. Equations in Banach space. Prerequisites: advanced calculus and consent of the instructor. (Not offered 1968–69.)

231A-231B-231C. Partial Differential Equations (3-3-3) **F-W-S**

Mr. Smith

Existence and uniqueness theorems, Cauchy-Kowalewski theorem, first order systems, Hamilton-Jacobi theory, initial value problems for hyperbolic and parabolic systems, boundary value problems for elliptic systems,

Green's function, eigenvalue problems, perturbation theory. Prerequisites: Mathematics 126A-126B, or consent of the instructor.

232A-232B-232C. Calculus of Variations (3-3-3) **F-W-S**
Mr. Halkin
Euler-Lagrange equation, theory of fields, Hamilton-Jacobi theory, sufficient conditions, Weierstrass E test. Mayer, Lagrange and Bolza problems. Optimal control, Pontryagin's Maximum Principle, existence theorems, sufficient conditions. Caratheodory's approach to calculus of variations. Prerequisites: Mathematics 240A-240B-240C or 210A-210B-210C, or consent of the instructor. (Not offered 1968–69.)

240A-240B-240C. Real Analysis (3-3-3) **F-W-S**
Mr. Shenk
Lebesgue integral and Lebesgue measure; Fubini theorems; functions of bounded variation; Stieltjes integral; derivatives and indefinite integrals; the spaces L and C; equi-continuous families; continuous linear functionals; general measures and integration. Prerequisites: Mathematics 155A-155B, or consent of the instructor.

241A-241B-241C. Functional Analysis (3-3-3) **F-W-S**
Mr. Holbrook
Metric spaces and contraction mappings; topological vector spaces; continuous linear operators; open mapping theorem; closed graph theorem; uniform boundedness principle; Hahn-Banach theorem; representation of continuous linear functionals; conjugate space; weak topologies; extreme points; Krein-Milman theorem; fixed-point theorems; Riesz convexity theorem; Banach algebras. Prerequisites: Mathematics 240A-240B-240C or 210A-210B-210C, or consent of the instructor. (Not offered 1968–69.)

243A-243B-243C. Fourier Analysis (3-3-3) **F-W-S**
Mr. Holbrook
Convergence and summability of Fourier series. Fourier transform, Hilbert transform. Trigonometric approximation and interpolation. Tauberian theorems, prime number theorem. Applications of Fourier analysis to probability theory: characterization of infinitely divisible and stable laws. Prerequisite: Lebesque integration, or consent of the instructor.

244B-244C. Distributions (3-3) **W-S**
Mr. Korevaar
Various definitions of distributions; derivatives and antiderivatives; structure of distributions; spaces of test functions and distributions; multiplication and convolution Fourier transforms; division problems; generalized functions; applications. Prerequisites: 212A-212B-212C or 240A-240B-240C.

248. Seminar in Real Analysis (3) **F,W,S**
Mr. Bishop
Prerequisite: consent of the instructor. (Satisfactory/Unsatisfactory grades permitted; not offered 1968–69.)

250A-250B-250C. Differential Geometry (3-3-3) **F-W-S**
Mr. Frankel
Differential manifolds, Sard theorem, tensor bundles, Lie derivatives, DeRham theorem, connections, geodesics, Riemannian metrics, curvature tensor and sectional curvature, completeness, characteristic classes. Differential manifolds immersed in Euclidean space. Prerequisites: Mathematics 110A-110B-110C, 166, or consent of the instructor. (Not offered 1968–69.)

260A-260B-260C. Mathematical Logic (3-3-3) **F-W-S**
Mr. Manaster
Propositional calculus and quantification theory. Completeness theorem; theory of equality; compactness theorem. Skolem-Lowenheim theorems; Vaught's test; Craig's lemma. Elementary number theory and recursive function theory. Undecidability of true arithmetic and of Peano's axioms. Church's thesis; set theory; Zermelo-Frankel axiomatic formulation. Cardinal and ordinal numbers. The axiom of choice and the generalized continuum hypothesis. Incompleteness and undecidability of set theory. Relative consistency proofs. Prerequisite: consent of the instructor. (Not offered 1968–69.)

270A-270B-270C. Numerical Analysis (3,3,3) **F-W-S**
Mr. Stoer
Accuracy of numerical calculations; interpolation; numerical quadrature; continued fractions in numerical analysis; determination of the zeros of a polynomial; elimination methods for linear equations; eigenvalue problem for hermitean matrices; eigenvalue problem for general matrices; iterative methods for linear equations. Prerequisites: Mathematics 100, 101, 102, 110A, 110B, or consent of the instructor.

274A-274B-274C. Numerical Aspects of Differential Equations (3-3-3) **F-W-S**
Mr. Bulirsch
Ordinary differential equations: one-step methods for initial value problems; extrapolation methods for initial value problems; multi-step methods for initial value problems; boundary value problems. Partial differential equations: initial value problems for systems of quasilinear hyperbolic differential equations. Prerequisites: Mathematics 121, 122, 123 or consent of the instructor. (Not offered 1968–69.)

280A-280B-280C. Probability Theory (3-3-3) **F-W-S**
Mr. Sharpe
Probability measures; Borel fields; conditional probabilities; sums of independent random variables; limit theorems; zero-one laws; stochastic processes. Prerequisites: advanced calculus and consent of the instructor.

281A-281B-281C. Mathematical Statistics (3-3-3) **F-W-S**
Mr. Rosenblatt
Testing and estimation; sufficiency; regression analysis; sequential analysis; statistical decision theory; non-parametric inference. Prerequi-

site: advanced calculus and consent of the instructor. (Not offered 1968–69.)

282A-282B-282C. Stationary Processes and Prediction Theory (3-3-3) **F-W-S**
Mr. Garsia
Ergodic theorems; Fourier analysis of Gaussian processes; prediction theory. Combinatorial identities and the Szegö theorems. Entropy. The fundamental theorems of information theory. The Kolmogorov-Sinai theorem. Prerequisite: Lebesque integration. (Not offered 1968–69.)

286A-286B-286C. Topics in Probability Theory (3-3-3) **F-W-S**
Mr. Getoor
Prerequisite: consent of the instructor. (Satisfactory/Unsatisfactory grades permitted.)

288. Seminar in Probability Theory and Mathematical Statistics
The Staff
Prerequisite: consent of the instructor. (Not offered 1968–69.)

290A-290B-290C. Topology (3-3-3) **F-W-S**
Mr. Frankel
Topological spaces; filters and limits; Hausdorff spaces; compact and locally compact spaces; uniform spaces; function spaces; singular homology and cohomology *CW* complexes; duality theorems; the cohomology ring, axiomatic homology and cohomology theory; homotopy of mappings; homotopy groups; homotopy sequences. Prerequisites: Mathematics 155A-155B or 290A for 290B-290C.

297A-297B-297C. Topics in Topology (3-3-3) **F-W-S**
Mr. Röhrl
Advanced material in special areas of topology to be selected by instructor. Prerequisite: Mathematics 290A-290B-290C or consent of the instructor. (Satisfactory/Unsatisfactory grades permitted.)

298. Seminar in Topology **F,W,S**
The Staff
Prerequisite: consent of the instructor. (Satisfactory/Unsatisfactory grades permitted.)

299. Reading and Research (1-12, 1-12, 1-12) **F,W,S**
The Staff
Independent study and research for the doctoral dissertation. One to three credits will be given for independent study (reading), and one to six for research. Prerequisite: consent of the instructor. (Satisfactory/Unsatisfactory grades permitted.)

MUSIC

Office: Building 407, Matthews Campus
Robert Erickson, *M.A., Professor of Music*

Kenneth Gaburo, *D.M.A., Professor of Music*
Wilbur Ogdon, *Ph.D., Professor of Music* (Chairman of the Department)
John Silber, *Ph.D., Professor of Music*
Rosalyn Tureck, *Professor of Music*
Thomas Nee, *M.A., Associate Professor of Music*
James L. Campbell, *M.S., Assistant Professor of Music*
Bertram J. Turetzky, *M.A., Assistant Professor of Music*

* * *

Pauline Oliveros, *B.A., Lecturer in Music*
Harry Partch, *Professor of Music in Residence*

Undergraduate courses offered by the Department of Music in 1968–69 will serve various purposes:

1. Enable students to begin a major consisting of from twelve to fifteen courses, according to the students' previous preparation.
2. Enable Muir College students to incorporate music courses into a special project undertaken in lieu of a major.
3. Provide a sequence of courses acceptable as a noncontiguous minor in Revelle College.
4. Enable students to satisfy the fine arts requirements of both Muir and Revelle Colleges.
5. Allow a choice of elective courses to all students, with or without prior music training.

Prerequisite to acceptance into a curriculum program leading to a B.A. with a major in music is a demonstrated level of reasonable competence in the reading and hearing of pitch and rhythmic relations. Music 2A-2B-2C are courses in basic musicianship designed to prepare for that ability. If the entering student already possesses a sufficient level of musicianship, he may begin his major courses, upon demonstration of such abilities, with Music 3, 4, 5.

Upper-division courses required for the B.A. in music include the following:

1. The six-course sequence, Music Theory and Practice (101A-101B-101C, 102A-102B-102C).
2. Three selected music literature lecture courses (Music 112, 114, 115, etc.), each supplemented by an appropriate weekly seminar.
3. One three-quarter seminar sequence in either chamber music or composition, equivalent to one course.
4. A continuing departmental seminar that includes concerts, lectures, and departmental discussions.
5. A senior comprehensive seminar, taken in the final quarter prior to graduation, equivalent to one course.
6. Elected music courses and independent study units equivalent to at least three courses or a number determined by the needs of the student.

Music courses taken as electives may or may not require prerequisite musical abilities. If they do, the student will be asked to request the con-

sent of the instructor prior to enrolment. Other opportunities for musical performance include participation in the University-Civic orchestra and vocal or instrumental ensembles.

Students who wish to go on to graduate work in music but have not had extensive training before undertaking the major may be obliged to elect music courses beyond the number required for a liberal arts major in order to be adequately prepared for graduate study.

COURSES

LOWER DIVISION

1A-1B-1C. The Nature of Music **F-W-S**
Development of music perception and discrimination through participation projects in tape music composition and small-group improvisation, and through critical observation of the preparation and performance of selected ensemble literature by experienced musicians. Prerequisites: 1A for 1B; 1B for 1C; or consent of the course committee.

2A-2B-2C. Music Fundamentals and Basic Musicianship **F-W-S**
An introduction to music symbols and their meaning. Practice in elementary pitch recognition, simple rhythmic relationships, intensity, timbre, and density discriminations. Prerequisite: for 2B—2A; for 2C—2B or proficiency certified by course committee.

3. Music Reading **W**
An intensive course in the reading of music presenting progressively more problematic relationships of pitch, rhythm, and other factors. Prerequisite: Music 2B or its equivalent by examination.

4. Physics of Musical Sounds **F**
A practical analysis of the physical nature of music through discussion and individually assigned projects. Three meetings.

5. A Comparative Introduction to the Parameters of Music **S**
A comparative study of pitch, time, density, timbre, and intensity as found in selected works from various historical style periods. Prerequisites: Music 2, equivalent proficiency, or consent of the instructor.

10. Projects and Studies in Music **F**
A study of the nature of music, how it is made, how to listen to it. Projects include improvising in groups, tape music composition, and invention of music notation. Old, new, and newest music will be listened to and studied. This course may be used in satisfying the Revelle College fine arts requirement.

30. Seminar in Chamber Music Performance I **F-W-S**
Performance of representative chamber music literature. Three consecutive quarters are equivalent to one undergraduate course. Students enrol in the fall and receive a grade at the end of the spring quarter. Prerequisite: proficiency on a musical instrument and consent of the instructor through audition.

UPPER DIVISION

101A-101B-101C. Music Theory and Practice F-W-S
Integrated studies in music theory, composition and styles study through analysis and performance. Must be taken in sequence. Prerequisite: Music 2C or equivalent certified proficiency.

102A-102B-102C. Advanced Music Theory and Practice F-W-S
Must be taken in sequence. Prerequisite: Music 101C or equivalent certified proficiency.

103. Seminar in Composition F-W-S
Individual projects in composition critically reviewed in seminar with fellow student and faculty composers. Three consecutive quarters are equivalent to one undergraduate course. Students enrol in the fall and receive a grade at the end of the spring quarter. Prerequisites: Music 101A-101B-101C, or permission of the Department.

104A. Principles of Electroacoustic Transmission of Music Information F
A study, involving electroacoustic principles, of the transmission of musical information. Operational techniques of microphones, amplifiers, magnetic-tape recorders, loudspeakers, and broadcast and recording facilities will be discussed. Three meetings. Prerequisite: Music 4.

104B. Projects in Electroacoustic Transmission of Music Information W
An investigation into the experimental use of electronic instruments relating to the storing and retrieving of aural information and applied to the multi-varying conditions caused by complex sound events. Three meetings. Prerequisite: Music 104A.

105A. Electronics in Music W
Exercises in electronic-sound generation and processing, with emphasis on voltage-controlled systems. Prerequisite: Music 104A.

105B. Electronics in Music Performance S
Projects seminar. Prerequisite: Music 105A or equivalent.

107. Beginning Computer Programming for Arts and Humanities W
An introduction to computer programming taught from the viewpoint of, and to the requirements of, the arts and humanities. No special background or ability in mathematics or science is required. The course includes a survey of pertinent literature.

112. Studies in Vocal and Choral Literature F
A critical study of representative works for solo voice (with piano or other accompaniment) and/or for choral ensemble. Since the selected literature will vary from year to year the course can be repeated for elective credit. Music majors are required to take additional projects seminar session for course credit. (Not offered 1968.)

113. Studies in Opera F
A critical study of representative operas. At least one opera discussed

will be selected because of the opportunity to see it in staged performance. Music majors are required to take an additional projects seminar for course credit. (Not offered in 1968–69.)

114. Music of the Twentieth Century **F**

An exploration of materials and methods used in the music of our time. Music majors are required to take an additional projects seminar session for course credit.

115. Seminar in Bach Studies **W**

A study of the art of J. S. Bach, with particular attention to problems of style and structure. Music majors are required to take an additional projects seminar session for course credit. Prerequisite: ability to read music or consent of the instructor.

116. Seminar in Medieval and Early Renaissance Music **S**

The development of an operational and intellectual account of medieval and early Renaissance music. Music majors are required to take an additional projects seminar session for course credit. (Not offered 1969.)

117. Seminar in Late Renaissance and Early Baroque Music **W**

Functional performance problems and realizations of music of the sixteenth and seventeenth centuries. Music majors are required to take an additional projects seminar session for course credit.

123. The Orchestra and Its Literature **S**

A study of the instruments of the orchestra: their resources, tonal effects; their use by major composers; methods of writing for modern instruments; analysis of representative scores. Music majors are required to take an additional projects seminar session for course credit. Three meetings. Prerequisite: ability to read music. (Not offered 1969.)

124. Studies in Chamber Music **S**

A critical study of representative works for small ensemble. The literature studied is selected and may vary from course to course. The course can be repeated for elective credit. Music majors are required to take an additional projects seminar session for course credit.

130. Seminar in Chamber Music Performance II **F-W-S**

Performance of representative chamber music literature. Three consecutive quarters are equivalent to one undergraduate course. Students enrol in the fall and receive a grade at the end of the spring quarter. Prerequisite: proficiency on a musical instrument and consent of the instructor through audition.

135. Concert Orchestra **F,W,S**

Activity. No credit. Audition required. One three-hour rehearsal weekly.

136. Reading Orchestra **F,W,S,**

Activity. No credit. One three-hour rehearsal in alternate weeks.

140. Concert Chorus F,W,S
Activity. No credit. Audition required. One three-hour rehearsal weekly.

141. Chamber Chorus F,W,S
Activity organized separately for each college. No credit.

197. Comprehensive Seminar for Senior Majors S
A two-hour seminar during which undergraduate learning experiences within the major are reviewed and correlated.

198. Departmental Seminar for Music Majors F-W-S
A non-credit departmental requirement for all music majors, this course provides a forum for visiting lecturers and faculty to share current research and new ideas with the undergraduate major. This course also provides for an exchange of ideas and accomplishments within the departmental student body. One meeting per week. Students enrol in the fall and receive a grade at the close of the spring quarter.

199. Independent Study F,W,S
Independent reading, research, or creative work under the direction of a faculty member. Projects must be approved by the Department committee on student and course review prior to enrolment. Prerequisite: consent of the instructor. (May be repeated for credit.)

GRADUATE

201A-201B-201C. Advanced Problems and Projects in Conducting and Performance (3-3-3) F-W-S
The Staff
(Satisfactory/Unsatisfactory grades permitted.)

202. Advanced Problems and Projects in Specialized Use of Electronics in Performance (3) S
Miss Oliveros

203. Advanced Projects in Composition (3, 3, 3) F,W,S
Mr. Erickson, Mr. Gaburo, Mr. Ogdon
(Satisfactory/Unsatisfactory grades only.)

204. Projects Seminar in Electroacoustic Transmission of Music Information (3) W
Mr. Campbell
Prerequisite: Music 104A.

205. Advanced Use of Electronics in Music (3) S
Advanced theoretical and applied research in the generation and processing of sound by means of voltage-controlled systems for the composition of electronic music. Prerequisites: Music 104A and 105A, or equivalent. (Not offered 1969.)

206. Seminar in Theoretical Studies (3, 3, 3) F,W,S
Mr. Erickson, Mr. Gaburo, Mr. Ogdon
Synthetical theory seminars offered by faculty within areas of present

research interests. The seminars offered will usually be project-oriented. Prerequisite: consent of the instructor.

212. Seminar in Vocal and Choral Literature (3) **F**

A critical and historical study of selected works and repertory.

213. Opera Studies (3) **F**

Mr. Ogdon

A detailed and comparative analytic study of selected operas in production in San Diego, Los Angeles, or San Francisco. (Not offered 1968.)

214. Seminar in Twentieth-Century Music (3) **W**

Mr. Ogdon

Detailed study of selected literature through the study of scores and writings, supplemented when possible by performance participation.

215. Seminar in Bach and Related Studies (3) **W**

Mme Tureck

A study of content and structure in selected compositions of J. S. Bach. Prerequisite: consent of the instructor.

216. Seminar Studies in Late-Medieval and Early-Renaissance Music (3) **S**

Mr. Silber

Problems of style and performance in selected music of the thirteenth, fourteenth, and fifteenth centuries. (Not offered 1969.)

217. Seminar Studies in Late Renaissance and Early Baroque Music (3) **S**

Mr. Silber

The study of early music as it has to do with theoretical systems, critical analyses, music and documentary source materials. (Not offered 1969.)

223. Seminar Studies in Orchestral Literature (3) **S**

Mr. Nee

Problems of performance and interpretation in representative works of orchestral music, including works for chamber orchestra, opera scenes, and choral works. Students will be responsible for problems of editing, bowings, and conducting.

224. Seminar Studies in Chamber Literature (3) **F**

A critical and historical study of selected works and repertory. (Not offered 1968.)

230. Advanced Seminar in Performance of Music for Small Ensemble (3) **F,W,S**

Performance of representative chamber music literature through coached rehearsal and seminar studies. Three consecutive quarters are equivalent to one graduate course. Students enrol in the fall and receive a grade at close of spring quarter.

298. Departmental Seminar **F-W-S**

A departmental requirement for all music graduate fellows, this course provides a forum for visiting lecturers and faculty to share current research and new ideas with the graduate fellow. It also provides for an exchange of ideas and accomplishments within the departmental student body. Students enrol in the fall and receive a grade at the close of the spring quarter. (Satisfactory/Unsatisfactory grades only.)

299. Advanced Research Projects and Independent Study (1-12, 1-12, 1-12) **F,W,S**

The Staff
(Satisfactory/Unsatisfactory grades permitted.)

NATURAL SCIENCES

See *Interdisciplinary Courses.*

OCEANOGRAPHY

See *Departments of Instruction: Scripps Institution of Oceanography.*

PHILOSOPHY

Office: 3112 Humanities-Library Building

Paul Henry, *S.J., D. es L., D.D., Professor of Philosophy*
Herbert Marcuse, *Ph.D., Professor of Philosophy*
*Stanley Moore, *Ph.D., Professor of Philosophy*
**Richard H. Popkin, *Ph.D., Professor of Philosophy*
Jason L. Saunders, *Ph.D., Professor of Philosophy* (Chairman of the Department)
Avrum Stroll, *Ph.D., Professor of Philosophy*
Piero Ariotti, *Ph.D., Assistant Professor of Philosophy* (Undergraduate Adviser)
Ronald Kirkby, *Ph.D., Assistant Professor of Philosophy*
†Rudolf Makkreel, *Ph.D., Assistant Professor of Philosophy*
Stanley Malinovich, *Ph.D., Assistant Professor of Philosophy*
David Fate Norton, *Ph.D., Assistant Professor of Philosophy* (Graduate Adviser)

* * *

Stephen Crites, *Ph.D., Visiting Associate Professor of Philosophy*
Ronald Scales, *M.A., Associate in Philosophy*

*On leave 1968-69
**On leave fall quarter, 1968
†On leave spring quarter, 1969

The Undergraduate Program

Students who wish to major in philosophy must have satisfied the gen-

eral lower-division requirements. No specific sophomore courses are recommended.

The members of the Department of Philosophy believe that an undergraduate major in philosophy should acquaint himself with the achievements and methods of other academic disciplines, since these are in part the subjects of philosophical inquiry. The background thus acquired should be complemented by a relatively small number of required courses in philosophy itself. The required courses, about half of which are concerned with the history of philosophy, are meant to introduce the student to a large number of philosophical issues and traditions. The pursuit of highly specialized concerns should be deferred until the student has begun graduate study.

The following courses are required of philosophy majors:

1. Philosophy 101-106 (History of Philosophy).
2. Philosophy 110 (Symbolic Logic) *or* 112 (Philosophy of Science).
3. Two courses from the following four: Philosophy 120 (Political Philosophy), 121 (Aesthetics), 122 (Philosophy of Religion), 123 (Ethics).
4. Philosophy 131 (Contemporary Anglo-American Philosophy) *or* 132 (Contemporary European Philosophy).
5. Four upper-division courses from one or more of the following fields: History, Linguistics, Literature.

The total is fourteen courses—ten in philosophy, four in related fields. Requirements can be met by examination. In upper-division courses, students may be expected to read materials in foreign languages, usually French or German.

