1969-1970

UNIVERSITY OF CALIFORNIA, SAN DIEGO

UCSD

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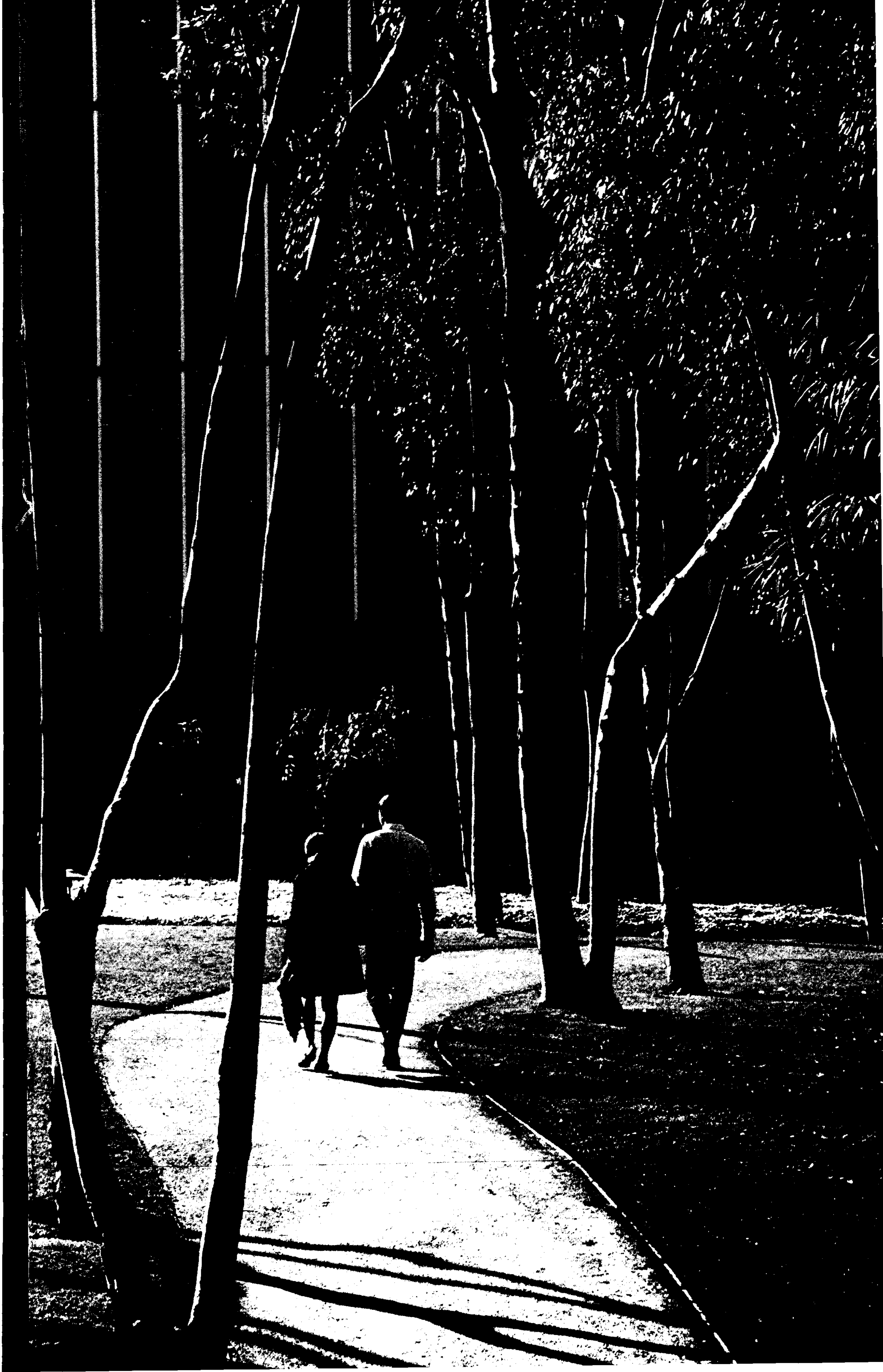

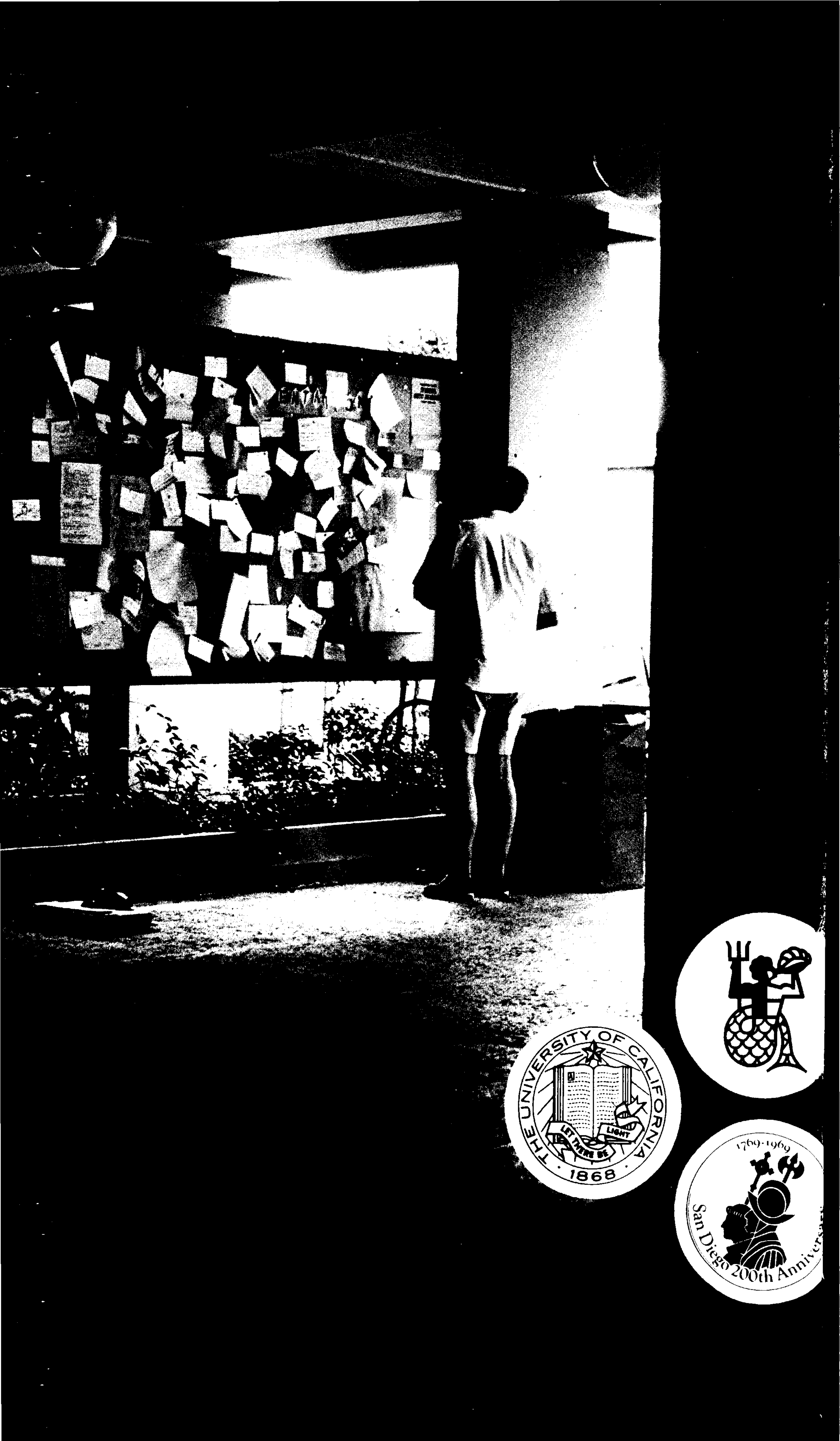
THE UNIVERSITY OF CALIFORNIA
LET THERE BE LIGHT
1868
1769-1969
San Diego 200th

"

We are committed

to providing the most favorable environment

for the

spirit of free inquiry.

"

CHARLES J. HITCH, President
University of California

GENERAL CATALOG

PRICE $1

Fall, Winter, and Spring Quarters
1969-1970

UNIVERSITY OF CALIFORNIA, SAN DIEGO

Post Office Box 109

La Jolla, California

92037

Academic Calendar 1969 - 1970

	Fall 1969	Winter 1970	Spring 1970
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 Office).	Mar. 1—Sat.	Nov. 1—Sat. (1969)	Feb. 1—Sun.
Final dates for filing application materials for graduate admission including transcripts, letters of recommendation, scores on the Graduate Record Examination, etc.:			
Foreign Students	Jun. 1—Sun.	Sept. 1—Mon. (1969)	Dec. 1—Mon. (1969)
Domestic Students	Aug. 1—Fri.	Nov. 1—Sat. (1969)	Feb. 1—Sun.
Final dates for filing applications for intercampus transfer (file with Registrar).	Mar. 1—Sat.	Nov. 1—Sat. (1969)	Feb. 1—Sun.
Final dates for filing applications for readmission to undergraduate standing (file with Admissions Office).	Aug. 1—Fri.	Nov. 1—Sat. (1969)	Feb. 1—Sun.
Administrative Holiday.	——	Jan. 1 - 2 Thu. - Fri.	——
Quarter begins.	**Sept. 29—Mon.**	**Jan. 5—Mon.**	**Mar. 31—Tue.**
Final dates for paying fees without penalty. $10 late-registration fee will be assessed after this date.	Sept. 26—Fri.	Jan. 5—Mon.	Mar. 31—Tue.
Instruction begins.	**Sept. 29—Mon.**	**Jan. 5—Mon.**	**Mar. 31—Tue.**
Final dates for filing applications for advancement to candidacy for the master's degree to be conferred at the end of the quarter (at least one quarter must intervene between advancement to candidacy and conferring of degree).	Oct. 10—Fri.	Jan. 16—Fri.	Apr. 10—Fri.
Final dates for filing official study-list packets without lapse of status and $10 reinstatement fee.	Oct. 8—Wed.	Jan. 14—Wed.	Apr. 13—Mon.

Undergraduates: final dates for adding courses. Final dates for dropping courses without late fee.	Oct. 10—Fri.	Jan. 16—Fri.	Apr. 10—Fri.
Graduates: final dates for adding or dropping courses without late fee.	Oct. 10—Fri.	Jan. 16—Fri.	Apr. 10—Fri.
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. 3—Mon.	Feb. 6—Fri.	May 6—Wed.
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. 3—Mon.	Feb. 6—Fri.	May 1—Fri.
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. 7—Fri.	Feb. 13—Fri.	May 12—Tue.
Final date for filing applications for graduate fellowships (Office of Graduate Studies and Research).	——	Feb. 1—Sun.	——
Academic and administrative holidays.	Nov. 27 - 28 Thu. - Fri.	Feb. 23—Mon.	May 30—Sat.
Final date for satisfying all requirements for advanced degrees to be conferred at Commencement.	——	——	Jun. 5—Fri.
Instruction ends.	**Dec. 6—Sat.**	**Mar. 14—Sat.**	**Jun. 6—Sat.**
"Free" Day. No student or faculty-sponsored events are to be scheduled for this day.	Dec. 8—Mon.	Mar. 16—Mon.	Jun. 8—Mon.
Final examinations.	Dec. 9 - 13 Tue. - Sat.	Mar. 17 - 21 Tue. - Sat.	Jun. 9 - 13 Tue. - Sat.
Final dates for satisfying all requirements for advanced degrees to be conferred at end of quarter.	Dec. 20—Sat.	Mar. 24—Tue.	Jun. 16—Tue.
Quarter ends.	**Dec. 20—Sat.**	**Mar. 24—Tue.**	**Jun. 16—Tue.**
Administrative holidays.	Dec. 25 - 26 Thu. - Fri.	Mar. 27—Fri.	——

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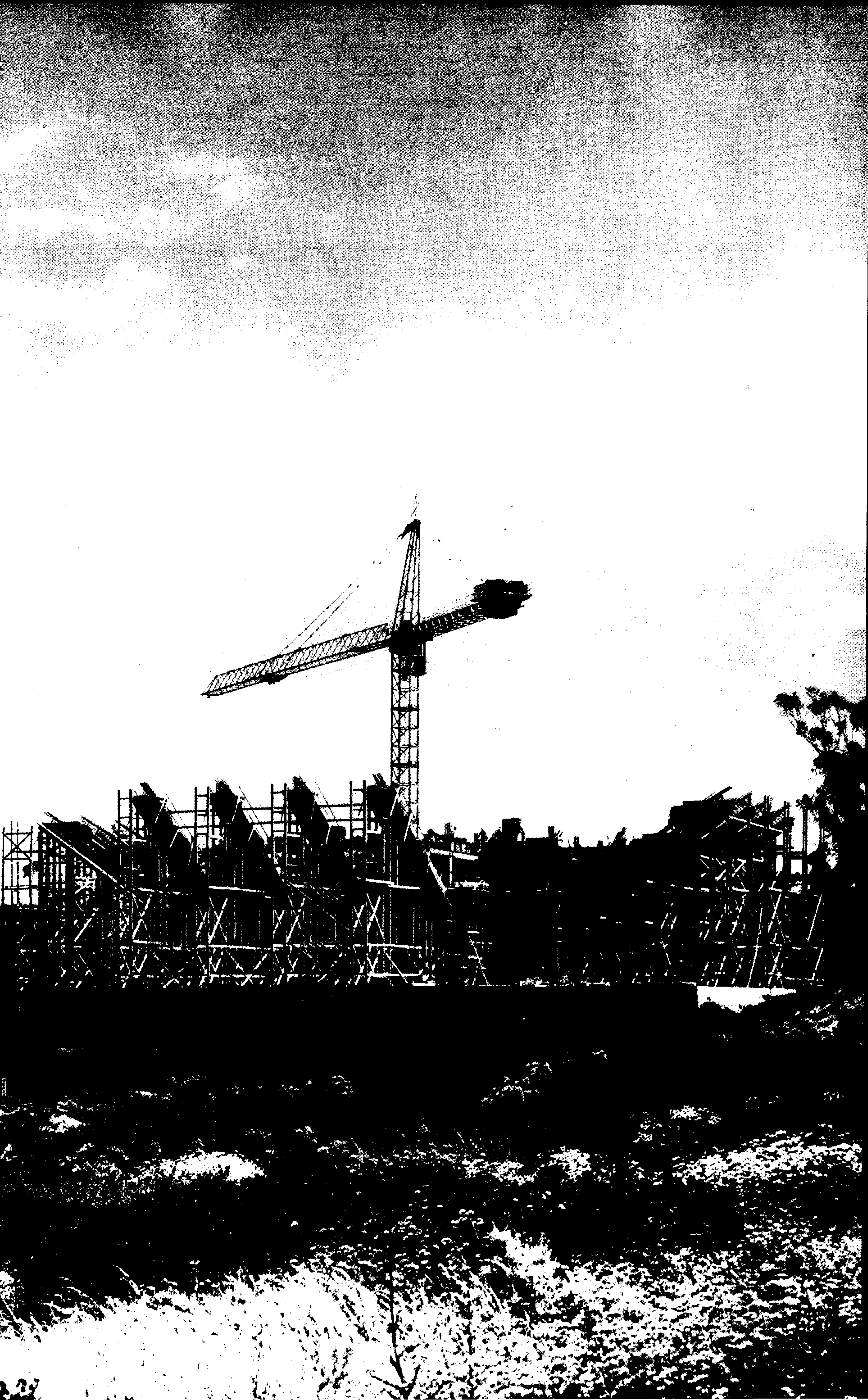

The University of California

THE STATEWIDE INSTITUTION

The University of California was established 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, celebrating the 200th anniversary of its founding, 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 theatre 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 theatre 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. Theatre, 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 enrollment of 27,500. By that time twelve interrelated colleges, grouped in clusters of three or four colleges each, will have been established. Each college 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 sixth year of undergraduate instruction in 1969, with about eleven hundred lower-division students and nine 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. In 1969 it will begin the 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 conservation 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

Third College is scheduled to begin instruction in the fall of 1970 in the Matthews Campus staging area. The first year enrollment of the College will be approximately 300 freshmen and 50 juniors; its eventual size will be somewhat smaller than Revelle College or Muir College.