Major Program in Philosophy (Recommended Schedule)

	Fall	Winter	Spring
Junior Year	Philosophy 101 *Philosophy 110 †	Philosophy 102 *Philosophy 123 †	Philosophy 103 *Philosophy 122 †
Senior Year	Philosophy 104 *Philosophy 120 †	Philosophy 105 *Philosophy 121 or 130 †	Philosophy 106 *Philosophy 112 or 131 †

*If student elects to meet major requirements with this course.
†Upper-division course in History, Linguistics, or Literature.

The Graduate Program

The Department of Philosophy offers programs in many fields of philo-

sophical study leading to the Master of Arts and Ph.D. degrees. Courses of study for the individual student are arranged according to his needs, interest, and previous work in philosophy: there is no established sequence of required courses in the graduate program.

The members of the Department of Philosophy hold the view that an adequate program of studies in philosophy should provide the student with a thorough training in the history of philosophy, in the systematic study of philosophical issues, and in varying approaches to these issues. The intent of the graduate program is, thus, to give the student a depth of understanding of divergent philosophical traditions and to aid in his development as a philosopher in his own right.

Master's Degree Program

The Master of Arts in Philosophy is offered under Plan II (comprehensive examination). (See *Graduate Division: The Master's Degree.*)

The student will be required to take 36 quarter-units of upper-division and graduate work, of which at least 14 must be in graduate courses in the major field. Of the remaining 22, 10 units must be in graduate courses, and 12 units in graduate or upper-division courses. Candidates for advanced degrees in Philosophy are required to have passed one foreign language examination (Greek, Latin, French or German) prior to attempting the written qualifying examination. (See *Graduate Division: Foreign Language Requirement.*) The comprehensive examinations will be identical with the written portion of the qualifying examination for the Ph.D. This will consist of written examinations in each of the following three areas:

1. History of philosophy: ancient, medieval, Renaissance, early modern, modern and nineteenth century.
2. Metaphysics: epistemology, logic, philosophy of science, contemporary philosophy.
3. Value theory: ethics, aesthetics, philosophy of religion, political and social philosophy.

Each examination will take three hours.

Doctor's Degree Program

During the period between admission to graduate standing and advancement to candidacy, a graduate student will normally be required in each academic year of residence to take at least 6 units in philosophy courses chosen from those numbered 201-299, inclusive. Ordinarily the course of study for the Doctor of Philosophy will include the course requirements for the Master of Arts, or their equivalent.

After having successfully completed the written examinations, as described above for the Master of Arts, the student will be required to submit a prospectus of his dissertation and to pass an oral examination focusing on the area of his dissertation.

Students will be required to demonstrate a satisfactory reading knowledge of two foreign languages chosen from the following: classical Greek, Latin, French, German, and such other languages as the student's re-

search may require, subject to the approval of the Graduate Council. (See *Graduate Division: Foreign Language Requirement.*)

Under the supervision of his doctoral committee, each candidate will write a dissertation demonstrating a capacity to engage in original and independent research.

The candidate will defend his thesis in an oral examination by the doctoral committee. (See *Graduate Division: The Ph.D.*)

COURSES

LOWER DIVISION

The Department of Philosophy cooperates in the teaching and administration of the Humanities sequence for Revelle College students. (See *Interdisciplinary Courses: Humanities.*)

10. The Nature of Philosophy F
An introduction to metaphysics and the theory of knowledge, dealing with such matters as the ultimate constituents and structure of the world, the nature of mind, knowledge and truth. Two hours lecture, one hour discussion.

11. The Nature of Philosophy W
An introduction to value theory, dealing with questions about morality, politics, religion and art. Two hours lecture, one hour discussion.

12. Introduction to Logic S
An inquiry into the nature of argument, inference and proof, fallacies, etc. Two hours lecture, one hour discussion.

20. Theories of Society I F
A course dealing with the development of social and political thought and institutions in ancient Greece and Rome. Two hours lecture, one hour discussion.

21. Theories of Society II W
A course dealing with the development of social and political thought and institutions in the Middle Ages and Renaissance. Two hours lecture, one hour discussion.

22. Theories of Society III S
A course dealing with the development of social and political thought and institutions in modern times. Two hours lecture, one hour discussion.

(Philosophy 20-21-22 may be used in fulfilling the Revelle College social science requirement.)

UPPER DIVISION

101. History of Philosophy F
Greek philosophy to Aristotle.—Examination of original materials in Greek philosophy, including those of the Pre-Socratics, Plato, and Aristotle. Two hours lecture, one hour discussion.

102. History of Philosophy W
Greek and Roman philosophy after Aristotle. Examination of original material of Hellenistic philosophy, including those of the Socratic schools down through the Stoic, Epicurean, Skeptic and Neo-Platonic. Two hours lecture, one hour discussion.

103. History of Philosophy S
Medieval and Renaissance philosophy. Examination of original materials in medieval and Renaissance philosophy, including those of medieval Christian, Jewish, and Moslem philosophers and representative figures of the later humanistic tradition. Two hours lecture, one hour discussion.

104. History of Philosophy F
Sixteenth- and seventeenth-century philosophy. Examination of original materials in early modern philosophy. From the late Renaissance and Reformation to Descartes, Leibniz, Spinoza and Locke. Two hours lecture, one hour discussion.

105. History of Philosophy W
Eighteenth-century philosophy. Examination of original materials of eighteenth-century philosophy, including such writers as Bayle, Berkeley, Hume and Kant. Two hours lecture, one hour discussion.

106. History of Philosophy S
Nineteenth-century philosophy. Examination of original materials of nineteenth-century philosophy, including such writers as Hegel, Schopenhauer, and Nietzsche. Two hours lecture, one hour discussion.

110. Symbolic Logic F
Introduction to mathematical logic. Three lecture-discussions.

112. Philosophy of Science S
The development and systematic methods of epistemology in the light of the historical development of science. Two or three lecture-discussions.

120. Political Philosophy S
An examination of problems and theories concerning the nature of the state, society, and government. Three lecture-discussions.

121. Aesthetics W
An inquiry into the nature of human artistic experience and works of art. Three lecture-discussions.

122. Philosophy of Religion S
An examination of the nature of the religious experience, the nature of faith, and the role of reason in religion. Three lecture-discussions.

123. Ethics W
An inquiry into the nature of human conduct. Three lecture-discussions.

131. Contemporary Anglo-American Philosophy W
Some main problems found in the literature of recent and contemporary Anglo-American philosophy. Two or three lecture-discussions.

132. Contemporary European Philosophy F
Some main problems found in the literature of recent and contemporary European philosophy. Two or three lecture-discussions.

199. Individual Study F,W,S
Prerequisite: permission of departmental adviser.

GRADUATE

200. Studies and Teaching in the Humanities (1-3, 1-3, 1-3) F,W,S
A course designed to meet the needs of graduate students who serve as teaching assistants in the Humanities sequence in Revelle College. Weekly meetings with assigned lecturers. (Satisfactory/Unsatisfactory grades permitted.)

201. Advanced Symbolic Logic (3)
An intensive examination of propositional and quantificational logic as a basis for further deductive development. (Not offered 1968–69.)

202. Topics in the History of Philosophy* (3)
A course of studies designed to prepare students for advanced work in seminars. (Not offered 1968–69.)

203. Topics in Contemporary Epistemology and Metaphysics* (3) F
A course of studies designed to prepare students for advanced work in seminars.

204. Topics in Moral and Political Philosophy* (3) F,S
A course of studies designed to prepare students for advanced work in seminars.

250. Seminar in Contemporary Analytic Philosophy* (3) F,W
An analysis of some important problems in recent and contemporary Anglo-American philosophy as illustrative of major movements of thought.

251. Seminar in Contemporary European Philosophy* (3)
An analysis of some important problems in recent and contemporary Continental philosophy as illustrative of major movements of thought. (Not offered 1968–69.)

252. Seminar in Ancient Philosophy* (3) W
An examination of typical problems and philosophic issues found in the study of Greek and Roman philosophers: e.g., the origin and development of Greek philosophical concepts; the philosophic schools from the beginnings of Stoicism, Epicureanism, Skepticism down through Neo-Platonism.

253. Topics in Philosophy of Logic (3)
A study of major topics included in the scope of logical theory, together with a close examination of contributions by different philosophical schools to the analysis of central issues in philosophy of logic. (Not offered 1968–69.)

254. Seminar in Social and Political Philosophy* (3) **F**
An analysis of social philosophies and ideologies as they emerge from basic types of social structure.

255. Seminar in Medieval Philosophy* (3) **W**
The medieval development of the Western philosophical tradition. Representative writings of Greek Gnosticism and the rise of the Latin Western Christian tradition: Clement of Alexandria, Tertullian, Philo, Augustine, Erigena, Bonaventura, Arabian and Jewish authors, Anselm, Thomas Aquinas and William of Ockham.

256. Seminar in Aesthetics (3)
An exploration of problems in philosophy of art, aesthetic experience and aesthetic judgment within the context of a critical survey of some current aesthetic theories and their illustrative application in the various fields of art. (Not offered 1968–69.)

257. Seminar in Philosophy of Religion (3) **W**
A study of the philosophical foundations of religious experience, including such problems as belief and knowledge, faith and reason, the nature of God, the character and meaning of religious commitment.

258. Seminar in Ethics (3)
An examination of the nature of moral problems, judgments and principles, with emphasis on recent developments in moral philosophy and classic formulations of ethical theories. (Not offered 1968–69.)

260. Seminar in Renaissance Philosophy (3) **S**
Philosophical and intellectual currents of the Renaissance, with reference to the origins and development of classical humanism and medieval scholasticism and the emergence of a Renaissance philosophy of man.

261. Seminar in Seventeenth- and Eighteenth-Century Philosophy* (3) **W,S**
An examination of the origins and development of early modern philosophy, together with its philosophical and intellectual foundations, including a study of such authors as Descartes, Malebranche, Spinoza, Leibniz, Newton, Locke, Bayle, Berkeley, Hume and Kant.

262. Seminar in Philosophy of Science (3) **S**
An examination of such problems as concept formation, the explanation of law, the role of logic and mathematics in the sciences.

263. Seminar in Theory of Knowledge* (3) **S**
An examination and critique of representative theories of mind, reality, knowledge and perception.

264. Seminar in Philosophy of History (3)
An examination of basic concepts, categories, and presuppositions of historical experience in the context of representative philosophies of history. (Not offered 1968–69.)

265. Seminar in Nineteenth-Century Philosophy* (3)
A study of representative philosophical movements of the nineteenth century, as found in the writings of such authors as Hegel, Schopenhauer, Comte, Mills and Nietzsche. (Not offered 1968–69.)

269. Departmental Colloquium (1-3)
Special topics submitted by visiting philosophers for critical appraisal by staff and students. (Satisfactory/Unsatisfactory grades permitted.)

270. Seminar on Special Topics* (1-3)
A seminar for examination of a specific philosophical problem. (Satisfactory/Unsatisfactory grades permitted; not offered 1968–69.)

280. Independent Study* (1-6)
Open to properly qualified graduate students who wish to pursue a problem through advanced study under the direction of a member of the staff. (Satisfactory/Unsatisfactory grades permitted.)

299. Thesis Research* (1-12)
(Satisfactory/Unsatisfactory grades permitted.)

*May be repeated for credit as topic changes.

PHYSICAL EDUCATION

Office: Gymnasium

Theodore W. Forbes, *Ed. D., Supervisor* (Chairman of the Department)
Walter W. Hackett, *M.A., Assistant Supervisor*
Howard F. Hunt, *M.A., Assistant Supervisor*
Richard N. Johnson, *B.A., Assistant Supervisor*
Neale R. Stoner, *B.A., Assistant Supervisor*
Elizabeth Ann Dale, *B.A., Assistant Supervisor*
Bobbie A. Lane, *B.S., Junior Supervisor*
J. Charles Millenbah, *B.S., Junior Supervisor*

The Department of Physical Education offers a variety of programs, including scheduled activity classes, intramural and intercollegiate athletics, and recreational activities. Undergraduate students in Revelle and Muir Colleges are thus afforded an opportunity to participate in a variety of ways commensurate with their abilities and interests.

The faculty considers physical exercise and recreation essential and complementary to the sustained intellectual pursuits of the students, and departmental programs are designed to enable all students to develop physical skills in accordance with their individual abilities. All undergraduates are encouraged to engage in some form of continuing physical activity. Intercollegiate and intramural activities at various levels of proficiency will be encouraged.

Intramural Sports

The program of intramural sports constitutes an important phase of

the comprehensive physical education program. Opportunities are provided for all students to experience, on a voluntary basis and under actual game conditions, the activities in which they receive instruction in the basic program of physical education.

The intramural program is intended primarily for students who would not normally find it possible to participate in intercollegiate athletics. Participation in intramural sports is rewarding not in terms of academic credit or material awards, but in terms of health, social and moral benefits, and enjoyment of the sport for itself. Teams are formed within the dormitories and by special-interest groups and clubs. Team and individual champions represent UCSD each year at the annual All-University Intramural Sports Day.

Recreation

Recreation programs offer all students an opportunity to participate in individual or group activities. A variety of activities are offered, including archery, angling, baseball, basketball, bicycling, boating, bowling, cross-country running, football, handball, mountaineering, riflery, sailing, SCUBA diving, skiing, skin diving, squash, swimming, surfing, tennis, volleyball, weight training, and wrestling. There are, in addition, many popular sports clubs bringing together students with a common interest in a particular activity.

A variety of facilities are available to students, including a natatorium and sundeck, and a new gymnasium surrounded by playing fields. All students are entitled to use recreation facilities at no charge. The spouses and children of UCSD students, as well as faculty and staff and their families, are entitled to the privilege of using facilities at a slight charge.

COURSES

Note: No academic credit is earned in the following physical education activities, but satisfactory completion is recorded on the student's transcript of record.

1. Weight Training and Physical Conditioning (Men) **F,W,S**
Participation in individual exercise routines, running, weight and strength exercises to increase general physical fitness, endurance and muscular efficiency. Classes are offered in advanced, intermediate, and beginning sections.

2. Women's Conditioning **F,W,S**
Designed to meet the individual needs of each woman enrolled in the class through personal evaluation, diet, measurements, and exercise.

3. Swimming **F,W,S**
Instruction designed to permit students to gain or improve swimming strokes, techniques, and aquatic skills on an individual basis. Classes are offered in beginning, intermediate, and advanced sections.

4. Synchronized Swimming for Women **F,W,S**
Designed for advanced swimmers. Fundamentals in individual and group water ballet. Opportunity for public presentations.

5. Skin Diving F,S
Skin diving techniques, pool and ocean. Underwater skills, knowledge through exploration of the underwater world. The course is designed to provide an opportunity for students to learn a new set of nature's rules and laws which are not encountered on the surface.

6. Lifesaving F,W
The American Red Cross Senior Lifesaving Certificate will be awarded to students who satisfactorily complete the course. Emphasis is placed upon the knowledge and skills which will prepare a student to save his own life or the life of another in an emergency. Prerequisite: advanced swimming or consent of the instructor.

7. Water Safety S
Standard American Red Cross course designed to train authorized water safety instructors to teach A. R. C. swimming and lifesaving courses thereafter. Only holders of the A. R. C. Senior Lifesaving Certificate are eligible to register. Students must pass Part I (12 hours) in order to qualify for Part II (15 hours). Examinations.

9. Tennis F,W,S
Instruction in the fundamentals of the serve, strokes, volley, rules, scoring, tactics, and court strategy. Classes are offered in beginning, intermediate, and advanced sections.

10. Golf F,W,S
Instruction and practice in the fundamentals of golf. Emphasis is placed upon the golf swing and techniques of using all clubs under varying conditions. Classes are offered in beginning and intermediate sections.

11. Gymnastics (Women) F,W,S
The fundamentals of gymnastics, including instruction in the use of apparatus and in simple tumbling routines. Designed for the student of beginning and intermediate ability.

12. Gymnastics (Men) S
Designed for the student of beginning and intermediate ability. The fundamentals of gymnastics, including instruction in the use of apparatus and in simple tumbling routines.

13. Rhythmic Gymnastics F
Exercise routines to music with an emphasis on body control, skill and precision of execution.

14. Modern Dance F,W,S
Opportunities in dance techniques. Pattern variations will be discovered in time, space, and design. These, together with the technical skills, will produce a means of communication through body control.

15. Volleyball F,W,S
An emphasis on fundamental skills in serving, spiking, blocking, and teamwork techniques. Opportunity for team competition. Classes are offered in men's, women's, and coed sections.

16. Handball F,S
Instruction in fundamentals of the serve, volley and court strategy. Opportunity for singles and doubles competition.

17. Karate F,W,S
Instruction and training in the fundamentals of Sho-to-kan Karate, emphasizing: (1) basic stances and techniques; (2) "kata," ancient stylized sequences of defensive and counteroffensive movements; (3) sparring, a graded progression from strictly controlled defense and counterattack situations to free sparring for competition.

18. Wrestling F,W
Fundamentals of wrestling, with emphasis on takedowns and counters, escapes, and pinning combinations. Students will learn timing and execution of a limited number of holds and maneuvers.

19. Techniques of Officiating F,W,S
Designed to give a thorough knowledge and mastery of rules, field layout, and scorekeeping under actual game conditions. A prerequisite for student employment in officiating at intramural athletic contests.

20. Badminton F,W,S
Instruction in the fundamentals of the serve, strokes, volley, rules, scoring, tactics, and court strategy. Classes are offered in beginning, intermediate, and advanced sections. Designed to allow both men and women students, novice and expert, an opportunity to enjoy participation.

21. Squash F,W,S
Instruction in the fundamentals of the serve, strokes, volley, rules, scoring, tactics, and court strategy. Classes are offered in beginning, intermediate, and advanced sections.

Intercollegiate Athletics

A large variety of intercollegiate sports activities is offered to all undergraduate students. The program is designed for those who possess a high degree of proficiency in sport skills. Competition with other colleges and universities is scheduled.

25. Water Polo F
26. Wrestling F,W
27. Basketball F,W
28. Basketball/Frosh F,W
29. Cross Country F
30. Crew W,S
31. Sailing F,W
32. Swimming W
33. Volleyball W,S
34. Tennis W,S
35. Rugby W

36. Golf	W,S
37. Track	W,S
38. Baseball	W,S
39. Football	F
40. Gymnastics	S
41. Soccer	F,W
42. Fencing	W

PHYSICS

Office: 3426 Physics-Chemistry Building

William Ian Axford, *Ph.D., Professor of Physics*
*Keith A. Brueckner, *Ph.D., Professor of Physics*
E. Margaret Burbidge, *Ph.D., Professor of Astronomy*
Geoffrey R. Burbidge, *Ph.D., Professor of Astrophysics*
George Feher, *Ph.D., Professor of Physics*
William R. Frazer, *Ph.D., Professor of Physics*
Walter Kohn, *Ph.D., Professor of Physics*
Norman M. Kroll, *Ph.D., Professor of Physics*
Leonard N. Liebermann, *Ph.D., Professor of Physics*
Ralph H. Lovberg, *Ph.D., Professor of Physics*
John H. Malmberg, *Ph.D., Professor of Physics*
George E. Masek, *Ph.D., Professor of Physics*
Bernd T. Matthias, *Ph.D., Professor of Physics*
Maria Goeppert Mayer, *Ph.D., Professor of Physics*
Carl E. McIlwain, *Ph.D., Professor of Physics*
William A. Nierenberg, *Ph.D., Professor of Physics*
Oreste Piccioni, *Ph.D., Professor of Physics*
Harry Suhl, *Ph.D., Professor of Physics*
William B. Thompson, *Ph.D., Professor of Physics*
John C. Wheatley, *Ph.D., Professor of Physics*
David Y. Wong, *Ph.D., Professor of Physics*
Herbert F. York, *Ph.D., Professor of Physics* (Chairman of the Department)
John M. Goodkind, *Ph.D., Associate Professor of Physics*
Francis R. Halpern, *Ph.D., Associate Professor of Physics*
Kazumi Maki, *Ph.D., Associate Professor of Physics*
Laurence E. Peterson, *Ph.D., Associate Professor of Physics*
Sheldon Schultz, *Ph.D., Associate Professor of Physics*
Robert A. Swanson, *Ph.D., Associate Professor of Physics*
William C. Black, Jr., *Ph.D., Assistant Professor of Physics*
Barry Block, *Ph.D., Assistant Professor of Physics*
Joseph C. Y. Chen, *Ph.D., Assistant Professor of Physics*
Donald R. Fredkin, *Ph.D., Assistant Professor of Physics*
*Robert J. Gould, *Ph.D., Assistant Professor of Physics*
William G. Mathews, *Ph.D., Assistant Professor of Physics*
Werner A. W. Mehlhop, *Ph.D., Assistant Professor of Physics*

Thomas M. O'Neil, *Ph.D., Assistant Professor of Physics*
*Shang-Keng, *Ph.D., Assistant Professor of Physics*
Herbert B. Shore, *Ph.D., Assistant Professor of Physics*
Wayne Vernon, *Ph.D., Assistant Professor of Physics*
Nguyen-Huu Xuong, *Ph.D., Assistant Professor of Physics*
*On leave 1968-69

The Major Program

The upper-division program is intended to provide basic education in several principal areas of physics, with some opportunity for study in neighboring areas in the form of restricted electives. Provision is made, both in the main course and in the elective subjects, for some training in a few of the more technological aspects of physics.

In the junior year the emphasis is on macroscopic physics; the two principal physics subjects are electromagnetism and mechanics. The mathematics background required for the physics program is completed in this year.

In the senior year a sequence of courses in quantum physics provides the student with the modern view of atomic and some aspects of subatomic physics, and teaches him the principal analytical methods appropriate in this domain. The relation of the microscopic to the macroscopic world is the subject of courses in thermodynamics and statistical physics, with illustrations drawn from gas dynamics and solid state physics. The quantum physics sequence aims at an integrated, descriptive and analytical treatment of those areas of physics in which quantum effects are important, particularly atomic and nuclear physics and elementary particles.

Students who expect to major in physics are strongly advised to take Mathematics 100 and Mathematics 101 in the lower division. Also, if they plan to do graduate study in physics, they should choose German, Russian, or French (preferably German or Russian) for meeting the language requirement.