A provisional faculty has been formed and a curriculum is being developed.

The Faculty of Third College

Name	Title	Department
Attiyeh, Richard E., Ph.D.	Associate Professor	Economics
Baron, Samuel H., Ph.D.	Professor	History
Brach, Paul, M.F.A.	Professor	Visual Arts
Burbidge, E. Margaret, Ph.D.	Professor	Physics
Carmack, Robert M., Ph.D.	Assistant Professor	Anthropology
Crowne, David K., Ph.D.	Assistant Professor	Literature
Frankel, Theodore T., Ph.D.	Professor	Mathematics
Hooper, John W., Ph.D.	Professor	Economics
Jacobs, Irwin M., Sc.D.	Associate Professor	APIS
Korevaar, Jacob, Ph.D.	Professor	Mathematics
Lindsley, Dan L., Jr., Ph.D.	Professor	Biology
Lovberg, Ralph H., Ph.D.	Professor	Physics
McGuire, William J., Ph.D.	Professor	Psychology
Moore, Stanley, Ph.D.	Professor	Philosophy
Ogdon, Wilbur L., Ph.D.	Professor	Music
Popkin, Richard H., Ph.D.	Professor	Philosophy
Rappaport, Armin, Ph.D.	Professor	History
Simon, Melvin I., Ph.D.	Assistant Professor	Biology
Thiess, Frank B., Ph.D.	Assistant Professor	Mathematics
Traylor, Teddy G., Ph.D.	Professor	Chemistry
Wright, Andrew, Ph.D.	Professor	Literature

The School of Medicine

The new and developing school of medicine offered its first internship and residency programs in July, 1966, and enrolled its Charter Class of undergraduate medical students in September, 1968. The Basic Science Building of the medical school complex on the La Jolla campus is completed, a Veteran's Administration Hospital is under construction, the Clinical Science Building and Campus Medical Center are being planned. As the building program and faculty acquisition approach "steady state," undergraduate student enrollment will be increased from the present class size of 48 to 96 for a total annual enrollment of almost 400.

The UCSD School of Medicine curriculum takes advantage of the unique opportunities for integration of teaching and research that exist on this campus where the medical school and the University are developing simultaneously. According to the medical school's academic master plan, some positions are assigned to the general campus for faculty whose scientific interest relate to medicine and human biology. These faculty members are from the campus Departments of Aerospace and Mechanical Engineering Sciences, Biology, Chemistry, Economics, Mathematics, Physics, Psychology, Scripps Institution of Oceanography, and Sociology. They occupy School of Medicine space, teach in the medical curriculum, create special courses and contribute to interdisciplinary teaching emphasizing areas of their disciplines most useful to medical students.

The main purpose of the curriculum is to develop critical, objective, and humane physicians equipped to meet change and to continue self-education. Students acquire understanding of basic medical sciences and clinical disciplines, and are encouraged to choose their own specialized areas of interest for eventual development into careers in the broadly diversified medical community. Individual student capabilities are enhanced through access to the best facilities and personalized counseling. Thus, the curriculum provides flexibility; form and content are adapted to individual needs of each student.

The curriculum consists of two major parts: The core curriculum and the elective programs. The first embodies those aspects of medical education essential to the student regardless of background or intended career direction. It includes courses in biomathematics, cell biology and biochemistry, organ physiology and pharmacology, neurosciences, basic neurology, pathology and microbiology, human anatomy, social and behavioral sciences, an introduction to clinical medicine in the first two years, and clinical clerkships in the third year. The fourth year will be primarily devoted to electives. Students with advanced training in a core area may, at faculty option, do advanced work in the same or another area, use the time to overcome deficits, or begin independent study.

Clinical medicine instruction begins early; students see patients whose diseases relate to subjects studied in basic science courses. Training in differential diagnosis and clinical medicine are condensed into the third year. Clinical training occurs in hospitals and out-patient clinics. The role of medicine and physicians in society is also studied.

Elective programs provide choices suited to each student's background, ability, and career objectives. Each student is expected to choose a "Concentration Area" suited to his needs and combining didactic, clinical, field work, and research experiences at UCSD or elsewhere. Electives occupy about a fourth of the student's time in the first two years and two-thirds in the fourth year. A written report covering work in the Concentration Area and prepared as though for publication is to be presented before the end of the fourth year as a requirement for graduation.

Selection Factors

Selection factors are based on the applicant's scholastic record, letters of recommendation, performance on the Medical College Admission Test, and personal interviews.

To insure that applicants with the potential to become qualified physicians are not refused admission simply because of financial need or remediable academic deficiencies, the school seeks to enroll a limited number of students in a specially designed extended program in 1969-70.

A complete catalog as well as information on the foregoing extended program is available upon request to:

The Office of Student Affairs
UCSD School of Medicine
University of California, San Diego 92037

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 he elects those additional courses which the medical schools of his choice may require for admission. Admission requirements differ among medical schools, but most require or strongly recommend courses in general physics, inorganic chemistry, mathematics, the humanities, and the social and behavioral sciences. Many schools require advanced 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
Allison, William S., Ph.D.	Assistant Professor	Chemistry
Ando, T., M.D.	Assistant Professor	Pediatrics
Ashburn, William L., M.D.	Assistant Professor	Radiology
Baily, Norman A., Ph.D.	Professor	Radiology
Bernstein, Eugene F., M.D., Ph.D.	Professor	Surgery
Bendixen, Hendrick H., M.D.	Professor	Surgery
Bickford, Reginald G., M.B.	Professor	Neurosciences
Bloor, Colin M., M.D.	Assistant Professor	Pathology
Braude, Abraham I., M.D., Ph.D	Professor	Medicine
Braunwald, Eugene, M.D.	Professor	Medicine
Braunwald, Nina, M.D.	Associate Professor	Surgery
Bridgman, Charles F., Ph.D.	Assistant Professor	Neurosciences
Brown, Kenneth R., M.D.	Assistant Professor	Medicine
Bullock, Theodore H., Ph.D.	Professor	Neurosciences

Carrington, Charles R., 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
Doppman, J. L., M.D.	Professor	Radiology
Dutton, Richard W., Ph.D.	Associate Professor	Biology
Elovson, John, Ph.D.	Assistant Professor	Biology
Evans, John W., M.D., Ph.D.	Assistant Professor	Mathematics
Fantino, Edmund J., Ph.D.	Assistant Professor	Psychology
Friedkin, Morris E., Ph.D.	Professor	Biology
Friedman, Paul J., M.D.	Assistant Professor	Radiology
Friedman, William F., M.D.	Assistant Professor	Medicine
Fronek, Arnost, M.D., Ph.D.	Associate Professor	AMES
Galambos, Robert, M.D., Ph.D.	Professor	Neurosciences
Garren, Leonard D., M.D., D.M.D.	Professor	Medicine
Gault, James H. M.D.	Assistant Professor	Medicine
Getoor, Ronald K., Ph.D.	Professor	Mathematics
Giammona, Samuel T., M.D.	Professor	Pediatrics
Gittes, Ruben F., M.D.	Associate Professor	Surgery
Gluck, Louis, M.D.	Professor	Pediatrics
Grobstein, Clifford, Ph.D.	Professor, Dean of the School	Biology
Hagiwara, Susumu, M.D., Ph.D.	Professor	SIO
Halasz, Nicholas A., M.D.	Associate Professor	Surgery
Hamburger, Robert N. M.D.	Professor	Pediatrics
Hammel, Harold T., Ph.D.	Professor	SIO
Harris, Seymour E., Ph.D.	Professor	Economics
Hougie, Cecil, M.B.	Professor	Pathology
Intaglietta, Marcos, Ph.D.	Assistant Professor	AMES
Jones, Oliver W., M.D.	Associate Professor	Medicine
Kaplan, Nathan, Ph.D.	Professor	Chemistry
Kisch, Arnold, M.D.	Associate Professor	Community Medicine
Kniazeff, Alexis J., D.V.M., Ph.D.	Professor	Medicine
Lampert, Peter W., M.D.	Professor	Pathology
Lange, G. David, Ph.D.	Assistant Professor	Neurosciences

Lasser, Elliott C., M.D.	Professor	Radiology
Lein, Allen, Ph.D.	Professor	Medicine
Liebow, Averill A., M.D.	Professor	Pathology
Lindsley, Dan L., Ph.D.	Professor	Biology
Livingston, Robert B., M.D.	Professor	Neurosciences
Mandell, Arnold J., M.D.	Professor	Psychiatry
Mani, Richard, M.D.	Assistant Professor	Radiology
Masouredis, Serafeim P., M.D., Ph.D.	Professor	Pathology
Mayer, Steven E., Ph.D.	Professor	Medicine
McGuire, William J., Ph.D.	Professor	Psychology
Moser, Kenneth M., M.D.	Associate Professor	Medicine
Nguyen-Huu, Xuong, Ph.D.	Assistant Professor	Physics/Biology
Nyhan, William L., M.D., Ph.D.	Professor	Pediatrics
O'Brien, John S., M.D.	Associate Professor	Neurosciences
O'Neil, Thomas M., Ph.D.	Assistant Professor	Physics
Orloff, Marshall J., M.D., Ph.D.	Professor	Surgery
Peters, Richard M., M.D.	Professor	Surgery
Pool, Peter E., M.D.	Assistant Professor	Medicine
Price, Paul A., Ph.D.	Assistant Professor	Biology
Reuter, Stewart R., M.D.	Associate Professor	Radiology
Robinson, Arthur B., Ph.D.	Assistant Professor	Biology
Ross, John, Jr., M.D.	Professor	Medicine
Roth, Thomas F., Ph.D.	Assistant Professor	Biology
Russell, Percy J., Ph.D.	Associate Professor	Biology
Seegmiller, Jarvis E., M.D.	Professor	Medicine
Shimkin, Michael B., M.D.	Professor	Community Medicine
Simon, Allan L., M.D.	Associate Professor	Radiology
Simon, Harold J., M.D., Ph.D.	Associate Professor	Community Medicine
Sobel, Burton E., M.D.	Assistant Professor	Medicine
Spooner, Charles E., Ph.D.	Assistant Professor	Neurosciences
Steinberg, Daniel, M.D., Ph.D.	Professor	Medicine
Stokes, Joseph, III, M.D.	Professor	Community Medicine
Talner, Lee B., M.D.	Assistant Professor	Radiology
Tisi, Gennaro M., M.D.	Assistant Professor	Medicine
Tschirgi, Robert D., M.D., Ph.D.	Professor	Neurosciences
Varon, Silvio, M.D., Eng.D.	Associate Professor	Biology
vonEssen, Carl F., M.D.	Professor	Radiology

West, John B., M.D., Ph.D.	Professor	Medicine
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
Zettner, Alfred, M.D.	Professor	Pathology
Zweifach, Benjamin W., Ph.D.	Professor	AMES

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 with graduate degrees in oceanography 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 seven curricular groups—biological oceanography, physical oceanography, marine biology, marine geology, marine chemistry, geophysics, and applied ocean sciences. The 53 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
Anderson, Victor C., Ph.D.	Professor	APIS
Arrhenius, Gustaf O., Ph.D., D.Sc.	Professor	SIO
Arthur, Robert S., Ph.D.	Professor	SIO
Backus, George E., Ph.D.	Professor	SIO
Benson, Andrew A., Ph.D.	Professor	SIO
Bramlette, Milton N., Ph.D.	Professor Emeritus	SIO
Bullard, Edward, Ph.D.	Professor	SIO
Bullock, Theodore H., Ph.D.	Professor	Neurosciences
Cox, Charles S., Ph.D.	Professor	SIO
Craig, Harmon, Ph.D.	Professor	SIO
Curray, Joseph R., Ph.D.	Associate Professor	SIO
Davis, Russ E., Ph.D.	Assistant Professor	SIO
Duntley, Seibert Q., Sc.D.	Professor	SIO
Eckart, Carl, Ph.D.	Professor	SIO/Physics
Engel, A. E. J., Ph.D.	Professor	SIO
Enright, James T., Ph.D.	Associate Professor	SIO
Fager, E. W., Ph.D., D.Phil.	Professor	SIO
Faulkner, D. J., Ph.D.	Assistant Professor	SIO
Fox, Denis L., Ph.D.	Professor	SIO
Garrels, Robert M., Ph.D.	Professor	SIO
Gibson, Carl H., Ph.D.	Assistant Professor	AMES/SIO

Gieskes, Joris M. T. M., Ph.D.	Assistant Professor	SIO
Gilbert, J. Freeman, Ph.D.	Professor	SIO
Goldberg, Edward D., Ph.D.	Professor	SIO
Hagiwara, Susumu, M.D., Ph.D.	Professor	SIO
Hammel, Harold T., Ph.D.	Professor	SIO
Haubrich, Richard A., Ph.D.	Professor	SIO
Hawkins, James W., Jr. Ph.D.	Assistant Professor	SIO
Haxo, F. T., Ph.D.	Professor	SIO
Hendershott, Myrl C., Ph.D.	Assistant Professor	SIO
Hessler, Robert R., Ph.D.	Associate Professor	SIO
Holland, Nicholas D., Ph.D.	Assistant Professor	SIO
Hubbs, Carl L., Ph.D.	Professor Emeritus	SIO
Inman, Douglas L., Ph.D.	Professor	SIO
Isaacs, John D., B.S.	Professor	SIO
Johnson, Martin W., Ph.D.	Professor Emeritus	SIO
Keeling, Charles D., Ph.D.	Professor	SIO
Lal, Devendra, Ph.D.	Professor	SIO
Lewin, Ralph A., Ph.D.	Professor	SIO
MacIntyre, Ferren, Ph.D.	Assistant Professor	SIO
McEwen, George F., Ph.D.	Professor Emeritus	SIO
McGowan, John A., Ph.D.	Associate Professor	SIO
Menard, Henry W., Jr., Ph.D.	Professor	SIO
Mullin, Michael M., Ph.D.	Assistant Professor	SIO
Munk, Walter H., Ph.D.	Professor	SIO
Newman, William A., Ph.D.	Assistant Professor	SIO
Nierenberg, William A., Ph.D.	Professor, Dean of the Institution	Physics
Parker, Robert L., Ph.D.	Assistant Professor	SIO
Peterson, Melvin N., Ph.D.	Associate Professor	SIO
Phleger, Fred B, Ph.D.	Professor	SIO
Raitt, Russell W., Ph.D.	Professor	SIO
Rakestraw, Norris W., Ph.D.	Professor Emeritus	SIO
Revelle, Roger R., Ph.D.	Professor Emeritus, Director Emeritus	SIO
Rosenblatt, Richard H., Ph.D.	Associate Professor	SIO
Schaefer, Milner B., Ph.D.	Professor	SIO
Scholander, P. F., M.D., Ph.D.	Professor	SIO

Shepard, Francis P., Ph.D.	Professor Emeritus	SIO
Shor, George G., Jr., Ph.D.	Professor	SIO
Spiess, Fred N., Ph.D.	Professor	SIO
Taft, Bruce A., Ph.D.	Assistant Professor	SIO
Vacquier, Victor, M.A.	Professor	SIO
Van Atta, Charles W., Ph.D.	Assistant Professor	AMES/SIO
Volcani, Benjamin E., Ph.D.	Professor	SIO
Wheelock, Charles D., M.S.	Professor Emeritus	SIO
Winterer, Edward L., Ph.D.	Professor	SIO
Wooster, Warren S., Ph.D.	Professor	SIO
ZoBell, Claude E., Ph.D.	Professor	SIO

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 600,000 volumes and receives 20,000 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 Central University Library Building, under construction, is to be completed in 1970.

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, in the Basic Sciences Building of the Medical School, contains research collections in biology and medicine. 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

During most of the 1969-70 academic year, the UCSD Computer Center expects to be operating two major computer systems. The CDC 3600 computer, which has been in operation since 1964, will be phased out of service by the summer of 1970. A new Burroughs B6500 system, with extensive facilities for communications with remote devices, will replace the 3600 starting in the summer of 1969. Together with the new system will come an expansion of services into a variety of computing fields not previously served on campus.

The central facility provides computing services to be used in connection with instruction in many fields, in connection with research activities, and in connection with campus administration. Most students and staff do their own programming. Open-shop access to the central computer is available to any programmer via any one of a number of remotely located Input/Output terminals. Large programs are run on a closed shop basis by a professional operations staff. Non-credit programming courses are offered at frequent intervals in several programming languages, and at several levels of sophistication. These courses supplement the credit courses which are offered by several academic departments on computer programming and methods. The Center also provides consultants to aid programmers on special problems.

The Computer Center regularly engages in the development of newer and more advanced systems. Most of this development is for software to run on present or planned equipment. Both students, on part time employment status, and full time staff members participate in the development work. Frequently, part time employment in the Center provides support for students working on advanced degrees in Information and Computer Science. Projects currently under way relate to: (*a*) communications between the central facility and remotely located small computers; (*b*) general purpose data management systems; (*c*) systems to make the computer more useful in educational applications.

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 Physics and Information Science, 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 Physics and Information Science, 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 Physics and Information Science, 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 turbulence research, 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 of California Extension is a flexible, active system that seeks out and interprets the needs of the community it serves and then focuses the skills and resources of the University on those needs. Its 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.
5. Public affairs education through programs designed to aid adults in meeting their responsibilities as citizens.

The University 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 enroll in University 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.

At present, the program is established on campuses in Jerusalem, Beirut, Gottingen, the United Kingdom, Dublin, Bordeaux, Madrid, Hong Kong, Lund, Padua, Tokyo, Mexico and Nairobi and Accra. A new program for teachers of French will open in Paris in 1969-70 and additional international centers may be established in future years.

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, proficiency in the language of the country, an overall 2.75 grade-point average (except for the United Kingdom where a 3.0 grade point average is required), 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 program.) 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 fall and winter quarters or the spring and summer 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 1970-71 will be accepted from September 29, 1969, through January 16, 1970. (Applications for the United Kingdom and Ireland must be filed no later than November 14, 1969.)

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. Fees submitted with duplicate applications will not be refunded.

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.

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.

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. A student who fails to register in the quarter for which he was admitted and who thereafter applies and is admitted to a subsequent quarter, must return a new *statement of intention to register* together with the nonrefundable fee of $50.00.

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 score of 550 or better in the CEEB Achievement Test in English composition, *or*
2. Achieving a grade of 5, 4, or 3 in the College Entrance Examination Board (CEEB) Advanced Placement Examination in English, *or*
3. Achieving an acceptable score in the CEEB College Level General Examination in English, *or*
4. Entering the University with credentials showing the completion of an acceptable college-level course of 4 quarter units or 3 semester units in English composition with a grade of C or better.

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 enroll 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.

Foreign Students

All foreign students, unless their native language is English, must take an English examination which is administered by the Office of International Education before the beginning of each quarter. Failure to pass the examination may result in the student being required to enroll in courses designed for those whose native language is not English.

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 enroll.

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. 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 for 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 1, 1969 (SAT only)	October 1, 1969
December 6, 1969	November 5, 1969
January 10, 1970	December 10, 1969
March 7, 1970	February 4, 1970
May 2, 1970	April 1, 1970
July 11, 1970	June 10, 1970

Applicants should arrange to take the tests as early as possible so that designed to admit nonresident applicants whose standing, as measured by

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.

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 for 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
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Applicants should arrange to take the tests as early as possible so that designed to admit nonresident applicants whose standing, as measured by

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 unit credit toward a degree will be granted for courses completed at a junior college, although subject credit may still be earned.

Each college at UCSD has its own set of breadth requirements (see college descriptions). These requirements consist of a certain number of units and courses covering a variety of fields. The courses so indicated may be taken at the University of California or elsewhere. The list of courses and their descriptions may be used by prospective transfer students as a guide in selecting courses of similar content and purpose offered in their own institutions. Students attending a California junior college should consult their counselors to determine which junior college courses are appropriate and are accepted in satisfaction of the breadth requirements by the college of the University in which they plan to enroll.

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 provost of the college in which the student plans to enroll.

Nonresident Applicants

It has been necessary to place some limitation on enrollment 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 applicant 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 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 language 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 basically the same for foreign students as for domestic students. It is recognized, however, that often a foreign student cannot fulfill all of the subject requirements although he will be expected to demonstrate adequate preparation for his chosen field. Only those applicants who present evidence of above average scholarship achievement will be considered for admission.

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

GRADUATE STANDARDS OF ADMISSION

General Requirements

An applicant for admission to the University for graduate studies and research must present evidence of his preparation and capacity for advanced work in one of the departments of instruction. He should hold a bachelor's degree or the equivalent, and his background should be comparable to that provided by an appropriate undergraduate program in the University of California.

Applicants are evaluated in terms of their scholastic qualifications and preparation for their proposed major field of study. A scholastic average equivalent to B or better in an acceptable undergraduate program is required. The Dean of Graduate Studies or the prospective major department may deny admission if the applicant's scholastic record is undistinguished, if his preparation is judged inadequate as a foundation for advanced work, or if the department's facilities are already filled to capacity.

Students who do not meet the requirements for admission for graduate studies and research but who seek a graduate degree may petition to be admitted as limited undergraduate students for the purpose of correcting deficiencies. An applicant will not be admitted to limited status for the sole purpose of raising a low scholastic average.

Procedures

A prospective graduate student should file with his proposed major department a completed application form and a transcript of his record from each college and university he has attended. An application fee of $10 must be paid before official admission can be granted.

An applicant who is also seeking financial assistance is required to submit his scores on the verbal and quantitative tests of the Graduate Record Examination, and other applicants are urged to provide these scores. This is especially important for those students whose grade-point averages are near the minimum required for admission to regular graduate status. Information concerning the Graduate Record Examination can be obtained from the Educational Testing Service, P.O. Box 1025, Berkeley, California 94720, or P.O. Box 592, Princeton, New Jersey 08540.

A single form is used to apply both for admission and for fellowships and assistantships. This form and all supporting materials should be filed with the applicant's prospective major department at least two months before the opening of the quarter in which he plans to enroll. Applicants seeking financial assistance must file their materials by February 1. The forms and more detailed instructions may be obtained from the departments, from the Office of Admissions, or from the Office of Graduate Studies and Research. Some departments have special procedures; applicants are urged to communicate with their prospective major departments as early as possible.

Returning students applying for readmission must submit transcripts for any academic work taken since they last enrolled in the University of California, San Diego. Such students are also urged 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.

Applicants from Other Countries

Applicants from outside the United States must satisfy the same requirements for admission as native applicants. In addition to an acceptable professional background, such applicants must have sufficient command of the English language to benefit from graduate study at UCSD. They must also possess sufficient funds to cover all fees, transportation, and living expenses connected with their stay at the University.

Since education outside the United States is often based upon systems or methods different from our own, it is important that a foreign applicant submit evidence that his academic background is substantially equivalent to that provided by an acceptable undergraduate program in the United States.

An applicant from outside the United States should arrange to have his application form and all supporting materials in the hands of his prospective major department at least four months before the beginning of the quarter in which he plans to enroll. A deadline of February 1 for submitting these materials applies to domestic and foreign students alike who are seeking financial assistance.

Every student whose native language is not English and whose undergraduate education was conducted in a language other than English must take the *Test of English as a Foreign Language* (TOEFL) before coming to UCSD. Arrangements for taking this test are made through 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 participate effectively in his proposed graduate program at UCSD.

Foreign students are required to obtain 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 to the UCSD Office of International Education, Building 250, Matthews Campus, which can assist them in making a smooth transition from their undergraduate education abroad to graduate studies and research at UCSD.

Non-Degree Study

Most students are enrolled for degrees, but under special circumstances others may be admitted for non-degree graduate study. Such students must meet the same admission requirements as those who intend to earn degrees and must apply to and be accepted for admission to a specific department.

Duplication of Higher Degrees

The duplication of advanced degrees is discouraged. A student who has received a master's degree 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 scholars to do postdoctoral work with members of the UCSD faculty. All interested candidates should make arrangements with the relevant department or research unit. Upon arrival, postdoctoral scholars should apply at the Office of the Registrar for official evidence which establishes 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 this service.

The University of California has always been hospitable to faculty members and researchers from other institutions who wish to visit UCSD during sabbatical leaves and leaves of absence. Facilities for study are made available whenever possible. Arrangements should be made through the relevant department or research unit.

Muir College

THE CHARACTER OF THE COLLEGE

John Muir College is a community engaged in inquiry and the exchange of ideas that reach beyond the classrooms into many aspects of life in the community and contemporary society.

The buildings of the college facilitate integration of learning and living. Small classrooms are 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. Through the generosity of Mr. Ernest W. Mandeville, the first Honorary Fellow of John Muir College, a suite for distinguished visitors is provided in one of the residence halls. Students not living in the residence halls are able to participate fully in the life of the college. The lounge areas of the college are planned to include them; they have ample room for storing books and equipment; and there are 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.

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. Thus, for example, the fine arts courses include periods of studio work or its equivalent. All first-year students are required to complete a course in contemporary issues. There is 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 work 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. 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 are eligible for various forms of an honors program which is being developed as the college grows larger. 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 Graduation Requirements

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. Satisfy the University of California requirement in American History and Institutions. (See *Rules and Procedures: American History and Institutions.*)
4. Pass 45 full courses or their equivalent. During his upper-division years a student must take at least nine courses within the college.
5. Fulfill the general education requirements described below. Exemption from part or all of the course work taken to fulfill 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 fulfill 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 fulfill 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 fulfill 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 enrollment.
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 sciences and psychology 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 approved by the faculty. 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 offered at the junior-senior level. Therefore, students who do not plan to major in science may enroll in science courses in the freshman and sophomore years or 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 physics and information science should take the courses numbered 2A through 2E. Students planning to major in biology should take the courses numbered 3A through 3E. The courses in these two sequences also serve to fulfill the science requirement of the College.

Full information regarding the science courses will be available at each enrollment 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 supervision of a Director 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 fulfill 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 fulfill the cultural traditions requirement may offer opportunities to demonstrate 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 fulfill 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 are available in the college. Interdisciplinary programs are being developed.

- Anthropology
- Applied Physics and Information Science*†
- Biology*†
- History
- Linguistics
- Literature
- Mathematics*
- Music
- Psychology*
- Sociology
- Visual Arts†

*Requires a particular mathematics sequence.

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

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.