Restricted Electives. The restricted electives in mathematics are discussed below. The other restricted electives may be chosen from upper-division or graduate courses in physics, chemistry, biology or mathematics, subject to the approval of the Physics Department.

Chemistry. The Department of Physics considers that a knowledge of the fundamentals of chemistry is essential for the study and practice of physics. Consequently, Natural Science 2F, or equivalent, or an upper-division chemistry course with associated laboratory, is required for the B.A. degree in physics.

Mathematics. For the restricted elective in mathematics in the junior year, Mathematics 120 is strongly recommended.

Students entering the upper division with a deficient mathematics background will have to make up this deficiency in the junior year. For example, a student who failed to take Mathematics 100 and 101 will be required to take these courses in the junior year in place of the non-contiguous minor. Such a student may find it necessary to use some or

all of his senior-year free electives to complete the noncontiguous minor.

Required courses for physics majors are listed in the following recommended schedule.

Major Program in Physics (Recommended Schedule)

	Fall	Winter	Spring
Junior Year	Physics 110A	Physics 110B	Restricted Elective
	Physics 100A	Physics 100B	Physics 100C
	Restricted Elective (Math)	†Physics 101A	†Physics 101B
		Math 121	Free Elective
	Free Elective	Free Elective	Free Elective
Senior Year	Physics 130A	Physics 130B	Physics 130C
	†*Physics 131A	†*Physics 131B	†*Physics 170
	Physics 140	Physics 141	Restricted Elective
	Free Elective	Free Elective	Free Elective
	Free Elective	Free Elective	Free Elective

†Half courses.

*Students are expected to take two courses from the group Physics 131A, 131B, 170.

Noncontiguous Minor in Physics (Revelle College)

Students majoring in fields other than the sciences may arrange noncontiguous minor programs in physics by consulting with the Physics Department. Examples of such programs are the following:

1. Mathematics 100, 121; Physics 110A, 130A-130B-130C
2. Mathematics 100, 121; Physics 110A, 130A, 160, 161
3. Mathematics 100, 101; Physics 100A-100B-100C, plus 101A-101B
4. Mathematics 100, 101; Physics 110A-110B, 140, 141

Because of the large number of mathematics prerequisites required for physics courses, students who elect noncontiguous minors in the field of physics may find it desirable to supplement the noncontiguous minor by devoting some of their free elective time to additional courses in physics.

The Graduate Program

The Department of Physics offers curricula leading to the Master of Science and Doctor of Philosophy degrees.

The entering graduate student will be required to have a sound knowledge of undergraduate mechanics, electricity and magnetism, and to have had senior courses or their equivalent in nuclear physics, atomic physics, thermodynamics and statistical physics. Upper-division courses numbered 130 or higher are available for students who have minor deficiencies in undergraduate training.

Master's Degree Program

Requirements for the Master of Science degree may be met according

to Plan I (thesis) or Plan II (comprehensive examination). (See *Graduate Division: The Master's Degree.*) Plan I is available, however, only in very special circumstances, and it is expected that nearly all the M.S. degrees conferred will be earned through Plan II. No student should enter UCSD expecting to undertake a master's thesis in physics unless special arrangements have been made with the Physics Department. A detailed specification of the Physics Department course requirements together with a list of approved courses is available in the Physics Department office. There is no language requirement for the Master's Degree.

Doctor's Degree Program

Upon a student's admission to the Department, the Chairman of the Department will appoint an adviser to assist the student in planning his program and in preparing for the qualifying examination.

Although there are no specific course requirements for the degree, the following courses are usually taken to prepare the student for the general departmental examination:

First Year

Mathematics 212A-212B. Mathematical Methods
Physics 200A-200B. Theoretical Mechanics
Physics 203A-203B. Advanced Classical Electrodynamics
Physics 212A-212B. Quantum Mechanics

Second Year

Physics 210A-210B. Statistical Mechanics
Physics 211. Solid State Physics
Physics 212C-212D. Quantum Mechanics
Physics 213A-213B. Theoretical Nuclear Physics
Physics 215. High Energy Nuclear Physics

The general departmental examination is offered at the beginning of the Fall and Spring Quarters of each year and consists of (a) a written part taken after the completion of one year of graduate work, and (b) an oral part taken after completion of two years of graduate work.

In order to be admitted to the oral qualifying examination for candidacy for the doctor's degree, a graduate student must pass the general departmental examination, be accepted by a faculty member as a thesis student, and pass the language examinations. To satisfy the language requirement, a student has the option of a reading knowledge of two languages (one language must be German or Russian; the second may be German, Russian, French, Italian or Spanish) or a reading and speaking knowledge of one language (German, Russian, French, Italian or Spanish; English will be acceptable for foreign students, on the approval of the Department). (See *Graduate Division: Foreign Language Requirement.*)

After admission to candidacy, the student will engage in his thesis research as well as take some of the advanced graduate courses. The normal duration of the entire Ph.D. program is four years, but shortening of this period is possible for the exceptional student.

COURSES

LOWER DIVISION

The Department of Physics cooperates in the teaching and administration of the Natural Science sequences for Revelle College students. (See *Interdisciplinary Courses: Natural Sciences.*)

UPPER DIVISION

(See also *Interdisciplinary Courses: Earth Sciences.*)

100A. Electromagnetism F
Coulomb's law, electric fields, electrostatics; conductors and dielectrics; steady currents, elements of circuit theory. Four hours lecture. Prerequisite or co-registration: Mathematics 100.

100B. Electromagnetism W
Magnetic fields and magnetostatics, magnetic materials, induction; AC circuits; displacement currents; development of Maxwell's equations. Three hours lecture. Prerequisites: Physics 100A; prerequisite or co-registration, Mathematics 101; co-registration, Physics 101A.

100C. Electromagnetism S
Electromagnetic waves, radiation theory; application to optics; motion of charged particles in electromagnetic fields; relation of electromagnetism to relativistic concepts. Four hours lecture. Prerequisites: Physics 100B; co-registration, Physics 101B.

101A. Electricity and Magnetism Laboratory (half course) W
Experiments with AC and DC circuits and electromagnetic phenomena in general; magnetism. Four hours. Co-registration: Physics 100B. Required of Physics majors.

101B. Electricity and Magnetism Laboratory (half course) S
Microwaves, electrodynamics; electrical and electronic measurements and test equipment; construction and testing of active circuits. Four hours. Prerequisites: Physics 101A; co-registration, Physics 100C. Required of Physics majors.

110A. Mechanics F
Mechanics of systems of particles; conservation laws; planetary motion; linear oscillators; statics and dynamics of plane rigid bodies. Four hours lecture. Prerequisite or co-registration, Mathematics 100.

110B. Mechanics W
Special relativity; Lagrange's and Hamilton's equations; small oscillations of coupled systems; non-inertial frames; general motion of rigid bodies. Four hours lecture. Prerequisites: Physics 110A; Prerequisite or co-registration, Mathematics 101.

130A. Quantum Physics F
Atomic physics in the nineteenth century; radioactivity, Rutherford experiments; Bohr model, optical spectra, X-ray spectra, electron spin, vector

model. Three hours lecture. Prerequisites: Mathematics 121, Physics 110A; co-registration, Physics 131A.

130B. Quantum Physics W
Atomic structure according to wave mechanics; Schrodinger equation for hydrogen-like atoms; Pauli principle, Heisenberg principle; particle in a periodic potential. Three hours lecture. Prerequisites: Physics 130A; co-registration, Physics 131B.

130C. Quantum Physics S
Elementary nuclear physics; quantum mechanics of radiation; elementary particles and scattering. Four hours lecture. Prerequisites: Physics 100C, 130B.

131A. Modern Physics Laboratory (half course) F
Experiments in atomic physics, optics, physical electronics, fluid dynamics, surface physics, etc. Four hours. Co-registration: Physics 130A. Required of Physics majors.

131B. Modern Physics Laboratory (half course) W
Continuation of Physics 131A. Experiments in radioactivity, x-rays, atomic physics, resonance physics, solid state physics, etc. Four hours. Prerequisites: Physics 131A; co-registration, Physics 130B. Required of Physics majors.

140. Thermodynamics F
Classical thermodynamics including the first, second and third laws; thermodynamic potentials; phase transitions; applications to low temperature physics, radiation, and chemical reactions. Four hours lecture. Prerequisite or co-registration: Mathematics 100.

141. Statistical Physics W
Elementary statistical mechanics, probabilistic interpretation of entropy, fluctuation phenomena, transport phenomena. Four hours lecture. Prerequisites: Physics 140, 110A.

150. Continuum Mechanics F
Mechanics of continuous media; waves, instabilities, applications to earth sciences, oceanography, and aerodynamics. Three hours lecture. Prerequisite: Physics 110B. (Not offered 1968.)

152. Introduction to Solid State Physics S
Crystal symmetry, free electron gas, band structure, properties of insulators, semiconductors and metals; atomic diffusion, alloys, electronic transport phenomena. Four hours lecture. Prerequisites: Physics 130B, 141.

160. Survey of Astronomy and Astrophysics F
Introduction to modern astronomy and astrophysics. Three hours lecture. Prerequisite: Physics 110A.

161. Astrophysics W
The physics of stars, interstellar matter, and stellar systems. Three hours lecture. Prerequisites: Physics 160, 130A.

162. Astrophysics S
Continuation of Physics 161. Three hours lecture. Prerequisites: Physics 161, 130B, 141.

170. Advanced Laboratory (half course) S
Experimental study of a special problem in optics, cryogenics, resonance physics, nuclear physics, etc., using existing apparatus or developing new apparatus, or both. Hours by arrangement. Prerequisites: Physics 101A-101B, 131A or 131B.

171. Advanced Electronic Laboratory F
Electrical networks, vacuum tube and solid state electronics, analysis and design, and components. Power supplies. Amplifiers, noise and feedback, oscillators, digital and logic circuits, microwaves and special topics. Emphasis on applications to physical research. Six hours. Prerequisite: consent of the instructor.

172. Computer Laboratory
Computer solution of practical problems in science and engineering; mathematics of approximation methods, computer programming. Students will use the University computer to solve specific problems. Four hours. Prerequisite: Mathematics 121. (Not offered 1968–69.)

199. Special Project F,W,S
Independent reading or research on a problem by special arrangement with a faculty member. Four hours. Prerequisite: consent of the instructor.

GRADUATE

200A. Theoretical Mechanics (4) F
Lagrangian mechanics with applications to linear and nonlinear motion in inertial and non-inertial frames.

200B. Theoretical Mechanics (3) W
Variational principles, Hamilton's equations, and Hamilton-Jacobi theory. Special relativity. Rigid body and continuum mechanics. Prerequisite: Physics 200A.

203A. Advanced Classical Electrodynamics (3) F
The boundary value problems of electrostatics and the electrostatics of macroscopic media, magnetostatics and the properties of magnetic materials, currents in extended media, macroscopic properties of superconductors, electromagnetic induction and quasi-static phenomena, Maxwell theory and wave propagation. Prerequisite: Physics 100C or equivalent.

203B. Advanced Classical Electrodynamics (4) S
Applications of Maxwell's equations to radiating systems and boundary value problems, such as wave guides and diffraction phenomena; relativistic electrodynamics; radiation by moving charges; classical electron theory; nonlinear phenomena. Prerequisites: Physics 100C or equivalent, Physics 203A.

210A-210B. Statistical Mechanics (3, 2) F,W
Systems of weakly interacting elements; ensemble theory; applications to gases, plasmas, and liquids; elements of theory of phase transitions; fluctuations and non-equilibrium processes. Prerequisites: Physics 140, 141, 152 or equivalent; Physics 212B.

211. Solid State Physics (4) S
Discussion of experiments and current theories in the following areas: Lattice dynamics, including point defects; Fermi surface and elementary excitations in normal metals; superconductivity; cooperative magnetic phenomena. Prerequisite: Physics 152 or equivalent.

212A. Quantum Mechanics (3) W
Physical basis of quantum mechanics, the Schrodinger equation and the quantum mechanics of one-particle system, matrices and the transformation theory of quantum mechanics, approximation methods for discrete stationary states. Prerequisite: Physics 130B or equivalent.

212B. Quantum Mechanics (3) S
Translational and rotational invariance, angular momentum and spin, the formal theory of scattering. Prerequisite: Physics 212A.

212C. Quantum Mechanics (3) F
Approximation methods in the continuum and for time-dependent problems; identical particles and the quantum theory of atomic structure; the statistical matrix and the quantum mechanical theory of measurement. Prerequisite: Physics 212B.

212D. Quantum Mechanics (3) W
Relativistic one-particle theory; quantization of the electromagnetic field and particle fields; nonrelativistic interaction of the quantized electromagnetic field with atomic systems. Prerequisite: Physics 212C.

213A-213B. Theoretical Nuclear Physics (3, 3) F,W
Nuclear forces, two-nucleon system, interaction of nucleons with the electromagnetic field, Beta transformation of nucleons; nuclear systematics, models of nuclear structure, nuclear transformations and reactions. Prerequisites: Physics 130C or equivalent; co-registration, Physics 212C and 212D.

214. Advanced Quantum Mechanics (3) S
Covariant perturbation theory, mass and charge renormalization of quantum electrodynamics, radiative corrections to scattering and atomic energy levels, introduction to dispersion theory. Prerequisite: Physics 212D.

215. High Energy Nuclear Physics (3) S
An introduction to the elementary particles with particular emphasis on the invariance principles by which they are classified. Prerequisites: Physics 212D, 213B.

217A. Astrophysics (3) F
Stellar spectroscopy (line, molecular, and continuum), stellar atmospheres, determination of abundances of elements in stars. Prerequisites: Physics 130C; Physics 141 or equivalent.

217B. Astrophysics (3) W
Stellar structure, degenerate matter, stellar evolution (theoretical and empirical), nuclear energy and nucleosynthesis. Prerequisite: Physics 217A.

217C. Astrophysics (3) S
Galactic structure, stellar populations, star cluster, interstellar medium, radio emission from galaxies. Prerequisite: Physics 217A.

220. Group Theoretical Methods in Physics (3) F
Study of the representations and applications of groups to problems in physics, particular emphasis on the permutation of unitary groups. Prerequisite: Physics 212C.

230. Advanced Solid State Physics (4) F
A selection of advanced topics such as electrical and thermal transport phenomena, cooperative magnetic phenomena, nuclear and electron magnetic resonance, superconductivity. Prerequisite: Physics 210C.

231. Collision Theory (3) S
Collision theory and its application to atomic and molecular processes. Description of collision processes, scatterings and resonances in composite systems. Rearrangement collisions and the methods of approximation. Prerequisites: Physics 212A, 212B.

232A-232B. Advanced Plasma Physics (3-3) W-S
Vlasov equations and elementary excitations of an infinite medium; kinetic theory with applications to diffusion, scattering, etc.; quasi-linear theory and turbulence. Invariants of single particle motions; stability theory; magnetohydrodynamics and generalizations to include resistivity and finite Larmor radius; microinstabilities; applications to fusion, MHD power generation, and propulsion. Prerequisites: Physics 200C, 203B, 210B.

233. Elementary Particle Theory (4) F
Current problems in elementary particle theory, especially the theory of strong interactions. Prerequisite: Physics 215.

234. High Energy Experimental Physics (4) F
Current elementary particles research. Techniques used in experiments with high energy accelerators. Prerequisite: Physics 215.

236. Many-Body Theory (4) W
Dilute classical systems; virial expansions; relation to statistical mechanics; quantum mechanical formulations; dilute systems, perturbation theory; calculation of ground state energy; nuclear matter; uncharged and charged Bose and Fermi liquids; collective modes of motion; screen-

ing; superconductivity and superfluidity; Green's function method; the self-consistent field; interacting systems of magnetic moments, ferromagnetism. Prerequisites: Physics 210C, 212D.

250. Solid State and Cryogenics Physics Seminar (1, 1, 1) **F,W,S**
Discussions of current research in solid state physics. (Satisfactory/Unsatisfactory grades only.)

251. High Energy Physics Seminar (1, 1, 1) **F,W,S**
Discussions of current research in nuclear physics, principally in the field of elementary particles. (Satisfactory/Unsatisfactory grades only.)

252. Plasma Physics Seminar (1, 1, 1) **F,W,S**
Discussions of recent research in plasma physics. (Satisfactory/Unsatisfactory grades only.)

253. Astrophysics and Space Physics Seminar (1, 1, 1) **F,W,S**
Discussions of recent research in astrophysics and space physics. (Satisfactory/Unsatisfactory grades only.)

299. Research in Physics (1-12, 1-12, 1-12) **F,W,S**
(Satisfactory/Unsatisfactory grades permitted.)

POLITICAL SCIENCE

Office: 1564 Humanities-Library Building

A Department of Political Science is being formed. In the absence of a regular department, a visiting professor will teach a sequence of courses in 1968–69.

COURSES

10-11-12. Introduction to Political Science **F-W-S**
Utilizing text, reading, and case studies, the three-course sequence will constitute an introduction to political science and institutions. In the context of their historical past, present situations in political, democratic, and foreign policy will be presented.

PSYCHOLOGY

Office: 4202 Urey Hall

*Norman H. Anderson, *Ph.D., Professor of Psychology*
J. Anthony Deutsch, *Ph.D., Professor of Psychology*
David M. Green, *D.Phil., Professor of Psychology*
George Mandler, *Ph.D., Professor of Psychology* (Chairman of the Department)
William J. McGill, *Ph.D., Professor of Psychology* (Chancellor)
William J. McGuire, *Ph.D., Professor of Psychology*

George S. Reynolds, *Ph.D., Professor of Psychology*
Harry L. Munsinger, *Ph.D., Associate Professor of Psychology*
Donald A. Norman, *Ph.D., Associate Professor of Psychology*
Edmund J. Fantino, *Ph.D., Assistant Professor of Psychology*
Peter H. Lindsay, *Ph.D., Assistant Professor of Psychology*
David E. Rumelhart, *Ph.D., Assistant Professor of Psychology*
Roland A. Wilhelmy, *Ph.D., Assistant Professor of Psychology*

* * *

Clyde H. Coombs, *Ph.D., Visiting Professor of Psychology*
Robert Galambos, *Ph.D., M.D., Professor of Neurosciences*
Theodore M. Newcomb, *Ph.D., Visiting Professor of Psychology*
John H. Taylor, *Ph.D., Research Psychologist, Lecturer in Psychology*

*On leave 1968–69

The Major Program

The department offers courses in all major areas of experimental psychology, with emphasis in the areas of human information processing, animal learning, physiological psychology, developmental psychology, and social psychology. Students majoring in psychology are expected to develop a knowledge of a broad range of content areas as well as basic skills in the experimental and analytic procedures used in the study of human and animal behavior.

The normal sequence of courses for the major in psychology includes a basic series in laboratory and quantitative methods (Psychology 101–104), four upper-division psychology electives selected from Psychology 130–150, a research project to be completed during a three-course sequence in the senior year (Psychology 198), and three related electives: a sequence of three courses in some field of instruction related to psychology.

Psychology 101–103 consists of three laboratory courses taken during the junior year. Special topics in probability theory and statistics are introduced during the spring quarter of the junior year (Psychology 104). (Prospective majors should note that Psychology 104 has prerequisites of Mathematics 130A and Mathematics 133A. Students should consult the Mathematics Department for prerequisites to these courses.) Because a thorough knowledge of scientific methods is essential to the understanding of experimental psychology, students are advised to finish the science requirements of their college by the end of their sophomore year.

Ordinarily one of the four psychology electives is taken during the junior year, and three psychology electives are taken during the senior year. The three related electives normally consist of a three-course sequence of upper-division courses which may be taken in the junior or senior year. Related electives provide the opportunity for students to obtain skills which may be necessary in the study of specialized areas in psychology. In addition to the courses offered by the Department of

Psychology, related electives may be taken in the Departments of Applied Electrophysics, Biology, Economics, Linguistics, and Mathematics.

Within the general requirements, students may take a wide variety of courses to fulfil the major program. Psychology majors will be assisted by departmental advisers in selecting a program suitable for their particular interests. A qualified major may elect to take graduate seminars in psychology, subject to approval by his adviser and the instructors of the relevant courses.

Major Program in Psychology (Recommended Schedule)

	Fall	Winter	Spring
Junior Year	Psychology 101 Mathematics 130A	Psychology 102 Mathematics 133A	Psychology 103 Psychology 104 Psychology elective
Senior Year	Psychology 198 Psychology elective *Elective	Psychology 198 Psychology elective *Elective	Psychology 198 Psychology elective *Elective

*Three related courses (see text)

The Noncontiguous Minor for Revelle College

A limited number of students may enrol in psychology in order to fulfil the requirements of the noncontiguous minor. The noncontiguous minor will normally consist of two of the lower-division courses in psychology, Mathematics 130A, and the sequence of laboratory courses 101-102-103. Students who wish to pursue a noncontiguous minor should consult with the department *before* enrolling for these courses. Lower-division psychology courses may not be used simultaneously to satisfy both the social science requirement and the noncontiguous minor requirement. Please note that Mathematics 130A is a prerequisite for Psychology 101 (concurrent registration is permitted).

The Graduate Program

The Department of Psychology provides broad training in experimental psychology. Increased specialization and the general burgeoning of knowledge make it impossible to provide training in depth in every aspect of experimental psychology, but most aspects are represented in departmental research. The Department concentrates especially on communication and information research and human information processing. In addition, the department has programs of study in animal learning, social psychology, physiological psychology (including motivation and emotion), and developmental psychology.

Preparation

Apart from the general University requirements, the Department generally expects adequate undergraduate preparation in psychology. A major in the subject, or at least a strong minor, is normally a prerequisite, but exceptions may be made for applicants with good backgrounds in such fields as biology and mathematics.

Language Requirements

There is no foreign language requirement for the M.A. Candidates for the Ph.D. degree must demonstrate comprehension of one of the following: German, French, or Russian. Another language may be substituted, with the approval of the Graduate Council, if it can be demonstrated that a significant literature in psychology exists in that language. (See *Graduate Division: Foreign Language Requirement.*)

Qualifying Examination

By the end of the second year a student proceeding to the Ph.D. degree will present a paper outlining the major problems and findings in his area of specialization, describing his thesis topic, and including any preliminary results obtained from pilot studies and other preparatory research. He will be examined by a doctoral committee on the contents of this paper.