Freshmen-Faculty Discussion Groups

It is the wish of the college that all freshmen participate in discussion meetings of small groups which include a member of the faculty. Those who enroll in a Contemporary Issues Seminar, in Applied Physics and Information Science 10, in Science 2A, or in Science 2B, are automatically involved in such meetings by virtue of the organization of these courses. For those not so enrolled, the college offers in all three terms informal weekly colloquia designed to welcome the newcomer into Muir College. Every discussion group is led by a faculty member. Typically there will be from three to ten students in a group. The topic for discussion for the quarter may be chosen from a long list. A few examples from last year are racism, topics from Mathematics 1A, Chinese poetry, modern art, the Book of Ecclesiastes, and chamber music. A list of topics for a given term will be provided with the registration material, together with instructions for joining a specific group.

Because of the limits on available openings in the groups, students enrolled in a Contemporary Issues Seminar (APIS 10, Science 2A, or Science 2B) may join a group only by special permission of the faculty member leading it.

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 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 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: The mathematics requirement must be met before the end of the sophomore year. Thus the student 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 fulfill the language requirement. 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 physics and information science or biology or in taking other advanced courses in the physical sciences.

Fall	Winter	Spring
Elective	Science	Science
Science or 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 the physical sciences should not be started until the students have completed either Mathematics 1A or 2A. Therefore their science is undertaken in the winter term. Those planning to do advanced work in Biology may begin their science sequence in the fall term. This example assumes that the student using it has to do a full year of language work and that he has decided to fulfill his humanities and fine arts requirement in the first year by studying music for three terms. The student may have 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 3	Music 4	Music 5
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 3. 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
Science or	Second Course in a Cultural Tradition	Third Course in a Cultural Tradition
First 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 move on toward courses normally taken in the second year or even later. In this example, the student is shown enrolled in a Cultural Tradition Sequence, which freshmen ordinarily do not take.

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 at least five preparatory courses, which are begun in the freshman year. Other students may take any four courses approved for the science requirement including 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.

The Faculty of Muir College

Name	Title	Department
Alazraki, Jaime, Ph.D.	Associate Professor	Literature
Allen, Don C., Ph.D.	Professor	Literature
Altman, Allan, Ph.D.	Assistant Professor	Mathematics
Anderson, Norman H., Ph.D.	Professor	Psychology
Antin, David, M.A.	Assistant Professor	Visual Arts
Axford, William I., Ph.D.	Professor	APIS/Physics
Baldessari, John A., Ph.D.	Assistant Professor	Visual Arts
Banks, Peter M., Ph.D.	Assistant Professor	APIS
Baron, Samuel H., Ph.D.	Professor	History
Benamou, Michel, Ph.D.	Professor	Literature
Bercovitch, Sacvan, Ph.D.	Assistant Professor	Literature
Berman, Ronald S., Ph.D.	Professor	Literature
Booker, Henry G., Ph.D.	Professor	APIS
Bowles, Kenneth L., Ph.D.	Professor	APIS
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 M., 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
Cohen, Alain J. J., Ph.D.	Assistant Professor	Literature
Coles, William A., Ph.D.	Assistant Professor	APIS
de Laix, Roger A., Ph.D.	Assistant Professor	History
De Moss, John A., Ph.D.	Professor	Biology
Deutsch, J. Anthony, Ph.D.	Professor	Psychology
Dolin, Edwin F., Jr., Ph.D.	Assistant Professor	Literature
Donald, John D., Ph.D.	Assistant Professor	Mathematics
Douglas, Jack D., Ph.D.	Associate Professor	Sociology

Eckart, Carl, Ph.D.	Professor	Physics/SIO
Erickson, Robert, M.A.	Professor	Music
Evans, John W., M.D., Ph.D.	Assistant Professor	Mathematics
Fejer, Jules A., D.Sc.	Professor	APIS
Fillmore, Jay P., Ph.D.	Assistant Professor	Mathematics
Flanigan, Francis J., Ph.D.	Assistant Professor	Mathematics
Fussell, Edwin S., Ph.D.	Professor	Literature
Gaburo, Kenneth L., Dr.Mus.Arts	Professor	Music
Gragg, William B., Jr., Ph.D.	Assistant Professor	Mathematics
Green, David M., Ph.D.	Professor	Psychology
Guillen, 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	APIS
Holland, John J., Ph.D.	Professor	Biology
Jacobs, Irwin M., Sc.D.	Associate Professor	APIS
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.	Associate 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
Levy, Robert I., M.D.	Professor	Anthropology
Lewak, George J., Ph.D.	Assistant Professor	APIS
Lewallen, Donald G., M.A.	Assistant Professor	Visual Arts
Lindsay, Peter H., Ph.D.	Assistant Professor	Psychology
Lohmann, Adolf W., Ph.D.	Professor	APIS
Lowe, Keith D., Ph.D.	Assistant Professor	Literature
Luo, Huey-Lin, Ph.D.	Assistant Professor	APIS
Manaster, Alfred B., Ph.D.	Assistant Professor	Mathematics
Mandler, George, Ph.D.	Professor	Psychology
Masry, Elias, Ph.D.	Assistant Professor	APIS
McGill, William J., Ph.D.	Professor	Psychology
Michels, Joseph W., Ph.D.	Assistant Professor	Anthropology
Mills, Stanley E., Ph.D.	Professor	Biology
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 E., Ph.D.	Assistant Professor	History
Perrin, Charles L., Ph.D.	Assistant Professor	Chemistry
Reynolds, George S., Ph.D.	Professor	Psychology
Reynolds, Roger, M.M.	Associate Professor	Music
Rodin, Burton, Ph.D.	Associate Professor	Mathematics
Rohrl, Helmut, Ph.D.	Professor	Mathematics
Rosenblatt, Murray, Ph.D.	Professor	Mathematics
Rotenberg, Manuel, Ph.D.	Associate Professor	APIS
Rumsey, Victor H., D.Eng.	Professor	APIS
Sato, Gordon H., Ph.D.	Professor	Biology
Saville, Jonathan, Ph.D.	Assistant Professor	Literature
Schalkwijk, Johan P., Ph.D.	Assistant Professor	APIS
Sharpe, Michael J., Ph.D.	Assistant Professor	Mathematics
Silber, John J., Ph.D.	Professor	Music
Smith, Douglas W., Ph.D.	Assistant Professor	Biology
Soulé, Michael E., Ph.D.	Assistant Professor	Biology
Spiro, Melford E., Ph.D.	Professor	Anthropology
Stewart, John L., Ph.D.	Professor, Provost of the College	Literature
Swartz, Marc J., Ph.D.	Professor	Anthropology
Thiess, Frank B., Ph.D.	Assistant Professor	Mathematics
Todd, Michael E., M.A.	Assistant Professor	Visual Arts
Tureck, Rosalyn	Professor	Music
Turetzky, Bertram J., M.A.	Assistant Professor	Music
Warschawski, Stefan E., Ph.D.	Professor	Mathematics
Wavrik, John J., Ph.D.	Assistant Professor	Mathematics
Wilden, Anthony G., Ph.D.	Assistant Professor	Literature
Wilhelmy, Roland, Ph.D.	Assistant Professor	Psychology
Yip, Wai-lim, Ph.D.	Assistant Professor	Literature
York, Herbert F., Ph.D.	Professor	Physics

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Honorary Fellows of the College

Georg von Běkěsy, *Psychologist and Nobel Laureate*
Ernst Krenek, *Composer*
Ernest Mandeville, *Philanthropist*
Claude E. Shannon, *Mathematician*
Robert Penn Warren, *Poet and Novelist*

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 fulfill 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 enrollment 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 fulfill 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 enrolls in one or the other sequence depending on his prior preparation in mathematics and his SAT and Mathematics Achievement Test scores. 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

*Students who have completed college courses in calculus or who present Advanced Placement Credit in Mathematics may not receive credit for mathematics courses which duplicate their advanced standing work.

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, philosophical 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 fulfillment 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* or Elective or Natural Science 1A	Natural Science 1B or 2A	Natural Science 2B or Elective

SOPHOMORE YEAR

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

*A student may enroll in a course in drama, music or visual arts to meet the Fine Arts requirement in any of the six quarters in which he has room to schedule a class that interests him.

**Not offered Fall, 1969.

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, Economics, Literature, Philosophy, and Physics.

The major program requires a minimum of 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. (See *Rules and Procedures: American History and Institutions.*)
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). Indi-

vidual departments may require 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 are Honors, High Honors, and Highest Honors. To be eligible for College Honors, a student must have completed at least 20 courses (80 quarter units) in the University of California and have the recommendation of his major department.

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 any University of California campus. (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
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
Blume, Bernhard, Ph.D.	Professor	Literature
Block, Barry, Ph.D.	Assistant Professor	Physics
Bond, Frederick T., Ph.D.	Assistant Professor	Chemistry
Bradner, Hugh, Ph.D.	Professor	AMES
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	AMES
Butler, Warren L., Ph.D.	Professor	Biology
Casalduero, Joaquin, Ph.D.	Professor	Literature
Chen, Joseph Cheng-Yih, Ph.D.	Associate Professor	Physics
Chodorow, Stanley A., Ph.D.	Assistant Professor	History
Clark, Leigh B., Ph.D.	Assistant Professor	Chemistry
Conlisk, John, Ph.D.	Associate Professor	Economics
Craig, Harmon, Ph.D.	Professor	SIO
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	AMES
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, Acting Provost of Third College	Physics
Fredkin, Donald R., Ph.D.	Associate Professor	Physics
Freeman, Gary L., Ph.D.	Assistant Professor	Biology
Fung, Yuan-cheng, Ph.D.	Professor	AMES
Gibson, Carl H., Ph.D.	Assistant Professor	AMES/SIO
Goodkind, John M., Ph.D.	Associate Professor	Physics
Gould, Robert J., Ph.D.	Associate Professor	Physics
Green, Melvin H., Ph.D.	Associate Professor	Biology
Grobstein, Clifford, Ph.D.	Professor	Biology

Halkin, Hubert, Ph.D.	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	SIO
Hayashi, Masaki, Ph.D.	Assistant Professor	Biology
Hegemier, Gilbert A., Ph.D.	Assistant Professor	AMES
Helinski, Donald R., Ph.D.	Associate Professor	Biology
Hinton, Sam	Lecturer	Literature
Holbrook, John A., Ph.D.	Assistant Professor	Mathematics
Hooper, John W., Ph.D.	Professor	Economics
Huang, Nai-Chien, Ph.D.	Assistant Professor	AMES
Humphreys, Tom D., II, Ph.D.	Assistant Professor	Biology
Intaglietta, Marcos, Ph.D.	Assistant Professor	AMES
Jackson, Gabriel, Ph.D.	Professor	History
Kamen, Martin D., Ph.D.	Professor	Chemistry
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	AMES
Liebermann, Leonard N., Ph.D.	Professor	Physics
Lin, Shao-Chi, Ph.D.	Professor	AMES
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
Makkreel, Rudolph 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	AMES
Miller, David R., Ph.D.	Assistant Professor	AMES
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	AMES
Nemat-Nasser, Siavouche, Ph.D.	Assistant Professor	AMES
Nguyen-Huu, Xuong, Ph.D.	Assistant Professor	Physics/Biology
Norman, Donald A., Ph.D.	Associate Professor	Psychology
Norton, David F., Ph.D.	Assistant Professor	Philosophy
Olfe, Daniel B., Ph.D.	Associate Professor	AMES
O'Neil, Thomas M., Ph.D.	Assistant Professor	Physics
Orr, Daniel, Ph.D.	Professor	Economics
Pawula, Robert F., Ph.D.	Assistant Professor	AMES
Pearce, Roy H., Ph.D.	Professor	Literature
Penner, Stanford S., Ph.D.	Professor	AMES
Peterson, Laurence E., Ph.D.	Associate Professor	Physics
Piccioni, Oreste, Ph.D.	Professor	Physics
Popkin, Richard H., Ph.D.	Professor	Philosophy
Ramanathan, Ramachandra, Ph.D.	Assistant Professor	Economics
Rand, Sinai, Ph.D.	Associate Professor	AMES
Randel, Fred V., Ph.D.	Assistant Professor	Literature
Roberson, Robert E., Ph.D.	Professor	AMES
Ruff, Larry E., Ph.D.	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
Schane, Sanford A., Ph.D.	Associate Professor	Linguistics
Schneider, Alan M., Sc.D.	Professor	AMES
Schrauzer, Gerhard N., Ph.D.	Professor	Chemistry
Schulman, Herbert M., Ph.D.	Assistant Professor	Biology
Schultz, Sheldon, Ph.D.	Associate Professor	Physics
Sham, Lu Jeu, 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	AMES
Spaethling, Robert H., Ph.D.	Professor	Literature
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	AMES
Vernon, Wayne, Ph.D.	Assistant Professor	Physics
Vold, Robert L., Ph.D.	Assistant Professor	Chemistry
Watson, Joseph W., Ph.D.	Assistant Professor	Chemistry
Weare, John H., Ph.D.	Assistant Professor	Chemistry
Wheatley, John C., Ph.D.	Professor	Physics
Wheeler, John C., Ph.D.	Assistant Professor	Chemistry
Wierschin, Martin W., Ph.D.	Assistant Professor	Literature
Williams, Forman A., Ph.D.	Professor	AMES
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	AMES

The Graduate Division

GRADUATE DEGREES OFFERED AS OF 1969-70

Applied Physics	M.S.,	Ph.D.
Information and Computer Science	M.S.,	Ph.D.
Biology	M.S.,	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 Mechanics	M.S.,	Ph.D.
Bioengineering	M.S.*,	Ph.D.*
Engineering Physics	M.S.,	Ph.D.
History	M.A.,	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	M.A.*,	Ph.D.*
Neurosciences		Ph.D.*
Oceanography	M.S.,	Ph.D.
Philosophy	M.A.,	Ph.D.
Physics	M.S.,	Ph.D.
Psychology	M.A.,	Ph.D.
Visual Arts	M.F.A.*	

*Final approval pending.

The Nature of Graduate Instruction

Graduate courses normally carry a number in the 200 series and may be conducted in any of several ways:

1. As formal lecture courses;
2. As seminars in which faculty and students participate;
3. As independent reading or study under faculty supervision;
4. As research projects carried on under faculty supervision.

Work toward the Ph.D. degree requires a considerable amount of independent study and research. Therefore, students are allowed great flexibility in enrollment subject only to certain broad restrictions. (See *Rules and Procedures: Graduate Student Registration* and *Study-List Limits.*)

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.