Course of Study

All students are expected to take the sequence in quantitative methods (Psychology 201A-201B-201C). Other courses are divided into two groups:

Basic Seminars. All students are normally required to take no less than four and no more than six quarter seminars at this level during their first year. These seminars (Psychology 202–219) are intended to cover current psychological knowledge and to provide the basis for more intensive and specialized study. Typically, two of these basic seminars should be taken in the first quarter, and one each in the second and third quarters.

Advanced Seminars. During the first year students may take up to two advanced seminars during the second and third quarters. These seminars (Psychology 220–239) focus on specific areas of current knowledge and research. Graduate and upper-division courses in other departments may be substituted with the approval of the Department. Course work in the second year will usually be confined to advanced seminars and to interdisciplinary work. There are no further course requirements.

Teaching

In order to acquire adequate teaching experience, all students are required to participate in the teaching activities of the Department in every year of residence.

Research

From the first year of graduate study all students are enrolled in a research practicum (Psychology 296). Students are assigned to current

research projects in the Department, and receive the personal supervision of a member of the staff.

Comprehensive Evaluation

Each student's work will be evaluated by the staff at the end of the first year of residence. This evaluation will consider all aspects of the student's performance: his work in courses and seminars, his ability to perform research, and his teaching. In addition, each student must submit a research paper based on his work during the first year. Admission to second-year standing depends upon the outcome of this evaluation. During the second year the Department will survey the student's general preparation in psychology. Additional written or oral evidence of competence in certain areas may be sought at this time, and, where necessary, additional course work may be required.

The M.A. Program

Normally, students will be accepted only for the Ph.D. Students in the doctoral program may, however, qualify for the M.A.

Plan II has been adopted by the Department (see *Graduate Division: The Master's Degree*). Each candidate must complete Psychology 201A-201B-201C, and at least six additional units in graduate courses other than the research courses 296, 298, and 299. Each candidate must also pass the master's examination, which is offered by the Department once each year.

COURSES

LOWER DIVISION

10. Developmental Psychology F

An introduction to the psychological development of the human organism with special reference to cognitive development in the child. Two hours lecture, one hour recitation.

11. Perception and Information Processing S

An introduction to basic principles of perception, learning, and information processing. Two hours lecture, one hour recitation.

14. Social Psychology W

An introduction to concepts and methods in social psychology. Two hours lecture, one hour recitation.

UPPER DIVISION

101. Experimental Psychology F

Mr. Norman

An introduction to the experimental investigation of human and animal behavior. Emphasis is given to problems in human and animal learning, perception, psychophysics, and information processing. Four hours labo-

ratory, two hours lecture and recitation. Prerequisite: Mathematics 130A (concurrent registration is permitted).

102. Experimental Psychology **W**
Mr. Fantino
Continuation of Psychology 101. Prerequisite: Psychology 101.

103. Experimental Psychology **S**
Mr. Rumelhart
Continuation of Psychology 102. Prerequisite: Psychology 102.

104. Quantitative Methods in Psychology **S**
Mr. Lindsay
An introduction to statistical and quantitative methods in psychology. Prerequisite: Mathematics 130A and 133A.

133. Physiological Psychology **F**
Mr. Deutsch
Intensive introduction to current knowledge in physiological factors in learning, motivation, perception, and memory. Prerequisite: Psychology 104.

134. Social Psychology **S**
Mr. Wilhelmy
Introduction to group behavior, attitude change, social perception. Prerequisite: Psychology 104.

135. Memory and Attention **W**
Mr. Norman
Survey of current research and theory in human memory and attention. Prerequisite: Psychology 104.

137. Developmental Psychology **W**
Mr. Munsinger
Intensive survey of current knowledge in cognitive and intellective factors in human development. Prerequisite: Psychology 104.

138. Introduction to Mathematical Psychology **F**
Mr. Rumelhart
An introduction to mathematical models in learning, perception, memory, and sensory processes. Prerequisite: Psychology 104.

139. Motivation and Learning **W**
Mr. Fantino
An intensive introduction to basic principles of human and animal motivation and learning. Prerequisite: Psychology 104.

180. Special Topics **F,W,S**
Selected seminars by members of the staff. Prerequisite: major in Psychology.

198. Research in Psychology F,W,S
Mr. Fantino, the Staff
Research seminars and research, under the direction of a member of the staff. Prerequisites: Psychology 103 and 104. May be repeated for credit.

199. Independent Study F,W,S
Independent study or research under direction of a member of the staff. Prerequisite: special permission of the Department.

GRADUATE

201A-201B-201C. Quantitative Methods in Psychology (3-3-3) F-W-S
Mr. Coombs, Mr. McGill
An intensive course in statistical methods and the mathematical treatment of data, with special reference to research in psychology.

202. Sensory Mechanisms (3) F
Mr. Green
An introduction to problems and methods. Seminar.

203. Physiological Psychology (3) F
Mr. Deutsch
The central nervous system and its relation to behavior. Seminar.

204. Social Psychology (3) F
Mr. McGuire
The behavior of man as a function of social variables. Seminar.

205. Memory and Attention (3) W
Mr. Norman
Contemporary theories of human attention and memory. Seminar.

206. Conditioning and Learning (3) S
Mr. Reynolds
Classical and operant conditioning in lower animals. Seminar.

207. Developmental Psychology (3) W
Mr. Munsinger
The original behavioral repertory of the child and its subsequent development. Seminar.

220. Detection Theory in Psychology (2) W
Mr. Green
The application of detection theory to human information processing. Advanced seminar.

221. Judgmental Processes (2)
Mr. Anderson
The psychology of judgments and information integration. Advanced seminar. (Not offered 1968-69.)

222. Brain Functions (2) W
Mr. Deutsch
Selected topics. Advanced seminar.

223. Advanced Topics in Psychophysics (2) S
Mr. McGill
Advanced seminar.

224. Verbal Learning and Memory (2) S
Mr. Mandler
Selected problems. Advanced seminar.

225. Experimental Analysis of Behavior (2) W
Mr. Reynolds
Advanced seminar in modern techniques and findings, with special emphasis on operant conditioning. Advanced seminar.

226. Contemporary Problems in Vision S
Mr. Taylor
Advanced seminar on recent research in vision.

227. The Human Dyad (2) W
Mr. Newcomb
Interaction processes; properties of the dyad as an entity; variables associated with its change and stability. Advanced seminar.

228. Advanced Topics in Mathematical Psychology (2) F
Mr. Rumelhart, the Staff
Advanced seminar on selected mathematical models in learning, perception, sensory processes, and memory.

229. Selected Topics in Social Psychology (2) S
Mr. McGuire
Advanced seminar on theoretical issues in attitudes and social perception.

230. Advanced Topics in Developmental Psychology (2) S
Mr. Munsinger
Theoretical and methodological problems in cognitive, perceptual, and social development. Advanced seminar.

280. Seminar in Communication and Information Research (1,1,1) F,W,S
The Staff and Visiting Lecturers
(Satisfactory/Unsatisfactory grades permitted.)

296. Research Practicum (1-12, 1-12, 1-12) F,W,S
The Staff
Research in psychology under supervision of individual staff members.
(Satisfactory/Unsatisfactory grades permitted.)

298. Library Research (1-12, 1-12, 1-12) F,W,S
The Staff
Reports and surveys of the literature on selected topics.

299. Independent Study and Thesis Research (1-12, 1-12, 1-12) F,W,S
The Staff
(Satisfactory/Unsatisfactory grades permitted.)

SCIENCE

See *Interdisciplinary Courses.*

SCRIPPS INSTITUTION OF OCEANOGRAPHY

Office: 1156 Ritter Hall

Gustaf Arrhenius, *D.Sc., Ph.D., Professor of Marine Geology*
Robert S. Arthur, *Ph.D., Professor of Oceanography*
George E. Backus, *Ph.D., Professor of Geophysics*
Andrew A. Benson, *Ph.D., Professor of Biology*
Edward C. Bullard, *Sc.D., F.R.S., Professor of Geophysics*
Theodore H. Bullock, *Ph.D., Professor of Neurophysiology*
Charles S. Cox, *Ph.D., Professor of Oceanography*
Harmon Craig, *Ph.D., Professor of Geochemistry*
Seibert Q. Duntley, *Sc.D., Professor of Physics*
Carl H. Eckart, *Ph.D., Professor of Geophysics*
Albert E. J. Engel, *Ph.D., Professor of Geology*
Edward W. Fager, *Ph.D., D.Phil., Professor of Marine Ecology*
Denis L. Fox, *Ph.D., Professor of Marine Biochemistry*
J. Freeman Gilbert, *Ph.D., Professor of Geophysics*
Edward D. Goldberg, *Ph.D., Professor of Chemistry*
Susumu Hagiwara, *M.D., Ph.D., Professor of Physiology*
Harold T. Hammel, *Ph.D., Professor of Physiology*
Francis T. Haxo, *Ph.D., Professor of Biology*
Douglas L. Inman, *Ph.D., Professor of Oceanography*
John D. Isaacs, *B.S., Professor of Oceanography*
Charles D. Keeling, *Ph.D., Professor of Oceanography*
Devendra Lal, *Ph.D., Professor of Nuclear Geophysics*
Ralph A. Lewin, *Ph.D., Professor of Biology*
Henry W. Menard, *Ph.D., Professor of Geology*
Walter H. Munk, *Ph.D., Professor of Geophysics*
William A. Nierenberg, *Ph.D., Professor of Physics* (Dean and Director of Scripps Institution of Oceanography)
Fred B Phleger, *Ph.D., Professor of Oceanography*
Russell W. Raitt, *Ph.D., Professor of Geophysics*
Milner B. Schaefer, *Ph.D., Professor of Oceanography* (Director of the Institute of Marine Resources)
Per F. Scholander, *M.D., Ph.D., Professor of Physiology*
Fred N. Spiess, *Ph.D., Professor of Oceanography*
Victor Vacquier, *M.A., Professor of Earth Sciences*
Benjamin E. Volcani, *Ph.D., Professor of Microbiology*
Edward L. Winterer, *Ph.D., Professor of Geology*

Warren S. Wooster, *Ph.D., Professor of Oceanography* (Chairman of the Department)
Claude E. ZoBell, *Ph.D., Professor of Marine Microbiology*
Milton A. Bramlette, *Ph.D., Professor of Geology, Emeritus*
Carl L. Hubbs, *Ph.D., Professor of Biology, Emeritus*
Martin W. Johnson, *Ph.D., Professor of Marine Biology, Emeritus*
George F. McEwen, *Ph.D., Professor of Oceanography, Emeritus*
Norris W. Rakestraw, *Ph.D., Professor of Chemistry, Emeritus*
Roger Revelle, *Ph.D., Professor of Oceanography, Emeritus*
Francis P. Shepard, *Ph.D., Professor of Submarine Geology, Emeritus*
Charles D. Wheelock, *M.S., Professor of Naval Architecture, Emeritus*
Joseph R. Curray, *Ph.D., Associate Professor of Oceanography*
James T. Enright, *Ph.D., Associate Professor of Oceanography*
Richard A. Haubrich, *Ph.D., Associate Professor of Geophysics*
John A. McGowan, *Ph.D., Associate Professor of Oceanography*
Melvin N. A. Peterson, *Ph.D., Associate Professor of Oceanography*
Richard H. Rosenblatt, *Ph.D., Associate Professor of Marine Biology*
Russ E. Davis, *Ph.D., Assistant Professor of Geophysics*
Carl H. Gibson, *Ph.D., Assistant Professor of Aerospace Engineering*
Joris M.T.M. Gieskies, *Ph.D., Assistant Professor of Oceanography*
James W. Hawkins, *Ph.D., Assistant Professor of Geology*
Myrl C. Hendershott, *Ph.D., Assistant Professor of Oceanography*
Nicholas D. Holland, *Ph.D., Assistant Professor of Marine Biology*
Ferren MacIntyre, *Ph.D., Assistant Professor of Oceanography*
Michael M. Mullin, *Ph.D., Assistant Professor of Oceanography*
William A. Newman, *Ph.D., Assistant Professor of Oceanography*
Robert L. Parker, *Ph.D., Assistant Professor of Geophysics*
Charles W. Van Atta, *Ph.D., Assistant Professor of Aerospace Engineering*

* * *

Elbert H. Ahlstrom, *Ph.D., Professor of Oceanography in Residence*
Reuben Lasker, *Ph.D., Associate Professor of Marine Biology in Residence*
Theodore Enns, *Ph.D., Research Physiologist and Lecturer*
Frederick H. Fisher, *Ph.D., Research Oceanographer and Lecturer*
Benton B. Owen, *Ph.D., Research Chemist and Lecturer*
Rudolph W. Preisendorfer, *Ph.D., Research Mathematician and Lecturer*
Joseph L. Reid, *M.S., Research Oceanographer and Lecturer*
William R. Riedel, *M.S., Research Geologist and Lecturer*
George G. Shor, Jr., *Ph.D., Research Geophysicist and Lecturer*
John D. H. Strickland, *Ph.D., Research Oceanographer and Lecturer*
Edward Brinton, *Ph.D., Associate Research Biologist and Lecturer*
Abraham Fleminger, *Ph.D., Assistant Research Biologist and Lecturer*

The Graduate Department of the Scripps Institution of Oceanography offers graduate instruction leading to M.S. and Ph.D. degrees in oceanography, in marine biology and in earth sciences. Emphasis is on the Ph.D. program. A student will normally concentrate his work in one of several

curricular programs within the Department. These programs now include: biological oceanography, marine biology, marine chemistry, marine geology, geophysics, physical oceanography.

No undergraduate major is offered in the Department. The interdisciplinary nature of research in marine and earth sciences is emphasized; students are encouraged to take courses in several programs and departments, and to select research problems of interdisciplinary character. The research vessels and other facilities of the Scripps Institution and its associated laboratories (including the Institute of Geophysics and Planetary Physics) are available to the Department's students, many of whom participate in oceanographic research at sea.

The Curricular Programs

Biological Oceanography is the field of study concerned with the interactions of populations of marine organisms with one another and with their physical and chemical environment. Since these interactions are frequently complex, and since the concepts and techniques used in investigating the environment and the populations are drawn from many fields, biological oceanography is, of necessity, interdisciplinary. Therefore, studies in physical oceanography, marine chemistry, and marine geology, as well as biology, are pertinent. Research activities in this curriculum include studies of the factors influencing primary and secondary productivity and nutrient regeneration, food-chain dynamics, community ecology of benthic and pelagic forms, population dynamics, fishery biology, taxonomy and zoogeography of oceanic organisms, behavior as it affects distribution, and sampling problems. Theoretical, experimental, and direct observational approaches to these problem areas are undertaken by both faculty and students.

Marine Biology is the study of marine organisms, their development, and their adaptations. It is, therefore, concerned with the physiological and biochemical processes in marine organisms, their genetic relationships, and the relationships between them and their environment, both biotic and physical. It encompasses several major areas of modern biology, and is interpreted from the viewpoints gained through understanding the physical and chemical dynamics of the seas. Research activities in the curriculum currently include microbiology, ultrastructure, photobiology (photosynthesis and respiration, energy-transfer processes and comparative anatomy and physiology of vertebrate and invertebrate vision), barobiology, cardiovascular physiology, comparative biochemistry, comparative and cellular physiology, neurophysiology, systematics, distribution, ecology and evolution of marine animals and plants.

Marine Chemistry is concerned with chemical processes operating within the marine environment: the oceans, the marine atmosphere, and the sea floor. The interactions of the components of seawater with the atmosphere, with the sedimentary solid phases, and with plants and animals form the basis for research programs, which include investigations of the carbon dioxide system, high-pressure physical chemistry of sea-

water, the formation of minerals on the sea floor, surface chemistry, and the distribution of noble gases and halogens in the marine environment.

Marine Geology includes those aspects of the earth sciences that relate to the marine realm and is the field of study concerned with the origin and history of ocean basins and with geological processes occurring in, under, and around the oceans. Research activities in the curriculum include the study of beach and near-shore processes and ecology, deep-sea sedimentation, stratigraphy, and vulcanism, geomorphology, structure and deformation of the Earth's crust, particularly in the ocean basins and at continental margins, geochemistry and petrology.

Geophysics emphasizes the application of general experimental and theoretical methods of physics to fundamental problems in the atmosphere, oceans, and interior of the Earth, and in the solar system. Research interests within the curricular group include: magnetohydrodynamic phenomena in the Earth's core, hydrodynamics of oceans and atmospheres, geophysical inverse problems, theoretical seismology, the design of geophysical arrays, multichannel data-processing methods, nonlinear tidal prediction, long-period resonant and equilibrium fluctuations in the Earth and its oceans, radiative transfer in the sea and the atmosphere, interactions of weakly nonlinear wave fields, studies of oceanic crustal structure, acoustic propagation in the oceans, interpretation of regional geomagnetic data, processes of ocean-floor spreading, and irreversible thermodynamics.

Physical Oceanography is the field of study that deals with mechanisms of energy transfer through the sea and across its boundaries, and with the physical interactions of the sea with its surroundings. Research activities within this curricular group include: study of the general circulation of the oceans, including the relations of ocean currents to driving forces and constraints of the ocean basins; fluctuations of currents, and the transport of properties; the mechanisms of transport of energy, momentum, and physical substances within the sea and across its boundaries; properties of wind waves, internal waves, tsunami and planetary waves; the thermodynamic description of the sea as a system not in equilibrium; optical and acoustic properties of the sea; and the influence of surf on near-shore currents and the transport of sediments.

Requirements for Admission

Candidates for admission should have a bachelor's or master's degree in one of the physical, biological, or earth sciences; in some cases a degree in mathematics or engineering science is accepted. The student's preparation should include:

1. Mathematics through differential and integral calculus.
2. Physics, one year with laboratory (the course should stress the fundamentals of mechanics, electricity, magnetism, optics, and thermodynamics, and should use calculus in its exposition).
3. Chemistry, one year with laboratory.
4. An additional year of physics or chemistry.

5. Biology or geology, one year with laboratory.
6. Preparation in at least one foreign language chosen from the following: German, Russian, a Romance language (French for the marine biology program).

Specific additional requirements for admission to the various curricular programs are as follows:

Biological oceanography—two years of chemistry, including general and organic chemistry (physical chemistry requiring calculus may be substituted for physics requiring calculus where a more elementary physics course was taken); a course in general geology and a year of general biology (or zoology, or botany). Normal preparation should also include at least one course in three of the following categories: systematics (e.g., invertebrate zoology), population biology (e.g., ecology), functional biology (e.g., comparative physiology), morphology (e.g., embryology). In special cases other advanced courses in mathematics or natural sciences may be substituted for one or more of the above.

Marine biology—a major in one of the biological sciences (or the equivalent), with basic course work in botany, microbiology, or zoology; two years of chemistry, including organic (biochemistry and physical chemistry will be expected of students in experimental biology, although the student may, if necessary, enrol in these courses at UCSD after admission). Training in several of the following areas is strongly recommended: cellular biology, molecular biology, comparative physiology, genetics, developmental biology, ecology, comparative anatomy, vertebrate and invertebrate zoology, plant taxonomy. A strong scholastic record in a narrower biological field may be considered in lieu of breadth of background.

Marine chemistry—major in chemistry or biochemistry.

Marine geology—major in geology. Physical chemistry with calculus is required; training beyond the minimum in mathematics, physics, and chemistry is strongly recommended.

Geophysics—major in physics or mathematics, or equivalent training.

Physical oceanography—major in a physical science, including three years of physics and mathematics.

Candidates with preparation different from that given above can be admitted only if their undergraduate or previous graduate record has been outstanding.

Programs of Study

Because of limited facilities, the Department does not encourage students who wish to proceed only to the M.S. If circumstances warrant, the degree is normally offered under Plan II (comprehensive examination) after completion of course work established by the Department. See *Graduate Division: the Master's Degree*.

The program of study for the Ph.D. degree is determined in consultation with the students adviser (after the first year, the chairman of his

guidance or doctoral committee). General requirements of the curricular groups are as follows:

Biological Oceanography

The student will be expected to be familiar with the material presented in the following courses: SIO 210A, 240, 260, 270A-270B, 271A-271B, 275A-275B, 276A-276B, and either 282A or 283. Other course work ordinarily will be recommended by the students advisory committee, usually including at least one advanced-level course in physical, chemical, or geological oceanography. Participation in an oceanographic cruise (minimum of two weeks duration) is required.

Marine Biology

At the time of the student's departmental examination (no later than the second quarter of his second year), the student will be expected to demonstrate his competence in general biology and in the material covered in the following courses: SIO 210A, 260, and 280A-280B-280C, as well as any other course work recommended by his advisory committee. All students are expected to enrol in a seminar during two quarters of each year.

Marine Chemistry

Students in this curriculum will be expected to take a substantial part of their graduate course work in the Department of Chemistry. Students oriented toward physical chemistry will be held responsible for the material presented in the graduate courses in chemical thermodynamics, statistical mechanics, and in the undergraduate course in inorganic chemistry. Students oriented toward organic chemistry or biochemistry will be held responsible for the material presented in chemical thermodynamics and in those graduate courses in organic chemistry related to their areas of interest. Each student will be expected to have taken several courses from the curriculum of the Scripps Institution of Oceanography within the areas of physical, biological, and/or geological oceanography.

Marine Geology

There are no general course requirements under this curriculum, other than the four "basic courses" (SIO 210A, 240, 260, and 270A). Additional courses to be taken in oceanography and related areas will be based on the needs of the individual student, as determined by his advisory committee. In some cases, these requirements may also include course work in selected subject areas at UCB or UCLA.

Geophysics

There is no single course of study appropriate for the geophysics curriculum; instead, the individual needs and interests of the student will determine the recommendations of his advisory committee with regard to course work in oceanography, earth sciences, and/or related areas.

Physical Oceanography

Students in this curricular program will normally be expected to demonstrate proficiency in the subject matter of the following courses: SIO 211A-211B, 212A-212B, 216A, 220, 222A-222B, 223, and 225 and in background material in acoustics and electromagnetic propagation in the sea. Additional requirements will be based on the objectives and needs of the individual student.

Language Requirements

The Department has no formal language requirements. Graduate students are expected to have satisfied the entrance requirement of preparation in at least one important foreign language. Within the Department, curricular programs may require demonstration of ability to use certain foreign languages pertinent to a student's research. All students must be proficient in English.