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 selected in consultation with his departmental adviser. In this case a longer period of residence may be required 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 advised to acquire the best possible preparation in languages before entering graduate school.

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.

The first attempt at an ETS examination is provided without charge; reexaminations are administered at a cost of $6 each. Special courses in required foreign languages are available for students who wish to prepare for the examinations. (See *Interdisciplinary Courses: Languages.*)

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 to continue in good standing must maintain a minimum grade-point average of 3.0 (B) in all courses taken in graduate status at UCSD. Failure to do so makes a student subject to dismissal, and ineligible for graduate degrees.

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 fulfillment of the requirements for the master's degree.

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 and must be approved by the major department concerned and by the Dean of Graduate Studies. Advancement to candidacy shall be accomplished 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. (See *Rules and Procedures: Study-List Limits.*)

Graduate Work at Other Campuses of the University of California

With the approval of the department concerned and of the Dean of Graduate Studies work completed at other campuses of the University of

California may satisfy one of the three quarters of the residence and one-half the quarter units required for the master's degree at UCSD.

Graduate Work Completed Elsewhere

With the approval of the department concerned and of the Dean of Graduate Studies a maximum of eight quarter units of credit for work completed at another institution may be applied toward a master's degree at UCSD.

Thesis

Students studying under Plan I (Thesis Plan) must prepare their thesis in accord with the "Instructions for the Preparation and Submission of Doctoral Dissertations and Masters' Theses" which is available through the Office of the Registrar. Reprints from publications which have resulted from thesis research may be used in part or in whole in lieu of the usual thesis format if procedures set forth in the "Instructions" are respected. The University Librarian is responsible to the Graduate Council for conformity to the criteria established for thesis preparation.

THE DOCTOR OF PHILOSOPHY DEGREE

The degree, Doctor of Philosophy, is awarded by the University of California to candidates who have mastered in depth the subject matter of their discipline and displayed, in addition, an ability to make original contributions to knowledge in their field. More generally, the degree constitutes an affidavit of critical aptitude in scholarship, imaginative enterprise in research, proficiency and style in communication including, in most departments, proficiency in teaching.

Program of Study

The student's program of study is determined in consultation with his adviser who supervises his activities until the appointment of his Doctoral Committee. Each student's program of study, designed with flexibility for individual needs and interests, lies within the scope of the departmental program which has been approved by the Graduate Council.

A doctoral program generally involves two stages. The first stage requires at least three academic quarters of residence, and is spent in fulfilling the requirements established by the Graduate Council and by the major department (course work, teaching, departmental examinations, etc.). When the department considers the student ready to take the Qualifying Examination, it arranges for the appointment of a Doctoral Committee. When the student passes the qualifying examination administered by the Doctoral Committee and is advanced to candidacy, the first stage is complete. The second stage is devoted primarily to research and to the preparation of the dissertation. At least three academic quarters must elapse from the date of advancement to candidacy to the taking of the final examination.

Residence Requirement

The residence requirement for the degree, Doctor of Philosophy, is six quarters. At least three of the six quarters must be in continuous residence at UCSD. (See *Rules and Procedures: Study-List Limits.*)

Qualifying Examination and Doctoral Committee

Upon nomination of the concerned department, a doctoral committee is appointed by the Dean of Graduate Studies acting on behalf of the Graduate Council. This committee conducts the qualifying examination, supervises and passes upon the dissertation, and conducts the final oral examination. The committee consists of five or more members selected in accord with Senate Regulations. For a variety of reasons a doctoral committee may have to be reconstituted by the Dean of Graduate Studies in accord with departmental nomination.

Unless the reports of the doctoral committee on the various examinations are unanimous, the Dean of Graduate Studies shall be called upon to review the case and report his findings to the Graduate Council which shall determine appropriate action.

Advancement to Candidacy

A formal application for advancement to candidacy for the doctorate must be made through the Office of the Registrar and must be approved by the chairman of the student's doctoral committee, by the major department concerned, and by the Dean of Graduate Studies. Application should be made immediately upon satisfactory completion of the qualifying examination. A fee of $25 must be paid with the application. Advancement to candidacy shall be accomplished at least three quarters prior to the final examination.

Dissertation

A dissertation is required of every candidate for the Ph.D. degree. It must bear on his major area of study, show evidence of his ability to do independent research, and be approved by the candidate's doctoral committee.

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. In accord with procedures set forth in "Instructions for the Preparation and Submission of Doctoral Dissertations and Masters' Theses" available from the Office of the Registrar, reprints from such prior publications may be used either in part or in whole in lieu of the usual dissertation format.

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.

Final Examination

The candidate's final examination is conducted by his doctoral committee. The examination is oral and deals primarily with the dissertation. The report of the final examination is not approved by the Dean of Graduate Studies until the dissertation has been accepted by the University Librarian, who is responsible to the Graduate Council for conformity to the criteria established for dissertation preparation. Approval of the "Report on Final Examination . . ." represents the final step in a candidate's doctoral program.

The Candidate in Philosophy Degree

Several of the departments with programs leading to the Ph.D. recommend the award of the intermediate degree of Candidate in Philosophy when the student is advanced to candidacy for the Ph.D. The minimum residence requirement for the C. Phil. degree is four quarters, three of which, ordinarily the last three, must be spent at UCSD. Students are not admissable to graduate study if they intend taking the C. Phil. degree as terminal.

Joint Doctoral Programs

Certain departments in the several campuses of the University of California cooperate with similar departments in the California State Colleges to offer joint programs of study leading to the doctorate. Individuals interested in such joint programs should consult the relevant department at either institution for details. At UCSD, a joint program in Chemistry is currently offered in conjunction with San Diego State College.

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)

Each year four or five quite different three-course sequences are offered for the use of Muir students in meeting a general education requirement of the college. The sequences are developd by a special committee of faculty and students in consultation with those who will teach them. The particular cultures to be studied vary from year to year, though some, such as the Afro-American, have attracted such widespread interest that they may be carried over from one year to the next. Other sequences have recently been offered in or are planned for such cultures as Greco-Roman, the Hispanic (including the New World), the Islamic, the Medieval, and the (Asian) Indian.

While no regulation prohibits freshmen from enrolling in these courses, they are conceived in the expectation that most students taking them will be in their second or later years in the college. A descriptive list of the sequences offered for the coming academic year is available in time for the spring pre-enrollment. Inquiries about the program or projected sequences should be addressed to the Provost.

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 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 the 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; neucleosynthesis; 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.

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

Students who wish to do independent reading or research on a problem in Earth Sciences make special arrangements with a faculty member and enroll through the Department of the Scripps Institution of Oceanography for SIO 199.

NOTE:

For Earth Sciences 122, Igneous and Metamorphic Petrology, now see SIO 253A.

For Earth Sciences 123, Sedimentary Petrology, now see SIO 245.

For Earth Sciences 150, Field Geology, now see SIO 256A-256B-256C.

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 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.)

For the 1969-70 academic year, courses in "Frontiers in the Earth Sciences and Oceanography," "Advances in Chemistry and Biology," and "Frontiers in Medical Science," are planned.

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 enroll in the sequence; instead, he is advised to enroll 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 fulfill 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 enroll in Language 19. Prior to registration students should consult the instructor of Language 19 who will establish a program of study 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. See general description above.

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 1969-70.)

Lang/Ru 2A,2B,2C. Intermediate Russian **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 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/Ru 11. Elementary Russian Reading* **F,W,S**
A course designed to prepare students for graduate reading examination.

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.

Language 19. Directed Study* (Half or Full Course) **F,W,S**
See general description above. Self-instructional materials are available at present in Afrikaans, Arabic (Egyptian), Arabic (Iraqi), Burmese, Chinese (Mandarin), Czech, Danish, Dutch, 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 enroll 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 enrollment 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 **F**

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. (Not offered 1969-70.)

1D. Natural Science: Physics **W**

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 **S**

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 enrollment in classes. Included are the courses cited below, which are intended for students planning to major in applied physics and information science, 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 1969-70.

COURSES

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 physics and information science 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.

3A. Science **F**
An introduction to chemistry. Atomic structure and the chemical bond. Emphasis on the structure of molecules related to molecular biology. Required for Muir students majoring in biology. Three hours lecture.

3B. Science **W**
An introduction to thermodynamics and the ideal properties of solutions. Emphasis on applications in molecular biology. Three hours lecture, two 3-hour laboratories.

3C. Science **S**
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, two 3-hour laboratories. Prerequisites: Science 3A-3B.

3D. Science **W**
Organic chemistry: an introduction to the structure, properties, and reactions of organic compounds. Three lectures, one recitation. Prerequisite: Science 3C. Required of Muir students majoring in biology.

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 3-hour laboratories. Prerequisite: Science 3D. Required of Muir students majoring in biology.

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*
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*
S. C. Lin, *Ph.D., Professor of Engineering Physics*
J. W. Miles, *Ph.D., Professor of Applied Mechanics and Geophysics* (Chairman of the Department)
W. Nachbar, *Ph.D., Professor of Applied Mechanics*
S. S. Penner, *Ph.D., Professor of Engineering Physics*
R. E. Roberson, *Ph.D., Professor of Aerospace Engineering*
Alan M. Schenider, *Sc.D., Professor of Aerospace Engineering*
F. A. Williams, *Ph.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* (Resident Dean, Revelle College)
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*

* * *

J. M. Covell, *M.D., Assistant Professor of Medicine and Bioengineering*
D. L. Franklin, *Associate Professor of Medicine and Bioengineering in Residence*

*On leave 1969-70

K. Fronek, *C.Sc., Associate Research Bioengineer, Lecturer*
T. J. Hendricks, *Ph.D., Assistant Research Engineer, Lecturer*
J. Lee, *Ph.D., Assistant Research Engineer, Lecturer*
H. S. Lew, *Ph.D., Assistant Research Engineer, Lecturer*
R. M. Peters, *M.D., Professor of Surgery and Bioengineering*
J. E. Prussing, *Sc.D., Assistant Research Engineer, Lecturer*
G. R. Stegen, *Ph.D., Assistant Research Engineer, Lecturer*
K. G. P. Sulzmann, *Ph.D., Research Engineer, Lecturer*
J. Waugh, *Ph.D., Research Engineering Physicist, Lecturer*
J. L. Way, *Ph.D., Assistant Research Engineer, Lecturer*
J. B. West, *M.D., Ph.D., Professor of Medicine and Bioengineering*

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; those considering a major in electromechanics are advised to take Mathematics 100 and 101 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 physics and information science.

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, thermodynamics and laboratory, represented by AMES 100, 101A, 110, 120A, 120B, 130A, and 170. Those students who have completed Mathematics 100 in the sophomore year are required to complete Mathematics 120, 121, and 122 in the junior year; those who have not done so are required to complete Mathematics 100 in the first quarter of the junior year.

To qualify for a major in AMES, a student must pass, or, in case of transfer students, have the equivalent of 18 courses in the AMES-approved list of courses, of which normally nine courses must be at the level of the 100 series or higher in the AMES department (or biology and chemistry in the case of bioengineering); a more flexible program can be arranged but deviations from these rules require approval by the AMES faculty adviser. Transfer students, who have taken equivalent courses elsewhere, normally must pass at least six courses in the AMES-100 or -200 series of courses on the San Diego campus, except that a larger number may be required at the discretion of the departmental adviser.

To fulfill the departmental scholastic requirements, the grade-point average for the required courses specified above must be at least 2.00.

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 fulfill 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 program 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 fulfill minimum graduation requirements are generally chosen in either mathematics, physics, or applied physics and information science. 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 fulfill 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 170 *______	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 101B **______ ______ ______	AMES 101C ______ ______ ______	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 101 B Chemistry 100B or Chemistry 140B ***______ ______	Biology 101C ***______ ______ ______

*Math 100, if not completed in the sophomore year.
†AMES 171A, 171B are recommended elective half courses. Those students not electing 171A,B, may be required to do some experimental work to meet the requirement of AMES 101A and AMES 130A.
§Those students who choose to continue their lab research projects in the senior year are recommended to sign up for AMES 199.
**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 pending final approval.

The Graduate Department of the Scripps Institution of Oceanography, the Department of Aerospace and Mechanical Engineering Sciences, and the Department of Applied Physics and Information Science offer an interdepartmental program in applied science related to the oceans. All aspects of man's purposeful and useful intervention into the sea are included. Students who enroll will receive the degree of Ph.D. upon completion of normal departmental requirements and certain others stipulated by an interdepartmental faculty committee. AMES students who contemplate graduate work in applied ocean sciences are advised to take physical science and mathematics electives, and to seek admission into some of the Scripps core courses 210A (Physical Oceanography), 240 (Marine Geology), 260 (Marine Chemistry), and 270A (Biological Oceanography).

Regardless of the discipline of specialization, graduate students 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 pending approval.) 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 fulfillment 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 are pending approval.

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. 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. 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. Prerequisites: AMES 101A, 110, Mathematics 121. (Not offered every year.)

101C. Fluid Mechanics W

Continuation of 101B. Viscous-flow theory, including boundary-layer theory; transport phenomena; applications in biophysics and in combustion and propulsion theory. Four hours lecture. 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.

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 or 121.

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 120.

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. 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, Ray-leigh waves, thermoelasticity). Simple illustrative problems in viscoelasticity and plasticity. Four hours lecture. 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 overview 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.) (Not offered 1969-70.)

170. AMES Laboratory **F**

Laboratory program in aerospace, mechanical engineering sciences and bioengineering. Modern lab techniques. Statistics and interpretation of data. Formulation of experiments. Students are introduced to modern laboratory equipment and required to formulate a project of research under close supervision of a faculty member for AMES 171A, 171B.

171A, 171B. Advanced AMES Laboratory (half course, 2 units each) **W,S**

Experimental research under close guidance of an AMES faculty member. Study of a special problem in aerospace sciences, mechanical engineering or bioengineering selected by the student. Hours by arrangement. Prerequisite: AMES 170 or consent of the instructor.

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

The Staff

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. Gibson, Mr. Libby, Mr. Miller

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

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. (Offered every other year; not offered 1969-70.)

211B. Propulsion: Chemical Rockets and Mission Analysis (3) W

Solid- and liquid-propellant rocket engines, combustion processes, motor design and performance; rocket configurations; mission analyses; optimization calculations. Prerequisites: AMES 211A, undergraduate fluid mechanics and thermodynamics, or consent of the instructor. (Offered every other year; not offered 1969-70.)

211C. Propulsion: Nuclear and Electric (3) S

Principles of nuclear, electrothermal, electrostatic and electromagnetic propulsion; high-temperature gas flows; electromagnetic momentum and energy equations, Ohm's Law; applications to electric thrusters. Prerequisites: AMES 211B, undergraduate electricity and magnetism; or consent of instructor. (Offered every other year; not offered 1969-70.)

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. Rand

Principles of electrodynamics and quantum mechanics; theories of atomic and molecular structure; perturbation method in quantum mechanics; semi-classical 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 non-uniform gases. Prerequisite: consent of the instructor. (Not offered every year.)

221B. Radiative Transfer Theory (3) **W**

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. (Offered every other year; not offered 1969-70.)

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 re-entry vehicles; radiative transfer effects on convection and turbulence. Prerequisites: AMES 221A-221B, or consent of the instructor.

222A-222B-222C. Advanced Fluid Mechanics (3-3-3) **F-W-S**
Mr. Van Atta, Mr. Miller, Mr. Gibson
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 Plasma Dynamics (3) **F**
Mr. Burton
Energy conversion, unsteady and quasi-steady electromagnetic propulsion; MHD shocks and ionizing shocks; principles of photoelectric, thermoelectric, thermionic and electromagnetic energy conversion. Prerequisite: AMES 211C.

225. Selected Topics in Plasmadynamics (3) **S**
Discussion of research areas under current investigation in plasmadynamics. Three hour lecture. Prerequisite: 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. Nemat-Nasser
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. Nachbar
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. Nachbar
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

The Staff

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. (Offered every other year; not offered 1969-70.)

233C. Advanced Viscoelasticity (3) S

Mr. Huang

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.

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: 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

Stability analysis of structural elements under steady, oscillatory, and impulsive loadings. Elastic and anelastic stability problems. Prerequisite: AMES 235A, or consent of instructor. (Offered every other year; not offered 1969-70.)

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. (Offered every other year; not offered 1969-70.)

238. Stress Waves in Solids (3) W

Mr. Ellis

Linear wave propagation: plane waves; reflection and refraction; dispersion induced by geometry and by material properties. Application of integral transform methods. Selected topics in nonlinear elastic, anelastic an anisotropic wave propagation. Prerequisites: AMES 231A-231B-231C, or consent of instructor.

250A. Astrodynamics and Rocket Navigation (3) F

The Staff

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

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. (Offered every other year; not offered 1969-70.)

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.

253A. State-Space and Time-Domain Approach to Control Theory (3) F

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. (Offered every other year; not offered 1969-70.)

255A. Theory of Optimal Control (3) W

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. (Offered every other year; not offered 1969-70.)

255B. Theory of Optimal Control (3) S

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. (Offered every other year; not offered 1969-70.)

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, Mathematics 101.

256B. Spacecraft Attitude Control (3) F

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 1969-70.)

264A-264B. Filtering and Random Processes in Control (3-3) W-S

Mr. Sorenson, Mr. Pawula

Extensive treatment of random processes in linear feedback systems, including optimum design; estimation theory, Wiener and Kalman filtering. Extensive treatment of nonlinear systems in the presence of a random noise. Prerequisites: feedback control theory and AMES 294A, or consent of instructor.

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

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. (Offered every other year; not offered 1969-70.)

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) S

Mr. Fronek, Mr. Fung, Mr. Zweifach

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.

277. Microcirculation in Health and Disease (2) S
Mr. Zweifach
Structural and functional aspects of transport and blood-tissue exchange in key organs during states such as circulatory shock, bacterial toxemia, hypertension. Also physical and ultrastructural techniques used to analyze small vessel dynamics. Prerequisite: consent of instructor.

294A. Methods in Applied Mechanics (3) F
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 1969-70.)

294B. Methods in Applied Mechanics (3) W
Mr. Miles, Mr. Williams
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.

294C. Methods in Applied Mechanics (3) S
Mr. Rand
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.

296. Independent Study (3,3,3) F,W,S
The Staff

297. Research Techniques (1-6, 1-6, 1-6) F,W,S
A course designed to present the techniques of research through organized lectures, special assignments and instruction on the techniques of selected research projects. Prerequisite: consent of the instructor.

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

ANTHROPOLOGY

Office: Building 508, Matthews Campus

Melford E. Spiro, *Ph.D., Professor of Anthropology*
(Chairman of the Department)
Marc J. Swartz, *Ph.D., Professor of Anthropology*
David K. Jordan, *M.A., Acting Assistant Professor of Anthropology*

The Department of Anthropology, still in process of being formed, will offer both an undergraduate major program and a graduate program leading to the Ph.D. Until the opening of the Third College, and the expansion of staff contemplated at that time, the Department will concentrate almost exclusively on cultural, psychological, and social anthropology. Within these areas, the initial emphasis will be placed on stability and change in cultural, personality, and social systems. Courses will be offered in a wide variety of topics, and, in all instances, the latter will be examined within a comparative perspective. That is, the analysis of man, society, and culture will draw upon materials from a variety of culture areas, and, more especially (in the initial phase of the Department), from Sub-Sahara Africa, Asia, Middle America, the Middle East, and Oceania.

The Major Program

Since the Department is still in process of being formed, it is premature to list its course offerings for 1969-70, or to designate a core of set courses for a major program. The former will be listed, however, in the 1969-70 *Schedule of Classes* for each of the three quarters, and the latter will be posted on the bulletin board in the Department office. Until a core program is instituted, students may qualify for a major by taking eight upper-division courses in anthropology, and four upper-division courses (approved by the anthropology adviser) in any other departments.

Beginning this year, lower-division courses in anthropology will be confined almost exclusively to the Department's offerings in the Muir College Cultural Traditions program. These offerings, therefore (which, from year to year, will rotate among Africa, Asia, and Oceania), will both satisfy the Muir College Cultural Traditions requirement, and provide lower-division anthropology courses for students in other colleges. The latter may take one or more quarters of a Cultural Traditions course as an elective, without having to register for the entire sequence.

The Graduate Program

Since the Department of Anthropology expects to offer a Ph.D. degree in the near future, it will institute a Ph.D. training program in 1969-70, when a small number of select students will be admitted for graduate study. It is expected that the Ph.D. degree will be offered by the time these students complete their training. Until it is described in the *UCSD Catalog,* information concerning the Ph.D. program, apart from the general University requirements, may be obtained by writing directly to the Department Chairman. It is to be noted here that all students are required, as part of their training, to do some apprentice teaching during their residence. Course offerings for 1969-70 will both be listed in the 1969-70 *Schedule of Classes,* and posted on the bulletin board in the Department office.

APPLIED PHYSICS AND INFORMATION SCIENCE

Office: 3216 Building 2A

Victor C. Anderson, *Ph.D., Professor of Applied Physics* (Sea Grant College)
W. Ian Axford, *Ph.D., Professor of Applied Physics*
Henry G. Booker, *Ph.D., Professor of Applied Physics* (Chairman of the Department)
Kenneth L. Bowles, *Ph.D., Professor of Applied Physics* (Director of the Computer Center)
Jules A. Fejer, *D.Sc., Professor of Applied Physics*
Carl W. Helstrom, *Ph.D., Professor of Applied Physics*
Adolf W. Lohmann, *Ph.D., Professor of Applied Physics*
Victor H. Rumsey, *D.Eng., Professor of Applied Physics*
Irwin M. Jacobs, *Sc.D., Associate Professor of Information and Computer Science*
Manuel Rotenberg, *Ph.D., Associate Professor of Applied Physics*
Peter M. Banks, *Ph.D., Assistant Professor of Applied Physics*
William A. Coles, *Ph.D., Assistant Professor of Applied Physics*
George J. Lewak, *Ph.D., Assistant Professor of Applied Physics*
Huey-Lin Luo, *Ph.D., Assistant Professor of Applied Physics*
Elias Masry, *Ph.D., Assistant Professor of Information and Computer Science*
J. Pieter Schalkwijk, *Ph.D., Assistant Professor of Information and Computer Science*

* * *

Hannes Alfvén, *Ph.D., Senior Lecturer in Applied Physics*
Gustaf O. S. Arrhenius, *D.Sc., Ph.D., Professor, Scripps Institution of Oceanography*
Marshall H. Cohen, *Ph.D., Professor of Radio Astronomy in Residence*
Joe R. Doupnik, *Ph.D., Lecturer in Applied Physics*
Seibert Q. Duntley, *Sc.D., Professor, Scripps Institution of Oceanography*
Ray Fitzgerald, *M.S., Lecturer in Applied Physics*
*Stanford Goldman, *Ph.D., Visiting Professor of Information and Computer Science (Professor of Electrical Engineering, Syracuse University)*
James P. Hurley, *Ph.D., Adjunct Associate Professor of Applied Physics (Associate Professor, Department of Physics, University of California, Davis)*
Robert D. Moore, *Ph.D., Lecturer in Applied Physics*
Andrew F. Nagy, *Ph.D., Visiting Professor of Applied Physics (Professor, Space Science Laboratory, University of Michigan)*

*February - June 1970

Lin-Kuan Su, *B.S., Visiting Professor of Applied Physics (Chairman, Physics Department, The Chinese University of Hong Kong)*

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 APIS 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 APIS 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 Major Program

The major is intended to provide a sound education in basic physics and mathematics, combined with the opportunity to study in depth one or more of the branches of applied physics and of information and computer science in which the department is particularly strong. The program is arranged in a flexible manner so that students may concentrate on applied physics, or on information and computer science, or may combine the two. The combination permits the study of the signal processing problems encountered in communication systems using optical, electromagnetic, and acoustic waves.

Recommended schedules for the options in applied physics and in information and computer science are shown in the Tables I and II. These two options may be combined in several ways to produce options in signal processing, as shown in Table IIIA (Electronic Signal Processing), Table IIIB (Optical Signal Processing), and Table IIIC (Acoustic Signal Processing). Tables I-III exclude six courses available for completion of College requirements and for free electives. No student is required to take more than eighteen upper-division courses in Applied Physics, Physics, and Mathematics.

The major necessitates taking basic courses in physics and mathematics in the lower division. These include in the sophomore year Math 100 (Fall), Math 120 (Winter), and Math 101 (Spring). Alternatively Math 120 may be deferred to the fall quarter of the junior year. Muir College students should take Science 2A-2B-2C-2D-2E; Revelle College students should take Natural Sciences 2A-2B-2C-2D-2E. The freshman course APIS 10 is strongly recommended for all students.

The undergraduate major is arranged to permit interested students realistically to obtain a Ph.D. degree in seven years from entry as a freshman undergraduate. This is achieved by arranging for considerable parallelism between the senior-year undergraduate program and the first-year graduate program. An unusually well qualified student can be permitted to take first-year graduate work in his senior undergraduate year. Such a student should petition to take in his senior year a program similar to one of the

Graduate I programs in Tables IV-VI, with required College courses replacing APIS 200 and 299. He is then in a good position to take the Graduate II program in his first graduate year and is likely to obtain his Ph.D. degree one year early.

The Graduate Program

There are three main divisions of study:

1. Applied Physics

This division includes the following areas of study:

(A) Radio Astronomy and Space Physics. The theoretical and experimental investigation of physical processes relating to the structure of the sun and planetary bodies. Current studies relate to planetary atmospheres, ionospheres, magnetospheres, the nature of the solar wind and solar corona, and condensation of matter in space.

The Department has available the facilities of several radio astronomical observatories. In addition a large local radio observatory has been established to observe the structure of the solar wind by means of radio star scintillations.

(B) Materials Science, particularly Applied Solid State Physics and Quantum Electronics. This field includes materials analysis (x-ray techniques, optical and electron microscopy, metallography), and when fully developed will also comprise materials purification, crystal growth and the study of metals, semiconductors, dielectrics, and ceramics.

Areas of current research interest include the study of superconductors and the physics of metals and alloys. In addition, transistors, masers and lasers, and the propagation of coherent light through solids, liquids, and gases are covered, including applications such as holography.

2. Information and Computer Science

This division is concerned with the study of information-bearing symbols and their encoding, communication, and transformations; digital computer structure and applications, including programming languages, automata theory, artificial intelligence, and the theory of computation; the analysis and synthesis of complex systems with emphasis on reliability and the man-machine interface; and acoustical, electronic, and optical signal processing.

Areas of current research interest include information theory and coding, programming languages and translators with emphasis on laboratory satellite computers, and related problems in formal languages. Future work will be directed towards game theory, optimization theory and resource allocation, information management and retrieval, design and engineering of hybrid (analog-digital, hardware-software) systems, computer graphics and man-machine interaction, and systems modeling and simulation.

Signal processing is an area of information and computer science in which the department is particularly strong at the present time. Signal processing involves the detection of signals and the transmission and processing of information in the acoustic, radio, and optical domains, the prediction and filtering of random processes, communication theory, and the propagation of acoustic and electromagnetic waves. Applications are made to such fields as communications, radar, sonar, oceanography, holography, image processing, and visibility in air and water. Signal processing is carried out by electronic, acoustic, and optical filtering, photographically, and by digital computers. Both theoretical and practical aspects of signal processing are studied.

3. Interdepartmental Curriculum in Applied Ocean Science

   The Graduate Department of the Scripps Institution of Oceanography, the Department of Aerospace and Mechanical Engineering Sciences, and the Department of Applied Physics and Information Science offer an interdepartmental program in applied science related to the oceans. All aspects of man's purposeful and useful intervention into the sea are included. Students who enroll will receive the degree of Ph.D. upon completion of normal departmental requirements and certain others stipulated by an interdepartmental faculty committee.

Preparation

Applications will be considered from students who have taken undergraduate majors in one of the following disciplines: applied electrophysics, applied mathematics, applied physics, computer science, electrical engineering, engineering physics, engineering science, mathematics, and physics. 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 who have satisfied the equivalent of the undergraduate foreign language requirements of any one of the UCSD colleges, or 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.

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

All graduate students are expected to take part in the teaching, research, and seminar programs of the department. In particular, graduate students are expected to join in the teaching of the following courses: APIS 10, APIS 161A-161B-161C, Science 2A-2B-2C-2D-2E.