Departmental and Qualifying Examinations

Doctoral candidates normally will be required to take a departmental examination not later than early in the second year of study. The examination will be primarily oral, although written parts may be included. The student will be required to demonstrate in a quantitative and analytical manner his comprehension of required subject material and of the pertinent interactions of physical, chemical, biological, or geological factors.

After the student has passed the departmental examination, and has completed an appropriate period of additional study, the Department will recommend appointment of a Doctoral Committee. This Committee will determine the student's qualifications for independent research, normally by means of a qualifying examination late in the second year of study or early in the third year, and will supervise the student's performance and reporting of his research.

The nature of the qualifying examination varies between curricular groups. In biological oceanography, marine biology, marine geology, and physical oceanography, the student will be expected to describe his proposed thesis research and satisfy the committee, in an oral examination, of his mastery of this and related topics. In marine chemistry, the student will be expected to present, in an oral examination, both a major and a minor proposition. The major proposition will consist of a statement of an original research problem or scientific idea within his area of interest. He should be prepared to discuss the theory and experimental techniques that may be involved, the significance of the proposition, and its relationship to previous knowledge. The minor proposition should consist of a research problem or scientific idea outside the student's main field of interest. In geophysics, the examination consists of an oral presentation and defense of a proposed thesis problem and a written examination composed of questions submitted by members of the staff and related to the content of graduate courses.

Dissertation

A requirement for the Ph.D. degree is the submission of a dissertation and a final examination in which the thesis is publicly defended. It is expected that each doctoral candidate will submit a manuscript based on his dissertation for publication in a scientific journal.

Special Financial Aids

In addition to teaching and research assistantships, fellowships, traineeships and other awards available on a campus-wide competitive basis, the Department has available a certain number of fellowships and research assistantships supported from research grants and contracts, or from industrial contributions.

COURSES

UPPER DIVISION

199. Special Studies (1-4, 1-4, 1-4) **F,W,S**
The Staff
Independent reading or research on a problem by special arrangement with a faculty member. Prerequisite: consent of the instructor.

GRADUATE

207A-207B. Problems in General and Physical Oceanography (2-2) W-S
Mr. Isaacs
Presentation of reports, review of literature, and discussion of various regions and aspects of the ocean, oceanography, and related fields. Seminar.

208. Oceanography Field Course (2-4, 2-4, 2-4, 2-4) **F,W,S,Su**
The Staff
Methods of measurement, observation, and sampling used at sea; oceanic cruise dealing with problems of current interest; analysis and interpretation of results with a report. Prerequisites: SIO 210A, 240, 260, 270A.

209. Special Topics (1-4, 1-4, 1-4) **F,W,S**
The Staff
Within the next few years, lectures on various special subjects will be offered by members of the staff. The emphasis will be on topics that reveal the interdependence of the biological, chemical, geological, and physical processes operating in the oceans.

210A. Physical Oceanography (3) **F**
Mr. Hendershott, Mr. Reid
Physical description of the sea; physical properties of seawater, methods and measurements with demonstration at sea, boundary processes, regional oceanography. Prerequisites: the mathematics and physics required for admission to the graduate curriculum in the Scripps Institution of Oceanography (see text), or consent of the instructor.

210B. Physical Oceanography (3) **W**
Mr. Arthur, Mr. Cox
Mechanics of fluids on a rotating earth; Navier-Stokes equations, boundary-layer phenomena, turbulent flow, and wave motion with oceanographic applications. Prerequisites: SIO 210A and consent of the instructor.

211A-211B. Ocean Waves (3-3) **W-S**
Mr. Cox
Propagation of waves, long waves, internal waves, generation by wind, action of surf, effects of earth rotation. Nonlinear aspects of wave motion. Prerequisite: 210B or consent of the instructor. (211B offered in alternate years.)

212A. Dynamical Oceanography (3) **F**
Mr. Arthur
Dynamics of ocean currents; transport phenomena; turbulent processes and the air-sea boundary layer. Prerequisites: differential equations and consent of the instructor.

212B. Dynamical Oceanography (3) **S**
Mr. Arthur, Mr. Hendershott
Wind currents, theories of ocean circulation, boundary currents. Prerequisites: SIO 212A and consent of the instructor.

216A-216B. Physics of Sediment Transport (3-3) **W-S**
Mr. Inman
Mechanics and energetics of sediment transport by water, wind, waves, and density flows. Application to the near-shore environment and to the formation of sedimentary structures. Laboratory and field demonstrations. Prerequisites: consent of the instructor. (216B offered in alternate years.)

219. Special Topics in Physical Oceanography (1-4, 1-4, 1-4) **F,W,S**
The Staff

220. Topics in Geophysical Continuum Mechanics (3) **F**
Mr. Backus, Mr. Gilbert
Mathematical foundations, physical limitations and selected geophysical applications of continuum mechanics. Topics include finite strain; thermodynamics of stress-strain relations; phenomenology and mechanisms of dissipation; continuum theory of dislocations; and generation and propagation of elastic waves in a nearly homogeneous medium. Prerequisites: differential and integral calculus and differential equations, linear algebra.

221. Topics in Geophysical Fluid Dynamics (3) **W**
Mr. Backus
Effects of viscosity, density gradients, and gravitational and electromagnetic fields on fluid motion. Topics include forced and free convection and percolation, Alfvén waves, and the theory of the origin and secular variation of the earth's magnetic field. Prerequisite: SIO 220. (Offered in alternate years.)

222A-222B. Hydrodynamics (3-3) **W-S**

Mr. Eckart

Applications of hydrodynamics to the motion of stratified fluids, such as the atmosphere and oceans. Internal waves, steady currents, and related phenomena. Prerequisite: consent of the instructor. (Offered in alternate years.)

223. Geophysical Measurements (3) **S**

Mr. Haubrich

Design of geophysical experiments and analysis of geophysical measurements, interpretation of geophysical time series; wave number filters, theory of arrays, geophysical systems analysis. Prerequisite: elementary complex variables. (Offered in alternate years.)

224. Geophysical Random Processes (3) **S**

Mr. Preisendorfer

Basic concepts of probability; introduction to the random process and its calculus; harmonic representation of general and stationary random processes. Applications to selected diffusion processes, wave phenomena and linear systems in random geophysical settings. Prerequisites: advanced calculus and differential equations or consent of the instructor.

225. Tides and the Rotation of the Earth (3) **W**

Mr. Munk

Kepler's laws, tide-generating potentials, static and dynamic theory of ocean tides; atmospheric tides; Love numbers and bodily tides; tidal friction and the length of day; Chandler wobble, historical variations, figure of the Earth. Prerequisites: SIO 220 and 221, and Physics 200A-200B-200C.

226A-226B. Internal Constitution of the Earth (3-3) **W-S**

Mr. Raitt, Mr. Vacquier

Study of the physical nature of the Earth's interior revealed by observations of seismic waves, gravity and geomagnetic fields, electrical conductivity, heat flow, and related information from various geological sciences. Fundamentals of geophysical techniques of observation and analysis. Critical discussion of current knowledge. Prerequisite: calculus and differential equations, basic physics. (Offered in alternate years.)

227. Seismology (3) **S**

Mr. Gilbert

Equation of motion, exact transient solution of canonical problems, interface pulses, geometrical diffraction theory, ray theory and mode theory in plane-layer media, free oscillations of the Earth, radiation from moving sources, source determination, aeolotropic and heterogeneous media, dissipation, interpretation problems. Prerequisites: SIO 220, Physics 200A, Mathematics 210A; prerequisite or concurrent registration in Physics 200B or 200C, Mathematics 210B or 210C. (Offered in alternate years.)

228. Gravity and Geomagnetism (3) **W**
Mr. Vacquier
Measurement and analysis of gravitational and magnetic fields of the Earth, with emphasis on applications to geologic problems and prospecting. Prerequisites: differential and integral calculus. (Offered in alternate years.)

240. Marine Geology (3) **W**
Mr. Menard
Introduction to the geomorphology, sedimentation, stratigraphy, vulcanism, structural geology, and geologic history of the marine realm. Prerequisites: the physics and geology required for admission to the graduate curriculum in Scripps Institution of Oceanography, or consent of the instructor.

242A-242B. Marine Micropaleontology (3-3) **W-S**
Mr. Phleger
Introduction to the ecology of Foraminifera, with applications to problems of oceanography and paleoceanography. Prerequisites: SIO 240 or consent of the instructor for 242A; 242A for 242B.

243. Marine Stratigraphy (3) **S**
Mr. Winterer, Mr. Riedel
Principles of stratigraphy as applied to marine environments; laboratory study and interpretation of microfossils in oceanic sediments. Prerequisite: SIO 240 or consent of the instructor.

244. Marine Geophysics (3) **W**
Mr. Shor
Field methods and interpretation of geophysical measurements at sea.

245. Sedimentary Petrology (3) **F**
Mr. Winterer
Characteristics and origin of sediments and sedimentary rocks. Prerequisite: consent of the instructor.

246. Minerals and Processes of Sediments (3) **W**
Mr. Peterson
Minerals and mineral assemblages in sediments, processes of sedimentation, mineral formation. Mineral groups considered by crystal structure and composition. Recent trends in sediment research. Laboratory in instrumental methods, X-ray diffractometry. Prerequisite: consent of the instructor.

247. Tectonics (3) **S**
Mr. Menard
The large-scale structural and morphological features of continents and ocean basins, crustal deformation, oceanic rises, mountain-building, permanency of continents. (Offered in alternate years.)

248. Seminar in Marine Geology (2, 2, 2) **F,W,S**
The Staff
Origin and structure of ocean basins and continental margins, and their physiographic features; origin, distribution, interpretation, and methods of study of marine sediments.

249. Special Topics in Marine Geology (1-4, 1-4, 1-4) **F,W,S**
The Staff

251A. Thermodynamics of Natural Processes (3) **S**
Mr. Craig
Applications of thermodynamics to general problems in the earth sciences. Topics include chemical and phase equilibria in heterogeneous multicomponent systems; properties of substances at high temperatures and pressures; models for solid solutions and gaseous mixtures; phase equilibria in silicate melts; adiabatic and pseudo-adiabatic transport; steady-flow systems; closed and open system models of the atmosphere, oceans, and solid earth. Prerequisites: Chemistry 202B or Physics 140, Mathematics 100. (Offered in alternate years.)

251B. Nuclear Geochemistry (3) **W**
Mr. Craig
Geochemistry of stable and radioactive isotopes. Emphasis is on application of recent research to important problems in earth sciences. Topics include theory of isotope fractionation, separation effects in heterogeneous systems, mixing rates and residence times, cosmic-ray production of radioactive isotopes, mixing and exchange studies in the ocean and the atmosphere, the carbon cycle, stable isotope variations in minerals and rocks, geochemistry of volcanic waters and gases, etc. (Offered in alternate years).

252. Cosmochemistry (3) **F**
The Staff
A survey of important properties of the solar system. Abundances of elements in the solar system and the galaxy. Meteorites, especially their histories as determined by various nuclear physical techniques, isotopic anomalies and their interpretations, mineralogy and petrology of the various classes of meteorites, geochemical data and theories of their origin. Implications for galactic nucleosynthesis and deductions on the history of the galaxy. The origin of the Earth and its early history. Prerequisites: SIO 251B or consent of the instructor. (Offered in alternate years.)

253. Experimental Petrology (3) **F**
The Staff
Lectures and discussions on topics related to experimental investigations of petrological systems. Emphasis is placed upon interpretation and evaluation of experimental work on the stability and solubility of minerals of metamorphic and igneous rocks. Prerequisite: SIO 251A.

254. Igneous Petrology (3) W
Mr. Hawkins
Theoretical aspects of the genesis of igneous rocks are considered in the light of geologic and experimental evidence. Suits of thoroughly investigated and well-described rocks are studied and discussed in detail. Current lines of research in problems of magmatic and volcanic processes are critically reviewed. Prerequisite: consent of the instructor. (Offered in alternate years.)

255. Crustal Evolution (3) S
Mr. Engel
The properties, origin and evolution of the rocks in the earth's crust. Prerequisite: one year of graduate study in Scripps Institution of Oceanography. (Offered in alternate years.)

256. Earth Sciences Summer Field Course (6) Su
The Staff
Participation in a department summer expedition for four to six weeks. Field studies in geology, geochemistry and geophysics are conducted at sea and on islands and coastal regions. Areas recently studied include Central America and the Caribbean, Easter Island, the southeastern Pacific and the western Mediterranean. In 1967 the area studied was Melanesia. (Satisfactory/Unsatisfactory grades permitted.)

257. Seminar in Petrology (3, 3, 3) F,W,S
The Staff
Discussions of current research in petrology and mineralogy.

258. Seminar in Geology (3, 3, 3) F,W,S
The Staff
Discussions of current research and special topics in geology not treated in the general courses.

259. Seminar in Geochemistry (3, 3, 3) F,W,S
The Staff
The subject matter will vary from year to year and will normally cover an area of geochemistry not treated extensively in other courses.

260. Marine Chemistry (3) F
Mr. Goldberg
Chemical description of the sea; the distribution of chemical species in the world oceans, and their relationships to physical, biological, and geological processes.

261. Physical Chemistry of Seawater (3) F
Mr. MacIntyre
The consideration of seawater as an electrolyte solution with emphasis upon its structure and physical-chemical properties. Thermodynamic and kinetic studies of reactions in the marine environment. Prerequisite: Chemistry 202A-202B (may be taken concurrently).

262. Major Sedimentary Cycle (3) **W**
Mr. Goldberg
Role of the oceans in the major sedimentary cycle, with emphasis upon the interaction of the oceans with the asmosphere, biosphere, and sediments. Geochronologies in the sedimentary cycles.

263. Major Chemical Cycles in the Sea (3) **S**
Mr. Keeling
The distribution of chemical species in the world oceans and their relation to physical and biological processes, with emphasis on transport and exchange.

264. Solids in Nature (3) **S**
Mr. Arrhenius
Experimental and theoretical evaluation of geologically important properties of solids. Characteristic differences between solid types, electronic structure of solids; microscopic significance of thermodynamic concepts. Interaction between matter and radiation, structure of geologically important crystals and glasses, order and disorder. Band and optical properties of solids, with particular consideration of geological systems. Prerequisite: consent of the instructor. (Offered in alternate years.)

269. Special Topics in Marine Chemistry (1-4, 1-4, 1-4) **F,W,S**
The Staff

270A. Biological Oceanography: Environment and Organisms (3) **F**
Mr. McGowan, Mr. Mullin
An introduction to the biota and life zones of the open ocean; description of the physical, chemical, and biological factors of this environment; discussion of the influence of these factors on oceanic population. Prerequisites: the biology and chemistry required for admission to the graduate curriculum at Scripps Institution of Oceanography, or the consent of the instructor.

270B. Biological Oceanography: Processes and Events (3) **W**
Mr. McGowan, Mr. Mullin
An analysis of the concepts and theories used to explain the biological events observed in the ocean. Prerequisites: SIO 210A, 270A, or the consent of the instructor.

271A. Laboratory in Biological Oceanography (2) **F**
Mr. Brinton, the Staff
Laboratory and discussion of the phylogeny, comparative morphology; life histories and taxonomy of marine organisms. Emphasis will be placed on planktonic groups. Prerequisite: SIO 270A (or concurrent registration), or the consent of the instructor.

271B. Laboratory in Biological Productivity (2) **W**
Mr. Strickland
Introduction to techniques, especially those usable at sea, for measuring

the standing crop and productivity of marine communities. Prerequisites: SIO 270B (or concurrent registration), and consent of the instructor.

272. Oceanic Zoogeography (3) S
Mr. McGowan
The patterns of distribution and abundance of oceanic organisms; the nature of oceanic habitats; the relation of zoogeography to paleoceanography. Lectures, student reports, and discussions. Prerequisite: SIO 240 and 270B recommended. (Offered in alternate years.)

273. Introduction to Animal Behavior (3) F
Mr. Enright
Sensory capacities, instinct, and learning: a comparative examination of the relative importances of concurrent stimuli, inherited neural and motor organization, and the modification of central organization by past experience (including biorhythmicity), in determining animal behavior. Emphasis, where possible, on ecologically oriented studies and on studies involving invertebrate animals.

274. Population Dynamics (3) F
Mr. Schaefer
Theories and mathematical models of growth and dynamics of single-species populations, interspecific competition, predator-prey relationships, dynamics of exploited marine populations and other animal associations. Prerequisite: SIO 275A or consent of the instructor. (Offered in alternate years.)

275A-275B. Marine Ecology (3-3) W-S
Mr. Fager
Single-species population dynamics and interspecific relationships in communities; theory, observation, and interpretation. Behavior, environmental factors, and productivity as they relate to the distribution and abundance of organisms. Prerequisite: SIO 270A. (Offered in alternate years.)

276A-276B. Applied Statistics (3-3) W-S
Mr. Fager
Methods of statistical analysis, including both parametric and nonparametric procèdures; sampling and design of experiments, with emphasis on those procedures particularly useful in marine studies. Prerequisite: the mathematics required for admission to the graduate curriculum in the Scripps Institution of Oceanography, or consent of the instructor. (Offered in alternate years.)

278. Problems in Biological Oceanography (2) F
The Staff
Presentation of reports, review of literature, and discussion of current research in biological oceanography. Seminar.

279. Special Topics in Biological Oceanography (1-4, 1-4, 1-4) F,W,S
The Staff

280A-280B-280C. Marine Biology (3-3-3) **F-W-S**
Mr. Rosenblatt, Mr. Newman; Mr. Holland, Mr. Lasker; Mr. Enns, Mr. Benson
Fundamental aspects of marine biology. Included are studies of habitats, environment, and biogeography; comparative physiology, biochemistry, and adaptation, and the physical-chemical basis of living systems of marine organisms. Prerequisites: bachelor's degree in science or consent of the instructors.

282A-282B. Advanced Invertebrate Zoology (3-3) **F-W**
Mr. Newman
The natural history, zoogeography, taxonomy, and phylogeny of selected invertebrate groups. Emphasis will be on the broader aspects of current research. Two special problems will be undertaken; original problems will be encouraged. Prerequisite: consent of the instructor.

283. Biology of Fishes (4) **S**
Mr. Rosenblatt
The comparative evolution, morphology, physiology, and ecology of fishes. Special emphasis on local and deep-sea and pelagic forms in laboratory. Prerequisite: consent of the instructor.

284. Seminar in Advanced Ichthyology (2, 2) **F,W**
Mr. Rosenblatt

285. Biology of Algae (2) **F**
Mr. Haxo, Mr. Lewin
Systematics and ecology of shore algae with emphasis on comparative physiology. Integrated lecture, laboratory, and field instruction. Prerequisite: consent of the instructor.

286. Marine Microbiology (3) **F**
Mr. ZoBell
Ecology, biochemical activities, and methods of studying bacteria and allied microorganisms in the sea, with particular reference to their effects on other organisms and as geochemical agents. Prerequisites: preparation in general microbiology, bacterial physiology, and biochemistry. SIO 210A, 260, 270A are recommended.

287A-287B. Shore Microbiology (3-3) **W-S**
Mr. Lewin
Field and laboratory investigations of the ecology, physiology, and metabolic activities of marine littoral microorganisms: algae, bacteria, fungi, and protozoans. Special methods of isolating and culturing selected organisms, individual research projects. Prerequisites: preparation in biological sciences, including physiology or microbiology. Introductory courses in chemistry and biology of the sea are recommended.

289. Special Topics in Marine Biology (1-4, 1-4, 1-4) **F,W,S**
The Staff

290. Cellular Structure and Biochemical Function (3) **S**

Mr. Volcani

Lectures and laboratory studies of subcellular structures and their function in cell metabolism. Experiments involving techniques for isolation and biochemical assay with special reference to marine organisms. Prerequisites: preparation in biology and biochemistry; consent of the instructor. SIO 291A-291B and Biology 201 are recommended as background.

291A. Marine Biochemistry (3) **W**

Mr. Fox

Chemistry of living matter; osmotic adaptation in the hydrosphere; marine colloids; comparative biochemical and physiological activities of aquatic organisms, biochemical cycles in the sea; animal pigments. Prerequisites: preparation in biology, organic chemistry, and biochemistry of physiology; consent of the instructor. SIO 260, 270A are recommended.

291B. Marine Biochemistry (3) **S**

Mr. Benson

Biochemistry of major products of marine organisms, with emphasis on carbohydrates and lipids. The current concepts of their structural and physiological function will be presented and discussed. Prerequisites: organic chemistry required, physical chemistry and biochemistry recommended.

292A-292B. Physiology of Marine Animals (3-3) **W-S**

Mr. Holland

Physiology of marine animals at various levels of biological organization, with particular reference to cellular and organismal functions. In the laboratory, students will undertake individual research projects. Prerequisites: basic courses in biology and chemistry; consent of the instructor.

293. Physiology of Marine Algae (3) **F**

Mr. Haxo

Lectures and laboratory in comparative physiology of algae with emphasis on marine problems. Prerequisites: basic courses in biology and chemistry.

294. Selected Topics in Environmental Physiology (6) **F**

Mr. Scholander, the Staff

Some physiological principles operating in plants and animals will be discussed. Selected material will illustrate (1) physical processes, (2) reflexes, (3) regulation, and (4) integration. Field trips will be arranged when appropriate. Two lectures, one conference, and one laboratory per week. Prerequisite: consent of the instructor.

295. Laboratory in Physiology (2-4) **S**

Mr. Scholander

Research techniques and problems in selected areas of environmental physiology.

296. Isotope Tracer Techniques in Physiology (2) **S**

Mr. Enns

Physiological transport and related processes as determined by isotope tracers. Radiation physics and the quantitative detection of radioactive and stable isotopes. Prerequisite: physical chemistry recommended.

298. Marine Biology Seminar (1, 1, 1) **F,W,S**

Mr. Lewin, the Staff

A seminar dealing with various topics in the biological sciences. Lectures given by visiting scientists and resident staff and students.

299. Research (1-12, 1-12, 1-12) **F,W,S**

The Staff

(Satisfactory/Unsatisfactory grades permitted.)

SOCIOLOGY

Office: Building 412, Matthews Campus (Provost, Muir College)

Jack D. Douglas, *Ph.D., Associate Professor of Sociology*

Joseph R. Gusfield, *Ph.D., Professor of Sociology* (Chairman of the Department)

Both undergraduate and graduate programs in sociology are being formulated by the new Department of Sociology. The Department will emphasize the comparative study of social change and the observational study of human interaction in the analysis of social issues and of modern organizations. Opportunities will be made available for students to participate in supervised field research.