A graduate student normally devotes about three-quarters of his program to regular course work in the first two years. (An exception may occur for a student aiming at a seven-year Ph.D. degree; see above.) A graduate student should devote at least half his time to research in the third year, and almost all his time to research in the fourth year.

Graduate students may arrange their programs to concentrate on applied physics, to concentrate on information and computer science, or to combine the two to form a program in signal processing (electronic, optical, or acoustic). Programs are available that are mainly theoretical or that combine theoretical study with experimental research. Seven programs for the first two graduate years are suggested in Tables IV-VI. Each graduate student is encouraged to devise his own program in consultation with his adviser.

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 $290 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 Physics and Information Science.

I. Upper-division Program in Applied Physics

	Fall	Winter	Spring
Junior Year	APIS 101A	APIS 101B	APIS 101C
	Phys 110A	Phys 110B	APIS 103A
	APIS 105A	APIS 105B	APIS 105C
		Phys 101A (½)	Phys 101B (½)
Senior Year	APIS 103B	Elective	Elective
	APIS 110	Elective	Elective
		Elective	Elective
Electives	Phys 131A (½)	APIS 112	Phys 152
	Phys 150	APIS 111A	APIS 111B
	APIS 162A	APIS 162B	APIS 162C
	APIS 163A	APIS 163B	APIS 163C
	APIS 164A	APIS 164B	APIS 164C
	AMES 100	AMES 101A	AMES 101B
		APIS 113A	APIS 113B
		APIS 114A	APIS 114B
		APIS 119A	APIS 119B
		APIS 120	

II. Upper-division Program in Information and Computer Science

	Fall	Winter	Spring
Junior Year	APIS 161A	APIS 161B	APIS 161C
	APIS 163A	APIS 163B	APIS 163C
	Elective	Elective	Elective
Senior Year	APIS 162A	APIS 162B	APIS 162C
	APIS 165	APIS 166	APIS 167
	Elective	Elective	Elective
Electives	APIS 164A	APIS 164B	APIS 164C
	——	APIS 114A	APIS 114B
	Math 144A	Math 144B	——
	Math 110A	Math 110B	Math 110C
	Math 141A	Math 141B	Math 141C
	Psych 101	Ling 101A	Ling 101B
	Math 130A	Math 133A	Math 133B
	AMES 140A	AMES 140B	AMES 140C

IIIA. Upper-division Program in Electronic Signal Processing

	Fall	Winter	Spring
Junior Year	APIS 161A	APIS 161B	APIS 161C
	APIS 163A	APIS 163B	APIS 163C
	APIS 105A	APIS 105B	APIS 105C
Senior Year	APIS 162A	APIS 162B	APIS 162C
	APIS 164A	APIS 164B	APIS 164C
	Elective	Elective	Elective
Electives	APIS 110	APIS 111A	APIS 111B
	Math 144A	Math 144B	APIS 103A
	APIS 103B	Phys 101A (½)	Phys 101B (½)
	Math 110A	Math 110B	Math 110C
	Math 130A	Math 133A	Math 133B
	Math 141A	Math 141B	Math 141C
	AMES 140A	AMES 140B	AMES 140C

IIIB. Upper-division Program in Optical Signal Processing

	Fall	Winter	Spring
Junior Year	APIS 101A	APIS 101B	APIS 101C
	APIS 163A	APIS 163B	APIS 103A
	APIS 105A	APIS 105B	APIS 105C
Senior Year	APIS 162A	APIS 162B	APIS 162C
	APIS 110	APIS 114A	APIS 114B
	Elective	Elective	Elective
Electives	APIS 103B	APIS 111A	APIS 111B
	Phys 131A (½)	Phys 101A (½)	Phys 101B (½)
	APIS 161A	APIS 161B	APIS 161C
		APIS 113B	APIS 163C
		APIS 119A	APIS 119B

IIIC. Upper-division Program in Acoustic Signal Processing

	Fall	Winter	Spring
Junior Year	APIS 163A	APIS 163B	APIS 163C
	APIS 105A	APIS 105B	APIS 105C
	AMES 100	AMES 101A	Elective
Senior Year	APIS 162A	APIS 162B	APIS 162C
	Elective	APIS 119A	APIS 119B
	Elective	Elective	Elective
Electives	APIS 161A	APIS 161B	APIS 161C
	APIS 164A	APIS 164B	APIS 164C
	Math 141A	Math 141B	Math 141C
	Math 144A	Math 144B	AMES 101B
		APIS 114A	APIS 114B

IVA. Graduate Program in Theoretical Plasma Physics and Space Science

	Fall	Winter	Spring
Graduate I	Phys 203A AMES 294A or Math 212A APIS 224 APIS 200/299	APIS 201B AMES 294B or Math 212B APIS 211 APIS 200/299	APIS 201C AMES 294C or Math 212C Elective APIS 200/299
Graduate II	APIS 212A Phys 210A Elective APIS 200/299	APIS 228 Phys 210B Phys 232A APIS 200/299	APIS 212B/C Elective Phys 232B APIS 200/299

IVB. Graduate Program in Radio Astronomy and Experimental Space Science

	Fall	Winter	Spring
Graduate I	APIS 224 AMES 294A or Math 212A APIS 162A APIS 200/299	APIS 201B AMES 294B or Math 212B APIS 162B APIS 225	APIS 201C AMES 294C or Math 212C APIS 162C APIS 200/299
Graduate II	APIS 260A APIS 262A APIS 263A APIS 200/299	APIS 260B APIS 262B APIS 263B APIS 200/299	APIS 260C APIS 262C APIS 263C APIS 200/299

IVC. Graduate Program in Solid State Physics

	Fall	Winter	Spring
Graduate I	Phys 203A Math 212A APIS 206 APIS 200/299	APIS 201B Math 212B APIS 207A APIS 200/299	APIS 201C Math 212C APIS 207B APIS 200/299
Graduate II	Elective Phys 210A Elective APIS 200/299	APIS 205A Phys 210B APIS 230 APIS 200/299	APIS 205B Phys 211 Elective APIS 200/299

V. Graduate Program in Information and Computer Science

	Fall	Winter	Spring
Graduate I	APIS 263A	APIS 263B	APIS 263C
	Ling 231A	Ling 231B	APIS 266
	Math 212A	Math 212B	Math 212C
	APIS 200	APIS 299	APIS 299
Graduate II	APIS 264A	APIS 264B	APIS 264C
	APIS 260A/262A	APIS 260B/262B	APIS 260C/262C
	Math 260A	Math 260B	Elective
	Elective	Elective	Elective

VIA. Graduate Program in Electronic Signal Processing

	Fall	Winter	Spring
Graduate I	APIS 164A	APIS 164B	APIS 164C
	APIS 224	APIS 225	APIS 103A
	Math 212A	Math 212B	Math 212C
	APIS 200/299	APIS 200/299	APIS 200/299
Graduate II	APIS 260A	APIS 260B	APIS 260C
	APIS 262A	APIS 262B	APIS 262C
	APIS 263A	APIS 263B	APIS 263C
	APIS 200/299	APIS 200/299	APIS 200/299

VIB. Graduate Program in Optical Signal Processing

	Fall	Winter	Spring
Graduate I	APIS 224	APIS 205A	APIS 205B
	APIS 206	APIS 207A	APIS 207B
	APIS 162A	APIS 162B	APIS 162C
	APIS 200/299	APIS 200/299	APIS 200/299
Graduate II	APIS 205C	APIS 203A	APIS 203B
	APIS 262A	APIS 262B	APIS 262C
	APIS 263A	APIS 263B	APIS 263C
	APIS 200/299	APIS 200/299	APIS 200/299

VIC. Graduate Program in Acoustic Signal Processing

	Fall	Winter	Spring
Graduate I	SIO 210A	APIS 204A	APIS 204B
	APIS 162A	APIS 162B	APIS 162C
	AMES 210A	AMES 210B	AMES 210C
	APIS 200/299	APIS 200/299	APIS 200/299
Graduate II	APIS 204C	SIO 211A	SIO 224
	APIS 260A	APIS 260B	APIS 260C
	APIS 262A	APIS 262B	APIS 262C
	APIS 200/299	APIS 200/299	APIS 200/299

COURSES

LOWER DIVISION

The Department of Applied Physics and Information Science 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. Electromagnetism I F

Coulomb's law, electrostatic fields, capacitance, electric polarization, molecular theory of dielectrics. Uniqueness theorem, images, solutions of Laplace's equation. Magnetic effects of steady currents, Biot-Savart law, magnetic vector potential, Ampère's law, magnetic scalar potential. Ohm's law, DC circuits. Prerequisites: Science 2E (or Natural Science 2E) and Mathematics 101.

101B. Electromagnetism II W

Faraday's induction law, inductance and induced electromotance. AC circuit theory. Magnetic polarization, magnetic field intensity, hysteresis, magnetic field calculations. Maxwell's equations, plane electromagnetic waves in free space, Poynting vector. Propagation of plane waves in conductors, non-conductors and ionized gases. Prerequisite: APIS 101A.

101C. Electromagnetism III S

Reflection and refraction of electromagnetic waves, Fresnel's equations, radiation pressure. Guided waves, gauge invariance, retarded potentials, dipole and quadrupole radiation, reciprocity theorem. Radiation from a moving charge, Liénard-Wiechert potentials. Special relativity, Lorentz transformation. Prerequisite: APIS 101B.

103A. Introduction to Quantum Processes I S

Review of experimental bases of quantum theory: blackbody radiation, spectral emissions, wave-particle duality. Introduction to wave mechanics, Schrödinger equation, operators and eigenfunctions, one-dimensional models. Prerequisites: APIS 101B and Mathematics 120.

103B. Introduction to Quantum Processes II F

Angular momentum, selection rules, the hydrogen atom, atomic and molecular spectra. Introduction to scattering theory. Semiclassical theory of radiation and interaction with matter. Prerequisite: APIS 103A. (Not offered 1969-70.)

105A-105B-105C. Introduction to Mathematical Physics F-W-S

Fourier series, elementary partial differential equations, calculus of variations, complex variables, and integral transforms with applications to problems in particle and rigid-body dynamics, vibrations, wave motion, electric circuits, heat conduction, and fluid dynamics. Prerequisites: Science 2E (or Natural Science 2E) and Mathematics 100. (Not offered 1969-70. Requirements may be satisfied by taking Mathematics 120-121-122.)

110. Introductory Statistical Thermodynamics F

First and second laws of thermodynamics from the microscopic and macroscopic points of view. The method of the most probable distribution. The ideal gas and equations of state. Small departures from equilibrium. Methods of cooling. The Gibbs and Helmholtz free energy. Transport coefficients. Phase transitions. Prerequisites: Science 2E (or Natural Science 2E) and Mathematics 100.

111A. Atomic Physics and Quantum Electronics I W

Approximation methods in atomic structure. Complex spectra. Scattering of electrons and protons from atoms. Rearrangement collisions. Projection operator formalism. Prerequisite: APIS 103B.

111B. Atomic Physics and Quantum Electronics II S

Application of quantum theory to the solid state and to lasers. Energy bands, electron-phonon interactions, superconductors, semiconductors. Dia- and paramagnetism; paramagnetic resonance; the maser; stimulated emission; the laser. Prerequisite: APIS 111A.

112. Electromagnetism IV; Introductory Plasma Physics W

Magnetohydrodynamic equations. Stress tensor. Solutions of static and steady flow problems. Waves, shocks, stability. Occurrence of plasmas in nature. Motion of charged particles in electromagnetic fields. Particle drifts. Elementary kinetic theory—Vlasov equation, Boltzmann equation. Plasma oscillations, wave-particle interaction. Prerequisite: APIS 101C.

113A. Electromagnetism V; Elementary Plasma Waves W

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: APIS 101C.

113B. Electromagnetism VI; Radiation S

Reciprocity theorems, Huygens' principle, equivalence and uniqueness theorems. Frequency independent antennas. Periodic and log-periodic radiating structures. Field energy in dispersive media. Kramers-Kronig formula. Ray tracing in isotropic and anisotropic media. Radiation by moving charges. Synchrotron radiation. Cherenkov radiation. Prerequisite: APIS 101C.

114A. Optics I: Waves W

Wave equation. Fresnel diffraction. Fraunhofer diffraction. Coherent image formation with lenses and holograms. Prerequisites: APIS 101C and APIS 163B or consent of instructor.

114B. Optics II: Image Formation S

Linear filter of coherent systems. Interference. Partial coherence. Holographic interferometry. Incoherent image formation as a linear filtering process. Prerequisite: APIS 114A.

119A-119B. Introduction to Acoustics W-S

Vibrating strings, bars, membranes, plates. Transmission of plane and spherical acoustic waves. Transducers, speech, hearing. Architectural acoustics. Underwater acoustics. Prerequisites: Science 2 or Natural Science 2, Mathematics 100.

120. Structures of Solids W

Atomic structure, properties and growth of ordered and disordered solids. Laboratory work includes generation of x-ray spectra, symmetry determination by Laue technique, structure determination by single-crystal and powder techniques, electron diffraction and radial distribution analysis. Prerequisite: consent of instructor.

161A. Introduction to Computer Science F

Boolean algebra, combinational circuits, Karnaugh maps, sequential and pulse-sequential circuits. Prerequisite: APIS 10 or consent of instructor.

161B. Introduction to Computer Science W

Computer architecture, machine language, symbolic addressing, programming in assembly language, writing of assemblers, macro assemblers, data structures. Prerequisite: APIS 10 or consent of instructor.

161C. Introduction to Computer Science S

String processing language, use of recursive functions, BN notation, ALGOL, parsing, and the writing of translators. Prerequisite: APIS 10 or consent of instructor.

162A-162B-162C. Signal Processing F-W-S

Review of Probability theory: combinatorial analysis, generating functions, random variables, distributions, expectations, limit theorems. Stochastic processes: correlation functions, spectral densities, the Gaussian process, orthonormal expansions, mean-square filtering. Elements of information theory: entropy, mutual information, channel capacity, coding. Prerequisite: APIS 163C.

163A-163B-163C. Linear Systems and Networks F-W-S

Linear systems, Fourier series and transforms and their numerical calculation, applications to optics, network analysis, Kirchhoff's and Ohm's laws, matrix and topological analysis, graph theory, synthesis of simple analog and digital filters. Prerequisite: Mathematics 101, 120.