During 1968–69, undergraduate courses will be offered in the following topics: introductory sociology, human interaction in everyday life, comparative family systems, theories of sociological explanation, evidence and law, urban social problems, social conflict and change, educational institutions, problems of new nations. Additional courses, including special seminars, will be announced as they become available.

SUBJECT A

See *Interdisciplinary Courses.*

VISUAL ARTS

Office: Building 407, Matthews Campus

Paul Brach, *M.F.A., Professor of Visual Arts* (Chairman of the Department)

David Antin, *M.A., Assistant Professor of Visual Arts*

Newton Harrison, *M.F.A., Assistant Professor of Visual Arts*

*Donald Lewallen, *M.F.A., Assistant Professor of Visual Arts*
Michael Todd, *M.F.A., Assistant Professor of Visual Arts*

* * *

John Baldessari, *M.A., Lecturer*
Harold Cohen, *Diploma in Fine Arts (University of London), Lecturer*

*On leave 1968–69

The purpose of the Visual Arts Department is to give the general student visual literacy and an understanding of the art of the past and of the present. For students with more specialized interests there is a series of more demanding courses requiring greater talent and dedication.

Courses in the Visual Arts Department are divided into four categories —introductory, intermediate, advanced, and art history:

Introductory courses (1A-1B-1C-1D) are designed to be taken in any sequence, and any three may be used by Muir students in fulfilling the humanities and fine arts requirement. Any one of these courses may be taken by Revelle students in order to fulfil their fine arts requirement.

Intermediate courses (2A-2B-2C-2D-2E-2F) require as prerequisites three of the four introductory courses or their equivalent. These are designed for art majors or minors or other students who wish to continue studio courses.

Advanced upper-division courses in art will be offered from 1969–70 on. There will be none offered in 1968–69. These courses will be primarily for art majors and other selected students of sufficient competence. Until 1969–70, advanced students can take special studies (199) or upper-division sections of the introductory, intermediate, or art history courses for upper-division credit.

Art History courses (5, 6, 7) will require 1A or the equivalent as prerequisite and will be expanded to include all major periods of the history of art.

The Major Program

Students will be accepted as majors in Visual Arts *only* after having completed three of the four introductory courses, and then only after their work has been reviewed by the department faculty. The program for majors will take students through a series of intermediate and advanced courses designed to allow them to do increasingly independent work.

The Minor Program

Any student will be accepted as an art minor once he has completed three out of four of the introductory courses.

The Graduate Program

A Master of Fine Arts program in studio work is planned, to begin in 1969-70. A Ph.D. program in art criticism is planned for 1970-71.

COURSES

LOWER DIVISION

1A. Introduction to Art F,W,S
Fundamental aspects of the visual arts. Introduction to problems in art history, aesthetics, and other conceptual material relevant to the visual experience. Three hours lecture.

1B. Surfaces F,W,S
Fundamental aspects of the visual arts. Exploration of problems in organizing two-dimensional surfaces: function of color, composition, and spatial relationships. Six hours laboratory.

1C. Representation F,W,S
Fundamental aspects of the visual arts. Studies of systems of pictorial representation, including perspective, light and shade, photography, etc. Six hours laboratory.

1D. Structures F,W,S
Fundamental aspects of the visual arts. A pre-sculpture course concerned with space, volume, imagery, and the module. Six hours laboratory.
(Courses chosen from the introductory sequence listed above may be used in fulfilling the Muir College humanities and fine arts requirement and the Revelle College fine arts requirement.)

2A. Intermediate Problems in Art F
A studio course in painting, sculpture, and intermedia, stressing individual creative problems. Six hours laboratory. Prerequisites: any three of 1A-1B-1C-1D or the equivalent.

2B. Intermediate Problems in Art F
A studio course in painting, sculpture, and intermedia, stressing individual creative problems. Six hours laboratory. Prerequisites: any three of 1A-1B-1C-1D or the equivalent.

2C. Intermediate Problems in Art W
A studio course in painting, sculpture, and intermedia, stressing individual creative problems. Six hours laboratory. Prerequisites: any three of 1A-1B-1C-1D or the equivalent.

2D. Intermediate Problems in Art W
A studio course in painting, sculpture, and intermedia, stressing individual creative problems. Six hours laboratory. Prerequisites: any three of 1A-1B-1C-1D or the equivalent.

2E. Intermediate Problems in Art S
A studio course in painting, sculpture, and intermedia, stressing individual creative problems. Six hours laboratory. Prerequisites: any three of 1A-1B-1C-1D or the equivalent.

2F. Intermediate Problems in Art S
A studio course in painting, sculpture, and intermedia, stressing individual creative problems. Six hours laboratory. Prerequisites: any three of 1A-1B-1C-1D or the equivalent.

5. Italian Renaissance Art **F**
A survey of the painting, sculpture, and architecture of Italy from the fourteenth through sixteenth centuries. Three hours lecture. Prerequisite: 1A or the equivalent, or consent of the instructor.

6. Nineteenth-Century Art **W**
A survey of nineteenth-century art in Europe and America, stressing stylistic development from Neo-Classicism to Post-Impressionism. Three hours lecture. Prerequisite: 1A or the equivalent, or consent of the instructor.

7. Twentieth-Century Art **S**
A survey of twentieth-century art in Europe and America, tracing the major stylistic development from Cubism up to contemporary manifestations. Three hours lecture. Prerequisite: 1A or the equivalent, or consent of the instructor.

UPPER DIVISION

101A. Introduction to Art **F,W,S**
Fundamental aspects of the visual arts. Introduction to problems in art history, aesthetics, and other conceptual material relevant to the visual experience. Three hours lecture.

101B. Surfaces **F,W,S**
Fundamental aspects of the visual arts. Exploration of problems in organizing two-dimensional surfaces: function of color, composition and spatial relationships. Six hours laboratory.

101C. Representation **F,W,S**
Fundamental aspects of the visual arts. Studies of systems of pictorial representation, including perspective, light and shade, photography, etc. Six hours laboratory.

101D. Structures **F,W,S**
Fundamental aspects of the visual arts. A pre-sculpture course concerned with space, volume, imagery, and the module. Six hours laboratory.

102A. Intermediate Problems in Art **F**
A studio course in painting, sculpture, and intermedia, stressing individual creative problems. Six hours laboratory. Prerequisites: any three of 1A-1B-1C-1D or the equivalent.

102B. Intermediate Problems in Art **F**
A studio course in painting, sculpture, and intermedia, stressing individual creative problems. Six hours laboratory. Prerequisites: any three of 1A-1B-1C-1D or the equivalent.

102C. Intermediate Problems in Art **W**
A studio course in painting, sculpture, and intermedia, stressing individual creative problems. Six hours laboratory. Prerequisites: any three of 1A-1B-1C-1D or the equivalent.

102D. Intermediate Problems in Art **W**

A studio course in painting, sculpture, and intermedia, stressing individual creative problems. Six hours laboratory. Prerequisites: any three of 1A-1B-1C-1D or the equivalent.

102E. Intermediate Problems in Art **S**

A studio course in painting, sculpture, and intermedia, stressing individual creative problems. Six hours laboratory. Prerequisites: any three of 1A-1B-1C-1D or the equivalent.

102F. Intermediate Problems in Art **S**

A studio course in painting, sculpture, and intermedia, stressing individual creative problems. Six hours laboratory. Prerequisites: any three of 1A-1B-1C-1D or the equivalent.

105. Italian Renaissance Art **F**

A survey of the painting, sculpture, and architecture of Italy from the fourteenth through sixteenth centuries. Three hours lecture. Prerequisite: 1A or the equivalent, or consent of the instructor.

106. Nineteenth-Century Art **W**

A survey of nineteenth-century art in Europe and America, stressing stylistic developments from Neo-Classicism to Post-Impressionism. Three hours lecture. Prerequisite: 1A or the equivalent, or consent of the instructor.

107. Twentieth-Century Art **S**

A survey of twentieth-century art in Europe and America, tracing the major stylistic developments from Cubism up to contemporary manifestations. Three hours lecture. Prerequisite: 1A or the equivalent, or consent of the instructor.

199. Special Studies in the Visual Arts **W,S**

Independent reading, research, or creative work under direction of a faculty member. Prerequisite: permission of the department.

Rules and Procedures

REGISTRATION

After a student is officially admitted (see *Admission to the University*), he may register for classes. A student is not officially registered for classes each quarter until he has completed the *entire* registration procedure, which includes:

1. Consultation with academic adviser as required and the securing of any necessary permissions.
2. Filing of completed class enrolment and informational cards (official study-list packet) with the Registrar's Office.
3. Payment of fees at the Cashier's Office (including any outstanding debts from the previous quarter).

Detailed instructions will be published prior to each quarter's registration.

Graduate Student Registration

All students entering graduate status for the first time are considered new students and must file an application for admission to graduate status and be accepted for admission by the Graduate Division (see *Graduate Division*). Every candidate for a higher degree is required to register each quarter until all degree requirements are fulfilled (including the thesis or dissertation and final examination). The candidate must continue to register until either the degree is awarded or he is granted a formal leave of absence or withdrawal.

If a graduate student fails to register or is absent without leave, the University will presume that he has withdrawn from the Graduate Division. He may apply for readmission at a later date, but cannot be assured of acceptance.

Registration in the Final Quarter for the Award of the Degree

Under current policy, all graduate students are required to register in the final quarter in which they expect their degrees or graduate certificates to be awarded.

With respect to the interval between quarters, if a student is registered for the preceding quarter and completes all requirements before the

first day of instruction in the next quarter, he is not required to reregister to receive his degree dated the end of the prior quarter. During the interim between the completion of all requirements for the degree and the date of its award, Certificates of Completion are issued by the Registrar to certify the student's eligibility for the degree, for employment or other purposes.

When the award of a degree is expected at the end of a given quarter, but special circumstances over which the student has no control prevent the completion of all requirements before the first day of instruction in the next quarter, a student may petition the Dean of Graduate Studies for a waiver of registration for that quarter. Such petitions must be accompanied by a letter from the Graduate Adviser or Department Chairman elaborating the exceptional circumstances of the case. Consideration is necessarily limited to situations in which the faculty is responsible for delay in reading the thesis or dissertation or in conducting the final examination, or in which minor corrections or additions constitute the only steps necessary before approval of the thesis or dissertation.

A student who has completed his requirements for a graduate degree except for the final or comprehensive examination and the filing of the dissertation or thesis and who has no further occasion to use University laboratory, library or other facilities, may petition the Dean of Graduate Studies before the first day of instruction to be excused from registering during the quarter in which the degree is to be awarded. The Dean may authorize him to pay a $50 filing fee for the dissertation or thesis in lieu of registering.

Physical Examination

All new students, graduate and undergraduate (including former undergraduates entering graduate status for the first time), and all students returning to the University after an absence of two or more quarters must submit to the Student Health Service a completed medical examination form prior to their arrival on campus and must appear for a medical review during registration week. (See *Contents* for *Health Service.*)

Late Registration

Students will be assessed a late registration fee of $10 if they have not registered (paid fees) by the Registrar's deadlines (see *Academic Calendar*).

Registration Card

At the time of registration each student will receive a registration card, which is evidence that he is a regularly enrolled student at UCSD and which entitles him to library privileges, student health care, and other University privileges. In addition, the registration card provides, for the undergraduate, identification for Associated Students functions.

If the card is lost, a duplicate may be obtained from the Registrar's Office for $3.

OFFICIAL STUDY LIST

In order to receive credit for courses undertaken the student must list them on his official study-list card, secure a class card for each course so listed, and file them with the Registrar's Office.

Unapproved withdrawal from, or neglect of, a course listed on the official study-list card will result in a failing grade. Any change in program after filing the card—whether to add, replace, or drop a course—must be by formal petition approved by the instructor and by the Provost (undergraduates) or adviser and Dean of Graduate Studies (graduate students). The approved petition must be filed at the Registrar's Office.

Study-List Limits

The normal *undergraduate* program consists of an average of four courses each quarter for four years. However, a student may enrol for three courses without the approval of the Provost of his college, as long as he maintains an average of four courses for the four years. If a student wishes to enrol in less than three courses in any quarter, he must secure the permission of the Provost of his college. For purposes of the Registrar's Office and the Selective Service Office, three academic courses are considered the minimum for a full-time student.

While four courses are suggested as the maximum number to be taken during any one quarter, a superior student may take more with the permission of the Provost of his college.

Part-time or full-time employment would, of course, place limits on a student's course load (see *General Information for Students: Employment*).

A *graduate* student in a regular quarter is limited to 16 credits when he takes only undergraduate courses, to 12 credits when he takes only graduate courses, and to a total made up in the proper proportion of 12 to 16—as, for example, 6 graduate and 8 undergraduate—when he takes both undergraduate and graduate courses.

Research assistants and others employed approximately half time shall register each quarter for three-quarters of these limits; if their half-time employment significantly involves research or other activities which are awarded graduate credit, the graduate adviser of the student may authorize registration for 100 per cent of these limits. Full-time graduate study shall be defined as three-quarters of these limits. Thus graduate students holding appointments requiring the status of a full-time graduate student shall so register. Students engaged full time in other occupations are limited to 6 credits of graduate and/or upper-division courses.

Study lists exceeding these limits may be accepted only with the approval of the Dean of Graduate Studies.

Each graduate student must register for, attend, and complete upper-

division courses (courses in the 100 series), or graduate courses (200 series), amounting to at least 6 credits for each quarter so as to satisfy the minimum residence requirement in candidacy for most of the higher degrees or certificates issued by the University.

Change of Program

After the official study-list card has been filed, a student may add or drop courses, or change sections within a course, according to the following schedule:

First and second week of classes	ADD or DROP	No Fee
Third through sixth week of classes	DROP ONLY	$3 Fee

For undergraduates, permission to add or drop a course requires approval of the instructor and of the Provost. Permission to change sections within a course requires approval of the instructor only.

A petition for a change in the official study list is available in the Registrar's Office or the Provost's Office and must be filed with the Registrar if the student is to be relieved of responsibility for dropped courses and credited for the added courses.

Graduate students may withdraw from graduate courses within two weeks of the date of the first class. Thereafter, they may withdraw upon presentation to the Dean of Graduate Studies of a petition approved by the instructor and the chairman of their major department. Hardship, illness, or other inability to complete a course shall constitute sufficient grounds for withdrawal.

GRADES

Grades in courses (graduate or undergraduate) are defined as follows: *A*, excellent; *B*, good; *C*, fair; *D*, barely passing; *F*, not passing (failure); and *E* or *I*, undetermined (work of passing quality but incomplete). The designations *P*, passed, and *NP*, not passed, are used in reporting grades on some courses. The designations *S* and *U* are used in reporting satisfactory and unsatisfactory work in certain individual research or study programs for graduates. *NR* indicates that the instructor has not reported a grade.

All grades except *E* or *I* (incomplete) are final when filed by an instructor in his end-of-term course report. An exception is the correction of a clerical error. No term grade except *E* or *I* may be revised by re-examination.

Only courses for which grades *D* or *F* were received may be repeated for credit, and not more than once, unless authorized by the Provost of the student's college. When a course is repeated, the units will be credited toward a degree only once, but the student's grade-point average will be computed in terms of the total number of units attempted.

Incomplete Grades: Undergraduates

The Academic Senate regulations state that the *Incomplete* grade *I* for undergraduates shall be taken into account when calculating the grade-

point average, but carries zero grade points. In effect, until it is made up and grade points granted, it is figured the same as an *F* in grade-point average. An *Incomplete* may be assigned only when a student's work is of passing quality but incomplete.

Ordinarily the grade *Incomplete* is removed by an examination equivalent to the final examination and/or completion of the assigned course work. In special circumstances the Provost may authorize repetition of the course. An *Incomplete* which has not been removed by the end of the next quarter after it was incurred shall lapse into *F*.

The regulations also state that upon completion of the work, a student may receive appropriate grade points only if it is established that the work was incomplete for good cause. Good cause is interpreted as verified illness or other emergencies beyond the student's control. Therefore, the instructor has the right to deny grade points, even though he has allowed the student to make up the course and the units thus earned will count toward graduation.

To remove an *I* grade, the student must complete a petition (available at the Registrar's Office), secure the instructor's approval and a grade in the course, pay a fee of $5 at the Cashier's Office, and return the completed petition to the Registrar's Office.

Incomplete Grades: Graduate Students

The Graduate Council regulations state that in the event a graduate student receives an Incomplete grade *E*, the grade is to be ignored in calculating the scholastic status of the student. In other words, the units are omitted in the grade-point balance as well as in the grade-point calculation. An *Incomplete* may be assigned only when a student's work is of passing quality but incomplete.

Ordinarily the grade *E*, *Incomplete*, is removed by an examination equivalent to the final examination and/or completion of the assigned course work. In special circumstances the Dean of Graduate Studies may authorize repetition of the course. An *Incomplete* which has not been removed by the end of the next quarter after it was incurred shall lapse into an *F*.

To remove an *E* grade, the student must complete a petition (available at the Registrar's Office), secure the instructor's approval and a grade in the course, pay a fee of $5 at the Cashier's Office, and return the completed petition to the Registrar's Office.

Special Grade Options: Undergraduates

Passed/Not Passed

The *Passed/Not Passed* option is designed to encourage undergraduate students to venture into courses which they might otherwise hesitate to take because they are uncertain about their aptitude or preparation. Under such regulations as each College may determine, a student in good standing may take up to an average of one course per term on a *Passed/*

Not Passed basis. Enrolment under this option must take place at the beginning of the course. A grade of *Passed* shall be awarded only for work which otherwise would receive a grade of *C* or better. Units passed shall be counted in satisfaction of degree requirements, but such courses shall be disregarded in determining a student's grade-point average.

Students who elect to take one course on the *P/NP* basis will do so at the time of registration.

After the study-list packet has been filed, the Add/Drop Petition will be used to change from Grade to *P/NP* (or vice versa). The last day to add courses will be the final date to make this change.

Muir College policy regulations state that:

1) No courses to be counted as fulfilling a general education requirement of the college may be taken on the *Passed/Not Passed* basis. However, a course such as Literature 1C, which may also be taken as a free elective, may be taken on the *Passed/Not Passed* basis if it is counted only as an elective and not applied to the requirement.

2) Courses to be counted toward a departmental major or as prerequisites to the major may be taken on a *Passed/Not Passed* basis only with the consent of the department chairman or his designated representative.

3) Courses taken to be counted toward a special project (in lieu of a departmental major or toward an interdisciplinary major) may be taken on a *Passed/Not Passed* basis only with the consent of the faculty adviser of the project (or interdisciplinary major) and the Provost.

Revelle College policy regulations state that a student registered in Revelle College shall have the privilege of enrolling, with the permission of the instructor, in one course each quarter on a *Passed/Not Passed* basis, with the following provisions:

1) The course may not be used in satisfaction of any lower-division Revelle College breadth requirement except Fine Arts. For example, students who have completed the requirement of one year of calculus (through Mathematics 1C or 2C) may take other Mathematics courses on a *P/NP* basis. (Language 1 and 2 may not be taken for *P/NP*.)

2) The course may not be an upper-division course in the student's major department. Individual departments and/or advisers may authorize exceptions to this regulation, particularly for contiguous-area courses (required for the major, but given outside the major department).

In general, the Revelle faculty feels that students should be encouraged to use this option for courses taken in fulfilment of the minor. All courses taken as electives may be taken on a *Passed/Not Passed* basis.

Special Grade Options: Graduate Students

Passed/Not Passed

A graduate student in good standing, with prior approval of the instructor concerned, and with the approval of his adviser, may take up to an average of one course per quarter outside his major department on a *Passed/Not Passed* basis. Units passed shall be counted in satisfaction of

degree requirements, but the grades *Passed* and *Not Passed* shall be disregarded in determining a student's grade-point average. Enrolment under this option must take place at the beginning of the course.

Satisfactory/Unsatisfactory

In certain graduate courses approved by the department and by the Graduate Council the grades of *Satisfactory* and *Unsatisfactory* may be used. Courses currently so approved are identified in the several course listings in this catalog. Instructors and students in these courses should agree early in the quarter on the marking basis to be followed. For calculating grade-point averages, units with *S/U* grades shall not be counted. No credit will be allowed for work marked *Unsatisfactory*.

Grade Points

Grade points are assigned on a four-point basis: *A*, 4 points per unit; *B*, 3 points per unit; *C*, 2 points per unit; *D*, 1 point per unit; *E*, *F*, and *I*, zero points. Each undergraduate course counts 4 units, and graduate courses range from 1 to 12 units each. (See course descriptions under *Departments of Instruction.*) Grade-point average is computed by dividing the total number of grade points earned by the total unit value of courses attempted. *P*, *NP*, *S*, *U*, and *NR* grades are excluded in computing grade-point average.

Credit by Examination

With the instructor's approval, students in good standing may petition to obtain credit for some courses by examination. For further information, consult the Office of the Provost.

Final Examinations

Final examinations are obligatory in all undergraduate courses except laboratory courses and courses which, in the opinion of the Educational Policy Committee, require special treatment. In laboratory courses final examinations are held at the option of the department in charge. All examinations will be conducted in writing, as far as is practicable, and a maximum time will be assigned beforehand for each examination. The time for examination sessions may not be more than three hours.

Final Grades

As soon as possible after the end of each quarter, final grades will be available in the Registrar's Office. It should be emphasized that course reports filed by instructors at the end of each quarter are final.

SCHOLASTIC REQUIREMENTS: UNDERGRADUATES

The scholastic status of all UCSD undergraduates is governed by the following provisions:

1. *Probation.* A student will be placed on probation if, at the end of any quarter, his grade-point average falls below 2.0 (C), computed on the total unit value of all courses undertaken in the University, including courses graded Incomplete. The basis for removal from probation is the achievement of a 2.0 (C) grade-point average based on all work taken in the University.

2. *Dismissal.* A student will be subject to dismissal from the University if his grade-point average falls below 1.5 for any quarter, or if, after one quarter on probation, he has not achieved a 2.0 average, computed on the total of all courses undertaken in the University including those graded Incomplete. He will also be subject to dismissal if he fails to make satisfactory progress toward a degree at UCSD.

If a student becomes subject to dismissal, his grades and records will be carefully reviewed by the Provost of his college, who will consider the student's total performance and take appropriate action. If the Provost feels the student will be able to overcome his academic deficiency, he will suspend dismissal and allow the student to continue on probation.

The Provost also has the power to continue probation or authorize the return of a dismissed student to probationary status. Students on probation or subject to dismissal will be under the supervision of the Provost of the college.

A student who has been dismissed or who is on probation and wishes to transfer from one campus of the University to another, must obtain the approval of the Dean or Provost into whose jurisdiction he seeks to transfer. After completing a transfer the student is subject to the supervision of the Dean or Provost on the new campus. See *Intercampus Transfer* below.

SCHOLASTIC REQUIREMENTS: GRADUATES

For good standing and eligibility for an advanced degree, a graduate student must maintain a grade-point average of 3.0 (B), computed on the total unit value of all courses undertaken in graduate status at the University.

A graduate student is subject to dismissal if his overall grade-point average falls below 3.0 (B) at any time, or if his work in any two consecutive terms falls below a 3.0 average. (Grades of *Incomplete* are not considered in the computation of grade-point average for graduate students.)

SENIOR RESIDENCE FOR THE BACHELOR'S DEGREE

Each candidate for the Bachelor's Degree must complete 35 of the final 45 units in residence in the College or School of the University of California in which the degree is to be taken.

Under certain circumstances, such as when a student attends classes on another UC campus or participates in the UC Education Abroad Program, exceptions may be granted by the Provost.

ANNOUNCEMENT OF CANDIDACY

Every undergraduate, at the beginning of each quarter during his senior year, is required to file an *Announcement of Candidacy for a Degree* (the A card in his study-list packet). This enables the Provost of the college to determine whether or not the program the student is undertaking will satisfy degree requirements. The student will be notified of any deficiency.

The quarter he expects to graduate, the student is required to file a *Degree Name Card* (available in the Registrar's Office).

APPLICATION FOR READMISSION

The deadline for all returning students to file an application for readmission is four weeks prior to the first scheduled day of registration (see *Academic Calendar*). Transcripts for work taken at other institutions must be submitted as part of the application.

INTERCAMPUS TRANSFER

An undergraduate who is now, or was previously, registered in a regular session at any campus of the University of California, and has not since registered at any other institution, may apply for transfer in the same status to another campus of the University. The student who wishes to transfer must file an application on his *present* campus. Application forms for intercampus transfer are available in the Registrar's Office. They must be completed and filed with that office by March 1 for the fall quarter, by November 1 for the winter quarter, and by February 1 for the spring quarter. A $10 fee is charged for each application submitted.

INTERCAMPUS EXCHANGE PROGRAM

A graduate student registered on any UC campus who wishes to take courses on another campus may become an Intercampus Exchange Graduate Student with the approval of his adviser and the Dean of the Graduate Division on the campus to be visited. He is not admitted to the graduate division at the host campus, but continues to be considered a graduate student in residence on his home campus.

Application forms for the Intercampus Exchange Program for graduate students may be obtained from the Registrar's Office. Students planning to apply should make all necessary arrangements with appropriate faculty on the host campus before submitting the application.

CONCURRENT ENROLMENT

Concurrent enrolment in regular sessions at another institution or in University Extension while enrolled on the San Diego campus is permitted only when approved in advance by the Provost of the student's

college, or, in the case of a graduate student, by the Dean of Graduate Studies.

LEAVE OF ABSENCE

Graduate students who are severing their connection with the University for a specific period of time, after which they intend to resume their studies, must secure a formal leave of absence. Petitions are available at the Registrar's Office. Leave of absence is a privilege requiring the endorsement of the department in which the student is studying and approval of the Vice Chancellor–Graduate Studies and Research.

Graduate students who are granted formal leave of absence are exempt from all fees during the period of their leave.

WITHDRAWAL FROM THE UNIVERSITY

A student withdrawing from the University during a quarter must file a *Notice of Withdrawal* with the Registrar's Office before leaving the campus. In cases of illness or emergency, notice of withdrawal should be made as soon as the student decides not to continue.

The importance of giving proper notice before discontinuing attendance cannot be overemphasized. If proper notice is not filed, the student will receive failing grades in all courses and jeopardize his eligibility to reenter the University of California or his admission by transfer into another institution.

LAPSE OF STATUS

Lapse of status means the enforced withdrawal of a student from the University and may be caused by:

1. Failure to respond to official notices.
2. Failure to meet financial obligations.
3. Failure to complete the physical examination.
4. Failure to file an Official Study List.

Each student who becomes subject to lapse-of-status action is given advance notice and ample time to deal with the situation. However, if the student fails to respond, action will be taken without further notice and he is entitled to no further services of the University except assistance toward reinstatement.

A student wishing to have his status restored must secure a petition from the Registrar. If the petition is approved, a fee of $10 must be paid in addition to any other charges that may be outstanding. Reinstatement is not final until the petition has been accepted by the Registrar.

TRANSCRIPT OF RECORDS

A $1 fee is charged for each transcript of a student's record. Applications for a transcript of record should be submitted to the Registrar several days in advance of the time needed. An application for a tran-

script must bear the student's signature; transcripts will be released only upon signed request of the student.

Transcripts will not be issued for a student whose status has lapsed or who has not made satisfactory arrangements regarding bills due or other indebtedness to the University.

PRESERVATION OF RECEIPTS

All receipts of payments made to the Cashier, whatever their nature, should be carefully preserved. Not only do they constitute evidence that financial obligations have been discharged, but they may support a claim that certain documents or petitions have been filed.

REFUND OF FEES

Students who withdraw from the University during the first five weeks of instruction will receive refunds of registration fees, student activity fees, and nonresident tuition fees (if such have been paid) on the following basis:

First two weeks of instruction	80% of total paid
Third week of instruction	60% of total paid
Fourth week of instruction	40% of total paid
Fifth week of instruction	20% of total paid
After fifth week of instruction	No refund

The effective date for calculating a fee refund is the last day the student attended any University class. Claims for refund of fees must be presented during the fiscal year (July 1 to June 30) in which the claim is applicable. To obtain a refund, the student must surrender his registration card and present his fee receipt to the Registrar.

CHANGE OF NAME OR ADDRESS

Students must notify the Registrar's Office promptly of any change of name or address. Forms are available in the Registrar's Office.

RULES GOVERNING RESIDENCE

The residence classification of each student is determined in accordance with Section 244 of the California Government Code, Sections 23054, 23055, and 23057 of the California Education Code and the Standing Orders of the Regents. It is therein provided that a resident student is any person who has been a legal resident of the State of California for more than one year immediately preceding the opening day of the quarter during which he proposes to enrol.

The attention of the alien prospective student is directed to the fact that he is a nonresident unless, in addition to the general residence requirements for tuition purposes, he has been admitted to the United States for permanent residence in accordance with all applicable laws of the United States. The prospective student under the age of 22 whose

parents are not California residents, and the veteran who was not a resident of California at the time of his entrance into the Armed Forces, should note that presence in California for more than one year does not, of itself, entitle the student to classification as a resident.

Every student who is classified as a resident but who becomes a nonresident of California is obliged to notify the Deputy for the Attorney in Residence Matters at once.

Application for change of classification cannot be made retroactive under any circumstances.

A person incorrectly classified as a resident student is subject to reclassification as a nonresident. If the incorrect classification resulted from concealed facts or untruthful statements by him, the student shall be required to pay all tuition fees which would have been charged to him as a nonresident student. He shall be subject also to such discipline as the President of the University may approve.

Petitions for reclassification of residence are available in the Registrar's Office.

Residence Status

Every new or returning student is required to fill out a Statement of Legal Residence in order to determine his residence classification for fee purposes. If a student's family moves into or out of California, or if he maintains an independent household in any state other than that from which he was admitted, he should apply for reclassification to the Deputy for the Attorney in Residence Matters, Registrar's Office, or directly to the Attorney for the Regents in Residence Matters, 590 University Hall, University of California, Berkeley 94720.

General Information for Students

FEES AND EXPENSES

The exact cost of attending the University of California, San Diego, will vary according to personal tastes and financial resources of the individual. Generally, the total expense for three quarters, or a college year, will average about $2,050 for residents of California and $3,250 for nonresidents (including foreign students).

It is possible to live simply and to participate moderately in the life of the student community on a limited budget. The best that the University can do to assist the student in planning his budget is to indicate certain and probable expenses.

Estimated Expenses for Undergraduates

I. RESIDENTS OF CALIFORNIA

	Fall Quarter	Winter Quarter	Spring Quarter	Total
University Registration Fee	$100.00	$100.00	$100.00	$ 300.00
Associated Students Fee	6.00	6.00	6.00	18.00
Board and Room in Residence Halls*	353.00	353.00	353.00	1,060.00
Books	50.00	50.00	50.00	150.00
Personal Expenses†	150.00	150.00	150.00	450.00
Total	$659.00	$659.00	$659.00	$1,978.00

*Figures given for each quarter are one-third of total; actual payments vary according to the quarter. For single room, add $100.00 for the year. (Students living off campus must expect considerable variation in room and board costs, as well as the cost of transportation to and from the campus.)

†Includes laundry, clothing, medical costs not covered by student health insurance, recreation, transportation, etc.

II. NONRESIDENTS

In addition to the above expenses, nonresidents are required to pay a nonresident tuition fee of $400 per quarter or $1,200 per year.

University Registration Fee

The university registration fee is currently $100 per quarter for graduates and undergraduates. This fee, which must be paid at the time of registration, covers certain expenses for use of library books, for recreational facilities and equipment, for registration and graduation, for all laboratory and course fees, and for such consultation, medical advice, and hospital care or dispensary treatment as can be furnished by the Student Health Service or by health and accident insurance purchased by the University. No part of this fee is refunded to students who do not make use of these privileges. For undergraduate students, there is an additional Associated Students fee of $6 per quarter. This fee is used for the general student welfare at the discretion of the A.S. Senate and with the approval of the Chancellor.

Reduced Registration Fee

One-half of the established registration fee may be paid by:

1. Graduate students whose research or study requires them to remain outside the State of California throughout the quarter. Authorization for this privilege is secured from the Vice Chancellor–Graduate Studies and Research.
2. Graduate students who are full-time non-academic employees of the University, as provided for in Personnel Rules, Rule 19, June 1, 1958. Authorization for this privilege is secured from the Personnel Manager.

Miscellaneous Expenses

Books and stationery for a student average about $50 per quarter. Exact information on these items may be obtained by writing directly to the school or department. Students who fail to pass the required examination in Subject A must pay a fee of $45 for the course in Subject A.

Parking Fee

Students who park on the campus are charged an annual parking fee of $31.50 for a car or $12.00 for a motorcycle or motor scooter.

Tuition

There is no tuition fee for students classified as resident students. Students classified as nonresidents are subject to payment of a nonresident tuition fee of $400 per quarter. (Exemption may be granted to dependents of military personnel or University faculty.) See *Rules and Procedures: Rules Governing Residence; Residence Status*. Graduate stu-

dents may have the nonresident tuition fee waived under certain conditions (see below).

Nonresident Fee for Reduced Programs

For the undergraduate student enrolled in less than three courses, the nonresident tuition fee is $112 per course or the proportionate part for a fractional course. For graduate students the nonresident tuition is $400 per quarter regardless of the number of courses undertaken. There is no reduction in registration or Associated Students fees because of a reduced program.

FINANCIAL ASSISTANCE: UNDERGRADUATES

The University of California, San Diego, expects that the student and his family will bear as much of the necessary cost of the students' education as their circumstances will permit. In those cases where resources are insufficient to meet a normal budget, the Financial Aids Office will attempt to help students find supplemental financial aid. Applications and requests for information should be addressed to: Financial Aids Officer, University of California, San Diego, La Jolla, California 92037 (phone 453-2000, ext. 1946).

Students should have enough funds with them at the beginning of the fall quarter to cover registration fees, books, and initial housing costs, as scholarship and loan checks will not be available until after registration.

No student should leave the University for financial reasons until exploring all possible avenues of aid with the Financial Aids Office or the counselor of his college.

Scholarships

The Committee on Undergraduate Scholarships and Honors awards more than two hundred scholarships each year to undergraduate students enrolled on the San Diego campus. These scholarships are donated by private individuals, organizations, corporations, and by the Regents of the University.

All scholarship awards are made on a competitive basis, consideration being given to scholastic achievement, financial need (except for students applying for Regents' Scholarships), and promise. Eligibility for a scholarship is determined from the applicant's statements on his application form, appropriate letters of recommendation, official transcripts, and the Parents' Confidential Statement.

Applying for a Scholarship

Applications are available in the Financial Aids Office. Completed applications for the following academic year must be returned between December 1 and February 15. No application postmarked or presented in person after February 15 can be accepted.

Parents' Confidential Statement

To permit an evaluation of need, parents of all entering and contin-

uing students who apply for scholarships are required to provide financial information on the *Parents' Confidential Statement*. New students may obtain this form from their high school or college counselor. Continuing students may obtain a special form from the Financial Aids Office. This form must be filed by February 1 with the College Scholarship Service, P.O. Box 1025, Berkeley, California 94701 (or P.O. Box 176, Princeton, New Jersey 08540), and it must be indicated that a report is to be sent to the University of California, San Diego. A word of caution: The filing of the Parents' Confidential Statement does not constitute an application for a scholarship.

Announcement of Awards

Awards are announced by June 1. Most scholarships are awarded for one year; financial assistance for succeeding years will depend upon the student's academic performance in the University and continuing need. Unsuccessful applicants for scholarships beyond the first year should consult the Financial Aids Office. Every effort will be made to offer other assistance, such as long-term loans, part-time work, etc.

Regents' and Chancellor's Scholarships

The highest honor that may be conferred upon an undergraduate student is the awarding of a Regents' or Chancellor's Scholarship. They are granted by the President of the University and the Chancellor of the San Diego campus, on the basis of academic excellence and exceptional promise, without reference to need. Scholars receive an honorarium of $100 annually and, with the Regents' Scholarship, a stipend to cover the difference between their resources and the yearly standard cost of education. All scholarship applicants are considered for these awards. An applicant who wishes to be considered for a Regents' Scholarship with honorarium only should so indicate, and he need not file a Parents' Confidential Statement.

President's Undergraduate Fellowship Program

This new program (beginning 1967–68) is designed to assist unusually talented undergraduate students to carry out special studies and projects under faculty supervision. Three fellowships have been allocated to the San Diego campus. The prospective fellow and his faculty sponsor will submit a project proposal, including a tentative budget, preceding the academic year for which the award will be made. The Chancellor, acting with the advice of the Committee on Undergraduate Scholarships and Honors, will select the fellows by August 1 each year. Stipends will be based on need, to be determined by the cost of the project and the student's own resources.

Educational Opportunity Grants

The Higher Education Act of 1965 made provisions for Educational Opportunity Grants to assist students of exceptional financial need in

obtaining a college education. Awards to students meeting University admissions requirements are based upon financial need, and may vary from $200 to $800 per year, but in every case must be less than one-half the total aid required. The remainder may consist of a scholarship, a loan, or part-time employment. Each student receiving an Educational Opportunity Grant will be offered sufficient matching and supplemental financial assistance to meet his total financial need according to the Parents' Confidential Statement.

College Work-Study Program

This Federally financed program provides funds to finance student employment by the University or by public and private non-profit organizations. Students from low-income families and other students who would not be able to attend college without this assistance are eligible for referral to job interviews. Once employed, the student may work up to forty hours a week during the summer and other vacation periods, and up to fifteen hours a week during weeks of classes and examinations, until this financial need, as determined by the Parents' Confidential Statement, has been met, and as long as his work is satisfactory and he continues to be a full-time student in good standing at the University.

The Work-Study Program provides experience in many fields, including city planning, mental health, community service in economically depressed areas, recreation, library work, experimental sciences (chemistry, physics, biology, oceanography and related fields), hospital and business administration, and office work. Pay varies from $1.30 to $2.42 per hour.

Sigurd Burckhardt Prize in Literature

This annual prize is supported by a fund established in memory of Sigurd Burckhardt, Professor of German Literature, by his colleagues, friends, and family. Professor Burckhardt was one of the original group of four professors who founded the Department of Literature on this campus. A substantial cash prize will be awarded each year to the graduating senior who, in the judgment of the Department, has done the most distinguished work in literature.

FINANCIAL ASSISTANCE: GRADUATE STUDENTS

The following is a brief description of the kinds of financial assistance available to graduate students at UCSD. Further details about these awards are contained in a publication entitled "Financial Aid for Graduate Students," which may be obtained from department offices or from the Office of Graduate Studies and Research. The descriptions in this section deal entirely with appointments administered directly by the University. There are also numerous fellowships sponsored by agencies outside the University; applications for such fellowships should be submitted through the student's present college or directly to the agencies concerned. Veterans may wish to explore the benefits provided by the

United States or the State of California through inquiry of the appropriate federal or state offices.

UCSD administers several kinds of financial aid for graduate students in all departments. These include (1) fellowships and traineeships, (2) assistantships in teaching, language instruction, and research, (3) tuition waivers, and (4) loans. These are described in the following sections.

Fellowships and Traineeships

Fellowship and traineeship stipends are tax-free awards granted for scholarly achievement and promise and are made to enable a student to pursue graduate studies and research without requiring him to render any services. The stipends accompanying different awards are not all alike, but for the most part they are not less than $2,100 for the nine-month academic year, or $2,800 for twelve months. Unless explicitly stated otherwise, all fellows and trainees whose appointments are administered by the Office of Graduate Studies and Research are exempt from tuition and registration fees. A fellow or trainee is required to register for a full program of graduate study and research and may not engage in remunerative employment without the permission of the Dean of Graduate Studies.

The principal types of fellowships and traineeships are:

1) Regents' Fellowships
2) National Defense Education Act, Title IV, Fellowships
3) National Science Foundation Traineeships
4) National Science Foundation Summer Traineeships for teaching assistants
5) Public Health Service Traineeships

Assistantships

Graduate students may be employed by the University of California, San Diego, on a part-time basis to assist in the academic programs of the University. Such employment takes the form of an assistantship for which a taxable salary is paid. Experience has shown that most Research Assistants and those Teaching Assistants whose major departments require teaching experience for the doctorate obtain a tax refund upon application to the Internal Revenue Service. Assistantships do not include payment for tuition and fees, but many teaching assistants who are not residents of California receive tuition waivers. Current salaries for nine months for half-time assistants who are new graduate students are as follows:

Teaching	$3,240.00
Research	2,565.00

Combination Appointments

Students who are successful in the campuswide competition for fellowship support but for whom no appropriate fellowship is available may be

appointed to positions called Fellow-Teaching Assistantships or Fellow-Research Assistantships. These positions provide a stipend of $2,100 for the nine-month academic year, plus tuition and the University registration fee. A portion of the stipend is considered salary for services rendered as a one-quarter–time teaching assistant or a one-third–time research assistant and is subject to income tax withholding; the balance of the stipend is unequivocally tax-free. Internal Revenue Service regulations applying to conventional assistantships also apply to these positions, so that tax refunds are usually forthcoming upon application.

Waiver of Nonresident Tuition

Graduate students who are admitted without deficiencies, who have demonstrated that their scholarship is distinguished, and who carry full programs of graduate study leading toward higher degrees, may be eligible for waiver of nonresident tuition. Application for such an award is made in the same way as for an assistantship, fellowship, or traineeship.

Application Procedures

Application materials with instructions can be obtained from an academic department office, from the Office of Admissions, or from the Office of Graduate Studies and Research, University of California, San Diego, La Jolla, California 92037. Only one application form is needed to apply for admission and for any or all of the following types of financial aid: fellowships, traineeships, assistantships (teaching, language, or research), and tuition waivers. The form and all supporting materials are to be returned to the applicant's prospective major department.

In order for a student to be considered for a fellowship or traineeship for the ensuing academic year, his application and supporting materials, including scores on the aptitude tests of the Graduate Record Examination, must be received on campus before February 15. Applications for tuition waivers and for assistantships will be accepted after that date, but many departments offer assistantships at the same time they consider applications for fellowships. Therefore, applicants for such appointments are strongly urged to submit their applications as early as possible. The award of fellowships and traineeships for the following academic year will be announced not later than April 1.

LOANS

Loans are not intended to provide full support, but should be used to supplement other resources. Students with financial need are encouraged to request loan assistance as supplementary aid. Information about all available loans may be obtained from the Financial Aids Office.

Short-Term Loans

These funds, made possible by gifts to the University, are granted

in small amounts to help students in short-term emergencies, and usually must be repaid within thirty days to one year.

Regents' Loan Funds

These funds are used principally to supplement stipends of scholarship and fellowship recipients but may also be granted to other qualified students. Regents' Loans, normally repayable in five years, bear an interest rate of 3 per cent on the unpaid balance, beginning upon graduation or withdrawal from the University.

National Defense Education Act Loans

A student is eligible for a National Defense Student Loan if he is a United States citizen or holds an immigrant visa and is carrying at least one-half the normal full-time academic workload. An undergraduate student may apply for up to $1,000 a year to a total of $5,000 for his undergraduate career. A graduate or professional student may apply for up to $2,500 annually with a $10,000 maximum for his graduate career. Loans are granted for educationally related expenses and are intended to supplement a student's resources in order to meet standard costs of attending the University.

Repayment of NDEA loans begins nine months after graduation or withdrawal from the University and may be extended over a ten-year period at 3 per cent interest on the unpaid balance. Members of the armed forces, members of the Peace Corps, and VISTA may have their repayment deferred up to three years. Up to 50 per cent of the loan (and interest thereon) may be forgiven for borrowers who enter the teaching profession, at the rate of 10 per cent for each year of full-time teaching in a public or non-profit elementary or secondary school or in an institution of higher education. Borrowers who elect to teach in certain eligible schools located in low-income areas may qualify for cancellation of their entire obligation at the rate of 15 per cent per year.

Either a Parents' Confidential Statement or appropriate form to indicate financial need will be required in most cases for long-term and NDEA loans. Whenever possible, students should anticipate in the spring the financial need for the following academic year to allow for processing financial statements and applications for loans.

Employment

The Student Employment Office, under the direction of the Dean of Student Affairs, serves UCSD students seeking employment. Opportunities are available in a variety of job categories ranging from clerical, child-care, sales and manual labor, to the more specialized categories requiring high-level skills and talents, such as computer programming. These may range from temporary assignments to regular positions, both on and off campus.

Undergraduate students taking a full course load normally may not be employed more than fifteen hours a week during academic periods. The Dean of Student Affairs may approve a work load in excess of fifteen hours a week as an exception, but only after review of the student's academic status (the student must maintain a grade-point average of 2.5 or better), financial situation, and other financial aids available to him. Employment for twenty hours or more will require a corresponding reduction in course load, or must be work which permits some measure of concurrent study (e.g., Assistant I positions in the Language Laboratory and Physical Education Department).

Freshmen are not referred to jobs until they have been on campus for at least one month, except for those who are eligible for the College Work-Study Program. It is rcommended that freshmen limit their working hours to ten per week. No freshman will be permitted to work more than fifteen hours.

Since most of the jobs listed are for students who are immediately available, with the exception of live-in positions (room and board in exchange for work in private homes), it is impossible to arrange for employment by correspondence.

COUNSELING SERVICES

Counseling services at UCSD are multiple and varied. All such services are predicated on the philosophy that the purpose of University counseling is to help the normal student use his talents to their maximum in achieving the best possible education.

Academic counseling is done by faculty advisers and supplemented by the program planning done by the Provost's staff.

Attached to each college is a College Counselor. The College Counselor is readily available for short-term counseling in any area that hinders academic proficiency or personal happiness. He sees all students who withdraw during a term, to facilitate their move to another setting.

Long-term counseling can be arranged through the campus psychologist for those in need. Psychiatric evaluation or care is provided by consulting psychiatrists through the Health Center.

Vocational counseling is available at the Career-Educational Planning and Placement Center. Students are counseled individually or in groups, regarding majors or occupations.

Valuable additional counseling service is provided by campus pastors through the campus Office for Religious Affairs or at nearby religious centers.

CAREER–EDUCATIONAL PLANNING AND PLACEMENT CENTER

The Career–Educational Planning and Placement Center offers a wide variety of placement and counseling services to all students, graduate and undergraduate.

Vocational Counseling

A vocational counseling program is available to help students select a college major which is compatible with what they know about themselves. Students will explore and analyze occupations related to the various college majors so that, when they do select a major, they may predict with greater confidence their future adjustment in the related occupation. Even students who believe they know what they want in both a college major and subsequent occupation should ponder the question, "What degree of confidence do I have that the major I have selected will lead me to an occupation in which I can find great satisfaction?" Some students may wish to use the Center's vocational counseling service to verify their present career-educational plans.

Placement

Students at all degree levels and alumni desiring career placement are invited to register for guidance and placement services which may help them select another college or a suitable position. Candidates may avail themselves of counseling in such areas as analysis of prospective employers, organization of a job campaign, and other job-seeking techniques. Recruiting interviews on campus are scheduled so that students and alumni may talk with representatives of industry, business, government, service organizations and schools. Additionally, the Center assists students in communicating with employers who do not conduct campus interviews. Direct listings of vacancies are maintained and students may be referred for specific positions.

Teacher placement service is also available to students and alumni who are interested in this profession. Information on the background, training, and professional experience of the applicants, which is kept in confidential files, is sent or shown to employers. These files are retained and may be brought up to date and used at any time throughout the teaching career of the candidate.

Efforts are made to assist students in finding part-time and summer employment related to their prospective careers.

OFFICE OF INTERNATIONAL EDUCATION

The Office of International Education has both foreign and domestic functions. It is responsible for the proper documentation of all non-citizens on the campus, whether they be foreign students, postdoctoral fellows, or faculty. In addition to the official documentation required, the Office of International Education assists with hospitality programs, counseling, and other needs of the foreign community. All new students, researchers, and faculty who are citizens of a country other than the United States are asked to call at the Office of International Education as soon after their arrival on campus as possible and to bring their passports with them so that their visa status may be verified.

Education Abroad Program

A second and growing function of the Office of International Education is the Education Abroad Program. UCSD is associated with other campuses of the University of California in this program, which is created to provide opportunity for outstanding students of the University to participate in the life of a university overseas. Most participants are juniors, and must have applied in the first quarter of their sophomore year. The program is also available to graduate students, with the approval of their departments, the Graduate Division, and the Education Abroad Committee. At present, the program is established on campuses in Jerusalem, Beirut, Göttingen, the United Kingdom, Dublin, Bordeaux, Madrid, Hong Kong, Lund, Padua, and Tokyo. A new program in Mexico City will open in 1968–69. It is highly possible that additional international centers will be established in future years.

HOUSING

A brochure describing all types of living accommodations at or near the University is available through the Housing Office. This brochure automatically accompanies each admissions application forwarded to prospective students.

Students returning the housing application card (attached to the brochure) should read the instructions on the card and the entire brochure. The Housing Office will gladly furnish additional information upon request.

The University strongly encourages all freshmen to live on campus their first year at UCSD. Living accommodations are available in both Revelle and Muir Colleges. All residence halls are arranged on the suite plan, with six to ten students sharing a common study-living area. Both single and double rooms are available, with priority for singles given to returning residents. The present room-and-board rate is $1,060 for the academic year, with an additional charge of $100 for single accommodations. Room without board is not available.

Limited accommodations for single graduate students are also available in the residence halls on a first-come, first-served basis. Graduate students will be assigned to graduate suites identical to those described above.

Apartments for married students consist of 19 studio units (which may be available for single graduate students), 56 one-bedroom apartments and 31 two-bedroom apartments. All of these units are unfurnished except for stove and refrigerator. Coin-operated washers and dryers are supplied in the community building on the apartment grounds. Monthly rental prices, including utilities, are $80 to $90 for a studio, $100 for a one-bedroom apartment, and $110 to $120 for a two-bedroom apartment.

The Housing Office will assist others in finding suitable accommodations in the surrounding communities of Clairemont, Del Mar, La Jolla,

or Pacific Beach. There is a limited number of small apartments near the campus, many of which are of the studio type, with facilities for cooking, and large enough for two students to share. There are also a few room-and-board opportunities with private landlords. Rates per month may vary from $50 for a room to $100 and up for an apartment or room and board. Apartments or houses may be shared for a price range of $40 to $100 per student. Students should call in person at the Housing Office to request assistance for specific off-campus listings.

OFFICE OF SPECIAL SERVICES

The Office of Special Services provides assistance to students in a variety of areas. Any questions related to Selective Service, veterans' affairs, Social Security Educational Benefits or the Vocational Rehabilitation Service should be referred to this office.

Selective Service

The Office of Special Services primarily serves the students in all matters pertaining to the Selective Service System. Certification of enrolment is forwarded to local Selective Service boards upon the request of any male student. Questions regarding Selective Service and all branches of the military service open for enlistment should be referred to this office.

Veterans' Affairs, Social Security, Vocational Rehabilitation

Information regarding the Veterans' Readjustment Act, as well as Veterans' Dependents' Educational Benefits and Social Security Educational Benefits, may be obtained in the Office of Special Services.

If you wonder about your eligibility for educational benefits under any of these programs, please contact the appropriate local office near your home, or the campus Office of Special Services as soon as possible. Students already benefiting from any of these programs should contact the Office of Special Services immediately after their initial registration, and every fall registration while at the University.

Students receiving training through the Vocational Rehabilitation Service of the State Department of Education may call on the Office of Special Services for counsel or assistance at any time.

STUDENT HEALTH SERVICE

A comprehensive medical care program for students is included among the benefits provided by the University Registration Fee.

A qualified medical staff is available at the Health Center on campus to care for medical and emotional problems of students. Out-patient service is available during school hours, and a Student Health Service physician is on call for emergencies, nights, holidays, and weekends for students living on or near the campus.

Infirmary care is available at the Health Center for illness not requiring hospitalization. Hospitalization, surgery, and consultation fees are provided through a Student Health Service insurance program.

A comprehensive and economical insurance policy is also available for dependents of students. It is mandatory for dependents of foreign students. It is also available for students during the summer quarter, or for the quarter following withdrawal or graduation.

Mental health care through psychological and psychiatric counseling is available on an appointment basis at the Health Center.

Each new student, and each student re-entering UCSD after an absence of two or more consecutive quarters, is required to have had a physical examination (including tuberculin test or chest X-ray) not more than six months previous to his arrival on campus, and a smallpox vaccination not more than three years previous. The physical examination form is mailed in advance of registration (e.g., in June for fall registrants).

A medical review during registration week will allow medical staff and student to become acquainted and give an opportunity for discussing past and present medical problems.

ACADEMIC AND ADMINISTRATIVE OFFICERS OF THE SAN DIEGO CAMPUS

Chancellor
William J. McGill, Ph.D.

Vice Chancellor–Graduate Studies and Research
Dean of Graduate Studies
Frederick T. Wall, Ph.D.

Vice Chancellor–Medicine and Biological Sciences
Dean, School of Medicine
Clifford Grobstein, Ph.D.

University Librarian
Melvin J. Voigt, M.A.

Dean of Student Affairs
George S. Murphy, Jr., M.S.

Registrar and Admissions Officer
Harold E. Temmer, M.S.

Student Health Service Director
Robert W. Watson, M.D.

Provost, John Muir College
John L. Stewart, Ph.D.

Provost, Revelle College
Paul D. Saltman, Ph.D.

Provost, The Third College
Armin Rappaport, Ph.D.

Dean and Director, Scripps Institution of Oceanography
William A. Nierenberg, Ph.D.

Director, Emeritus
Roger R. Revelle, Ph.D.

PRINCIPAL ADMINISTRATIVE OFFICERS OF THE UNIVERSITY

CHARLES J. HITCH
President of the University

JOHN W. OSWALD
Executive Vice-President

ANGUS E. TAYLOR
Vice-President–Academic Affairs

EARL C. BOLTON
Vice-President–Administration

JAMES B. KENDRICK, JR.
Vice-President–Agricultural Sciences

GRAEME C. BANNERMAN
Vice-President–Business and Finance

FRANK L. KIDNER
Vice-President–Educational Relations

ELMO R. MORGAN
(On leave until June 30, 1969)

ROBERT J. EVANS (Acting)
Vice-President–Physical Planning and Construction

FREDERICK E. BALDERSTON
Vice-President–Planning and Analysis

EDWARD B. ROESSLER
(Acting)
Dean of University Extension

UNIVERSITY OFFICERS EMERITI

ROBERT GORDON SPROUL
President of the University, Emeritus

CLAUDE B. HUTCHISON
Vice-President of the University, Emeritus, and Dean of the College of Agriculture, Emeritus

ROBERT M. UNDERHILL
Vice-President and Treasurer of The Regents, Emeritus

JAMES H. CORLEY
Vice-President–Governmental Relations and Projects, Emeritus

UNIVERSITY CHANCELLORS

ROGER W. HEYNS
Chancellor at Berkeley

EMIL M. MRAK
Chancellor at Davis

DANIEL G. ALDRICH, JR.
Chancellor at Irvine

CHARLES E. YOUNG
Chancellor at Los Angeles

IVAN H. HINDERAKER
Chancellor at Riverside

WILLIAM J. McGILL
Chancellor at San Diego

WILLARD C. FLEMING
Chancellor at San Francisco

VERNON I. CHEADLE
Chancellor at Santa Barbara

DEAN E. McHENRY
Chancellor at Santa Cruz

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA

REGENTS EX OFFICIO

RONALD REAGAN
Governor of California
State Capitol,
Sacramento, California 95814

ROBERT H. FINCH
Lieutenant-Governor
State Capitol,
Sacramento, California 95814

JESSE M. UNRUH
Speaker of the Assembly
Box 65, State Capitol,
Sacramento, California 95814

MAX RAFFERTY
State Superintendent of
Public Instruction
721 Capitol Avenue,
Sacramento, California 95814

ALLAN GRANT
President of the State Board
of Agriculture
2855 Telegraph Avenue,
Berkeley, California 94705

JAMES Q. BRETT
President of the
Mechanics' Institute
57 Post Street,
San Francisco, California 94104

ROGER C. PETTITT
President of the Alumni
Association of the University
of California
550 South Flower Street,
Suite 636,
Los Angeles, California 90017

CHARLES J. HITCH
President of the
University of California
714 University Hall,
Berkeley, California 94720
2147 Administration Building,
Los Angeles, California 90024

APPOINTED REGENTS

The term of the appointed Regents is sixteen years, and terms expire March 1 of the year indicated in parentheses.

EDWIN W. PAULEY (1970)
Ten Thousand
Santa Monica Boulevard,
Los Angeles, California 90067

EDWARD W. CARTER (1982)
14th Floor, United California
Bank Building
600 S. Spring Street,
Los Angeles, California 90014

MRS. DOROTHY B. CHANDLER (1970)
202 W. First Street,
Los Angeles, California 90053

MRS. RANDOLPH A. HEARST (1974)
233 W. Santa Inez Avenue,
Hillsborough, California 94010

SAMUEL B. MOSHER (1972)
1010 Wilshire Boulevard,
Los Angeles, California 90017

JOHN E. CANADAY (1974)
Lockheed Aircraft Corporation,
Burbank, California 91503

PHILIP L. BOYD (1972)
3900 Market Street,
Riverside, California 92501

NORTON SIMON (1976)
1645 W. Valencia Drive,
Fullerton, California 92633

WILLIAM E. FORBES (1978)
637 S. Hill Street,
Los Angeles, California 90014

WILLIAM M. ROTH (1980)
Special Representative for
Trade Negotiations
1800 G Street, N.W.,
Room 719, Washington, D.C.
20025

MRS. EDWARD H. HELLER (1976)
99 Faxon Road,
Atherton, California 94025

FREDERICK G. DUTTON (1978)
100 Spencer Street,
Sausalito, California 94965

WILLIAM K. COBLENTZ (1980)
333 Montgomery Street,
San Francisco, California 94111

DEWITT A. HIGGS (1982)
707 Broadway,
San Diego, California 92101

H. R. HALDEMAN (1984)
6505 Wilshire Boulevard,
Los Angeles, California 90048

W. GLENN CAMPBELL (1984)
Hoover Institution,
Stanford, California 94305

WENDELL W. WITTER (REGENT DESIGNATE)
45 Montgomery Street,
San Francisco, California 94104

PRINCIPAL OFFICERS OF THE REGENTS

RONALD REAGAN
Governor of California
President

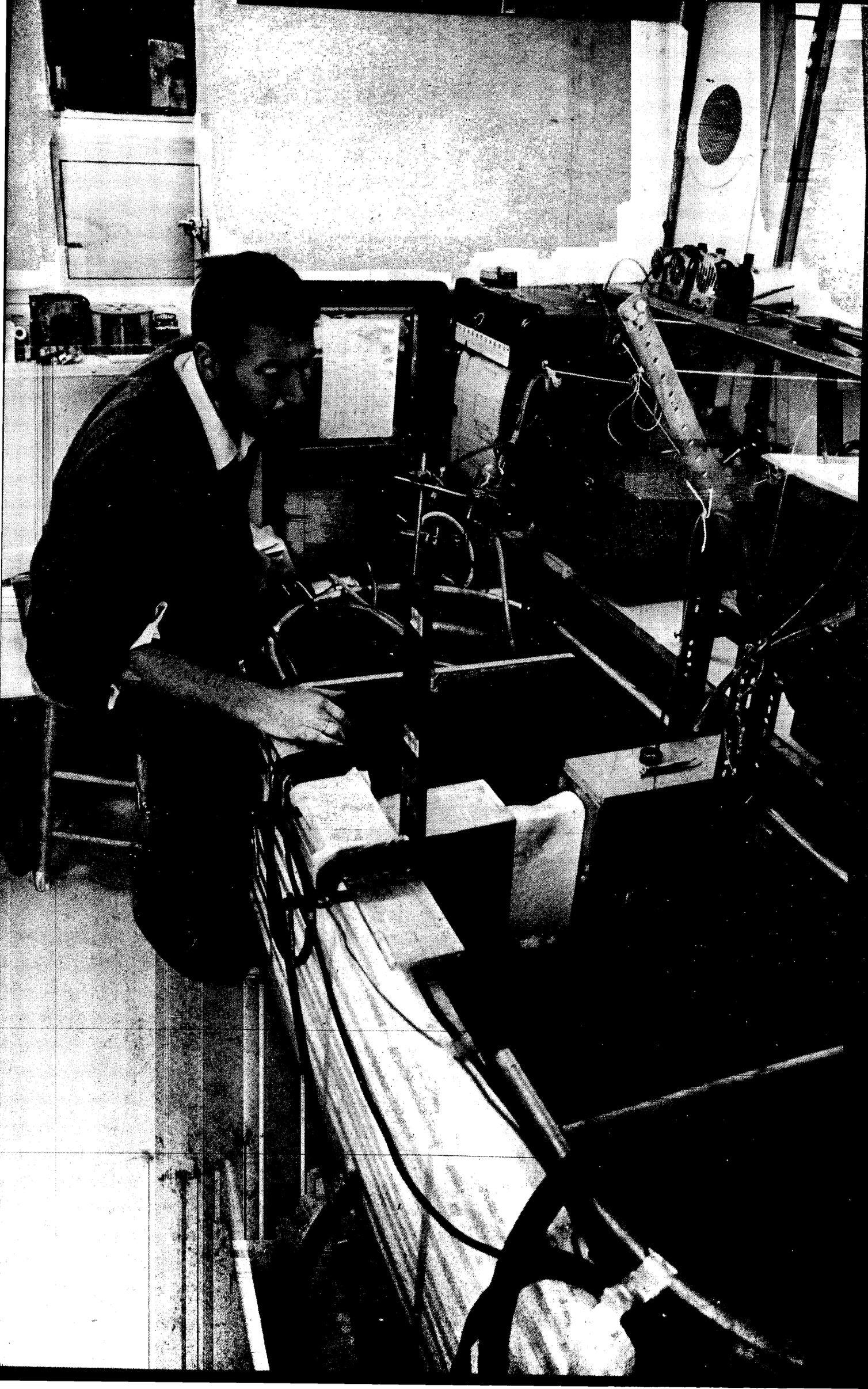
DeWITT A. HIGGS
Chairman

MRS. EDWARD H. HELLER
Vice-Chairman

THOMAS J. CUNNINGHAM
General Counsel of the Regents
590 University Hall,
Berkeley, California 94720

OWSLEY B. HAMMOND
Treasurer of the Regents
615 University Hall,
Berkeley, California 94720

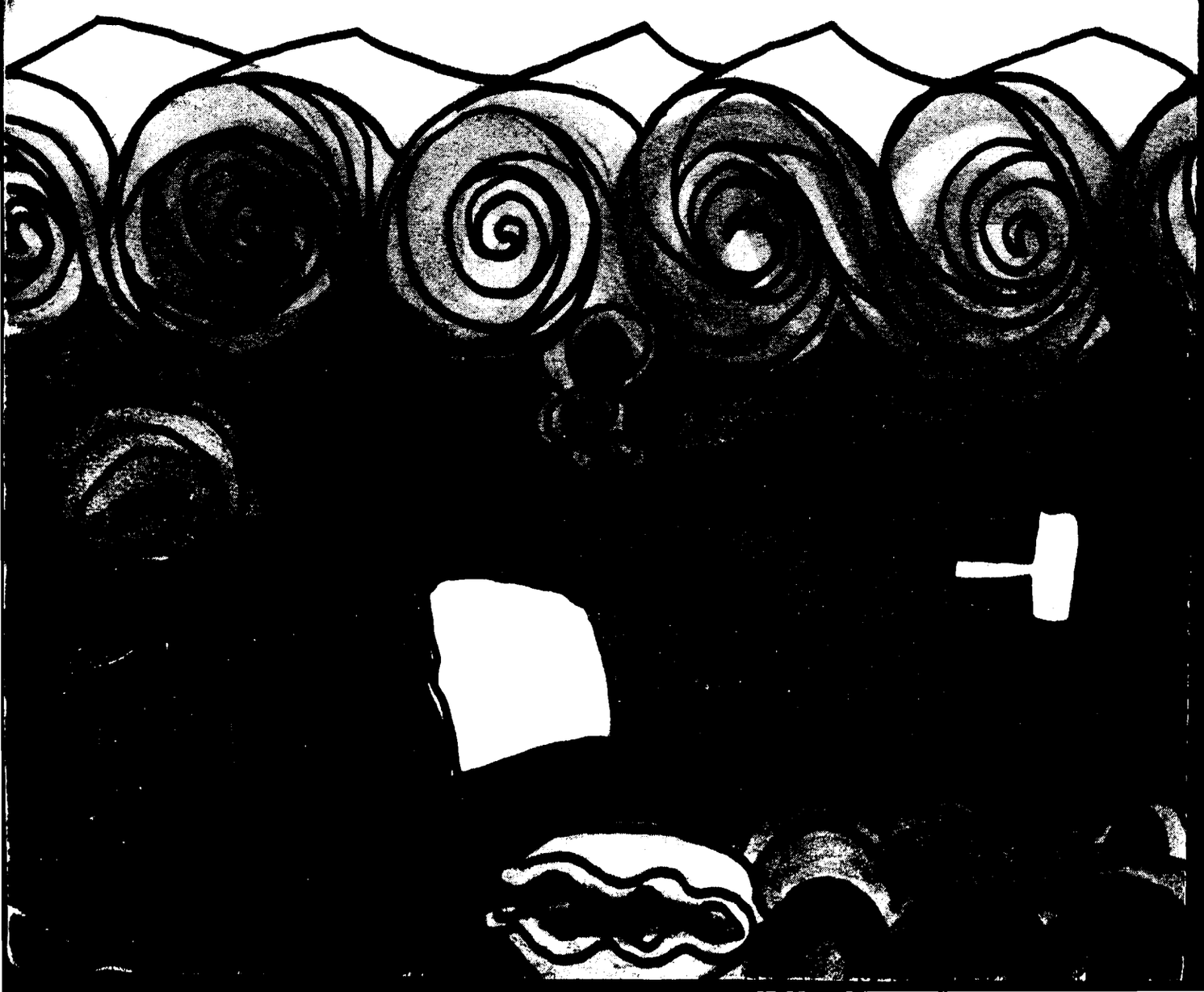
MISS MARJORIE J. WOOLMAN
Secretary of the Regents
689 University Hall,
Berkeley, California 94720



Index

UNIVERSITY OF CALIFORNIA, SAN DIEGO
POST OFFICE BOX 109
LA JOLLA, CALIFORNIA 92037

ENTERED AS SECOND CLASS



University of California, San Diego

General Catalogs,

1968/1969