164A-164B-164C. Electronic Circuits and Systems **F-W-S**

Semiconductor physics and physical electronics; structure and properties of transistors. Analysis of active circuits; equivalent circuits for transistors, vacuum tubes, photodetectors. Elementary analog and digital circuits. Systems approach to design of electronic devices. Prerequisite: APIS 163C or Physics 101B or consent of instructor. (Offering in 1969-70 depends on availability of staff.)

165. Artificial Intelligence **F**

Steps toward intelligent machine behavior: game-playing programs, heuristic and algorithmic methods, tree-searching; theorem-proving and problem-solving programs, pattern recognition, characteristic vectors and decision functions, training strategies, hierarchal structure. Appropriate programming languages. Prerequisite: APIS 161C. (Offering in 1969-70 depends on availability of staff.)

166. Interactive Graphics and Man-Machine Communication **W**

Man-machine interface. Displays, generation of points, vectors, and complex structures. Interactive versus passive graphics. Pattern recognition, syntax tables, random nets. Data structures, graphics software. Mathematics of three-dimensions, projections, and the hidden-line problem. Graphical programs. Computer-aided design and instruction, animated movies. Prerequisite: APIS 161C. (Offering in 1969-70 depends on availability of staff.)

167. Algorithms, Automata and Artificial Languages **S**

Intuitive notions of algorithms, register machines, Turing machines, recursive functions, Markov algorithms, finite-state machines, minimalization and decomposition, regular expressions, context-free languages and push-down automata. Prerequisite: APIS 161C. (Offering in 1969-70 depends on availability of staff.)

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

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

GRADUATE COURSES

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.)

201B. Introductory Plasma Physics (3) **W**

Mr. Fejer and Mr. Lewak

Magnetohydrodynamic equations. Stress tensor. Solutions of static and steady-flow problems. Waves, shocks, stability. Occurrence of plasmas in nature. Motion of charged particles in electromagnetic fields. Particle drifts. Elementary kinetic theory—Vlasov equation, Boltzmann equation. Plasma oscillations, wave-particle interaction. Term paper required. Prerequisite: APIS 101C.

201C. Electromagnetic Radiation (3) S

Mr. Rumsey and Mr. Fejer

Reciprocity theorems, Huygens' principle, equivalence and uniqueness theorems. Frequency independent antennas. Periodic and log-periodic radiating structures. Field energy in dispersive media. Kramers-Krönig formula. Ray tracing in isotropic and anisotropic media. Radiation by moving charges. Synchrotron radiation. Cherenkov radiation. Term paper required. Prerequisite: APIS 101C.

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.

204A-204B. Acoustics (3-3) W-S

Mr. Anderson

Vibrating strings, bars, membranes, plates. Transmission of plane and spherical waves. Transducers, speech, hearing. Architectural acoustics. Underwater acoustics. Term paper required. Prerequisite: consent of instructor.

204C. Acoustic Signal Processing (2) F

Mr. Anderson

Analog and digital beam-forming methods, correlation techniques, background and signal statistics. Hardware and systems. Prerequisite: APIS 204B.

205A. Optics I: Waves (3) W

Mr. Lohmann

Wave equation. Fresnel diffraction. Fraunhofer diffraction. Coherent image formation with lenses and holograms. Term paper required. Prerequisites: APIS 101C and APIS 163B or consent of instructor.

205B. Optics II: Image Formation (3) S

Mr. Lohmann

Linear filter theory of coherent systems. Interference. Partial coherence. Holographic interferometry. Incoherent image formation as a linear filtering process. Term paper required. Prerequisite: APIS 205A.

205C. Optics III: Signal Processing (3) F

Mr. Lohmann

The space-bandwidth product. Information theory in optics. Superresolution. Spatial filtering. Optical analog computers. Hologram generation by computer. Prerequisite: APIS 114B or 205B.

206. Introduction to Quantum Processes (3) F

Mr. Banks

Angular momentum, selection rules, the hydrogen atom, atomic and molecular spectra. Introduction to scattering theory. Semiclassical theory of radiation and interaction with matter. Term paper required. Prerequisite: APIS 103A. (Not offered 1969-70.)

207A. Atomic Physics and Quantum Electronics I (3) W

Mr. Rotenberg

Approximation methods in atomic structure. Complex spectra. Scattering of electrons and protons from atoms. Rearrangement collisions. Projection operator formalism. Term paper required. Prerequisite: APIS 206.

207B. Atomic Physics and Quantum Electronics II (3) S

Mr. Rotenberg

Application of quantum theory to the solid state and to lasers. Energy bands, electron-phonon interactions, superconductors, semiconductors. Dia- and paramagnetism; paramagnetic resonance; the maser; stimulated emission; the laser. Term paper required. Prerequisite: APIS 207A.

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. Term paper required. Prerequisite: APIS 101C.

212A. Advanced Plasma Physics I (3) F

Mr. Fejer

Motion of charged particles in magnetic fields; adiabatic drifts and invariants. The Vlasov plasma; conductivity tensor, waves, instabilities. Fluctuations in and scattering of electromagnetic waves by a plasma. Derivation of the Balescu-Lenard equation. Sources; the excitation of plasma resonances. Prerequisite: APIS 201B.

212B. Plasma Turbulence (3) S

Mr. Lewak

Weakly non-linear wave-wave interaction: The decay instability, many wave interaction in the random phase approximation. Wave-particle interaction: quasi-linear theory, electron plasma oscillation turbulence. Prerequisite: consent of instructor. (Offered in 1970-71 and alternate years.)

212C. Kinetic Theory of Plasmas (3) S

Mr. Lewak

The Liouville equation, the BBGKY hierarchy, kinetic equations; Vlasov, Boltzmann, Fokker-Planck, Balescu-Lenard. Applications: Plasma equilibrium solutions, transport properties, instabilities. Prerequisite: consent of the instructor. (Offered in 1969-70 and alternate years.)

224. Introduction to Radio Astronomy (3) F

Mr. Rumsey

Radio telescopes. Antennas for measurement of celestial brightness distribution. Receivers for detection of stochastic signals. Effects of aperture size, bandwidth and integration time. Radio continuum and line spectra. Partial coherence and Stokes' polarization parameters. Interferometric methods and synthesis of sky maps. Prerequisite: consent of instructor.

225. Signal Processing in Radar and Radio Astronomy (3) W

Mr. Coles

The measurement of spectrum and correlation functions of observed waveforms; angular spectra; scattering by weak plasma fluctuations; radar signal design; analog and digital processing methods; synthetic antenna apertures and numerical filtering. Prerequisites: APIS 224, APIS 162A, and concurrent registration in APIS 162B, or consent of the instructor.

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.

230. Structures of Solids (3) W

Mr. Arrhenius

Atomic structure, properties and growth of ordered and disordered solids. Laboratory work includes generation of x-ray spectra, symmetry determination by Laue-technique, structure determination by single crystal and powder techniques, electron diffraction and radial distribution analysis. Term paper required. Prerequisite: consent of instructor.

260A-260B-260C. Advanced Theory of Signal Processing (3) F-W-S

Mr. Masry

Probability theory and its application to signal processing—an advanced treatment. Random variables, limit theorems. Random processes, correlation functions and power spectra, series representation, mean-square linear and nonlinear filtering and prediction, adaptive filtering, sampling and quantization. Markov processes. Prerequisites: APIS 162C and either Mathematics 212C or AMES 294C.

262A-262B-262C. Detection Theory (3-3-3) **F-W-S**
Mr. Helstrom

Hypothesis testing; detection of signals in white and colored Gaussian noise; Karhunen-Loeve expansion; estimation of signal parameters; maximum-likelihood detection; resolution of signals; detection and estimation of stochastic signals; applications to radar, communications, and optics. Prerequisite: APIS 162C. (Offering in 1969-70 depends on availability of staff.)

263A-263B-263C. Information Theory (3-3-3) **F-W-S**
Mr. Jacobs

Principles of optimum communication: analog and digital modulation, mutual information and entropy, channel capacity, error exponents and the coding theorem, algebraic and sequential coding and decoding, use of feedback, multipath and diversity channels, source coding with a fidelity criterion. Prerequisites: APIS 162C, 163C.

264A-264B-264C. Information Systems (3-3-3) **F-W-S**
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. Prerequisite: APIS 161C or consent of instructor. (Offering in 1969-70 depends on availability of staff.)

266. Applications of Graph Theory (3) **S**
Mr. Schalkwijk

Applications of the theory of graphs to information theory, game theory, and computers. Also source encoding, graph theoretic error correcting codes, communication networks, two-person zero-sum games, information retrieval and other topics. Prerequisite: consent of the instructor.

290. Observatory Field Course (1-12, 1-12, 1-12) **F,W,S**
The Staff

Methods of measurement, observation, and data processing 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. Rumsey and Staff

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**

The Staff

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

294A. Graduate Seminar in Applied Solid State Physics (1) **F**

Mr. Luo

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

294B. Graduate Seminar in Holography (1) **W**

Mr. Lohmann

Research topics of current interest in optical signal processing. (Satisfactory/Unsatisfactory grades only.)

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 only.)

296. Graduate Seminar on Applications of Concepts of Engineering and Physics to Biology (1) **S**

Mr. Goldman

Examination of whether various concepts of engineering and physics such as matched impedance, noise, noise reduction, carrier, coherence, eigenstate, Q, and representation domain have intrinsic biological importance. (Satisfactory/Unsatisfactory grades permitted.)

297. Seminar in Applied Ocean Science (1-1-1) **F,W,S**

Applied Ocean Sciences Curriculum Committee

Topics in applied ocean science. (Satisfactory/Unsatisfactory grades permitted.)

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

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) **F,W,S**
The Staff
(Satisfactory/Unsatisfactory grades permitted.)

BIOLOGY

Office: 2150 Bonner Hall

Warren L. Butler, *Ph.D., Professor of Biology*
John A. DeMoss, *Ph.D., Professor of Biology*
Morris E. Friedkin, *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, *Ph.D., Professor of Biology*
Stanley E. Mills, *Ph.D., Professor of Biology*
Paul D. Saltman, *Ph.D., Professor of Biology* (Provost of Revelle College)
Gordon H. Sato, *Ph.D., Professor of Biology*
S. Jonathan Singer, *Ph.D., Professor of Biology*
Herbert Stern, *Ph.D., Professor of Biology* (Chairman of the Department)
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*
Percy J. Russell, *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*
John Elovson, *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*
Arthur B. Robinson, *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*
Douglas W. Smith, *Ph.D., Assistant Professor of Biology*
Michael Soulé, *Ph.D., Assistant Professor of Biology*
Nguyen-Huu Xuong, *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*
William J. Peacock, *Ph.D., Associate Research Biologist*

The Major Program

The undergraduate programs leading to a Bachelor of Arts in biology reflect 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 programs reflect the striking advances made in biology in recent years and the prospects of revolutionary developments in the future. They emphasize the basic mechanisms which help to correlate into an integrated whole the enormous diversity of living things.

Slightly different types of programs are offered in Muir and Revelle Colleges. The Revelle major in biology is intended for those who have a very strong interest in cellular and molecular biology. In order to fulfill this objective biology majors are required to take a substantial part of the course work which is required for chemistry majors. In general, the program is tightly knit and intended for those students who wish to train for this area of biology. The program is suitable for pre-medical students and with few exceptions is highly desirable for a variety of careers in biology.

The Muir biology major is more loosely structured than that of Revelle and is intended to accommodate those students who have strong interests in fields beyond molecular and cellular biology. Students selecting the Muir biology major get their basic chemistry preparation including organic chemistry during the lower-division years. In the upper-division years the core program involves three subjects: biochemistry, molecular genetics and cell biology. These include two laboratory courses. Beyond these courses the student is free to arrange for a selection of biology subjects in accordance with his special interest.

Revelle College
Major Program in Biology
(Recommended Schedule)

	Fall	Winter	Spring
Junior Year	Biology 101A Chemistry 100A Chemistry 140A Chemistry 143A	Biology 101B Chemistry 100B Chemistry 140B Chemistry 105A	Biology 101C Biology 102
Senior Year	Biology 111A	Biology 111B Biology 112	Biology 111C

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. 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

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.

Muir College Major Program in Biology (Recommended Schedule)*

	Fall	Winter	Spring
Junior Year	Biology 110A	Biology 110B	Biology 110C
	______	Biology 115A	Biology 115B
	______	(laboratory)	(laboratory)
	______	______	______
	______	______	______
Senior Year	______	______	Physical Biochemistry
	______	______	______
	______	______	______
	______	______	______

*Prerequisites for the junior year biology course in Muir College are Science 3A, 3B, 3C, 3D, 3E; Math 2A, B, C or Math 1A, B, C. (Natural Science 2A, 2B, or other physics are strongly recommended but not required.) All of these prerequisites should be taken in the first two years. In the senior year, Muir biology majors may choose any combination of upper-division courses appropriate to their educational and career goals.

The Graduate Program

Graduate studies for a Ph.D. degree in the Department of Biology are oriented mainly toward 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 courses in calculus, organic chemistry, physical chemistry and biochemistry.

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, Physics and the School of Medicine is a vital and stimulating aspect of the biology program. 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.*)

9A-9B. Principles of Modern Biology **F-W**

In the first quarter the essentials of cell biology, elementary cell chemistry, genetics, and the biological basis of certain disease states will be emphasized. In the second quarter the essentials of integrative processes in organisms and populations will be surveyed through an evolutionary framework. Must be taken in sequence. Three hours lecture, one hour recitation. Not open to Biology majors.

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. Prerequisite: Natural Science 1A or equivalent.

11. Introduction to Animal Biology **W**

Diversity in form and function in animals and the fundamentals of genetics, development, and evolution. Three hours lecture, three hours laboratory. Prerequisite: Natural Science 1A or equivalent.

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).

110A. Biochemistry **F**

General biochemistry. Required core course for Muir biology majors. Prerequisite: Organic Chemistry (Science 3D, 3E or equivalent). Three hours lecture.

110B. Molecular Biology **W**

Biological macromolecules and their roles. Special emphasis on genetics, regulatory phenomena, nucleic acids and proteins. Required core course for Muir biology majors. Prerequisite: Biology 110A. Three hours lecture.

110C. Cell Biology **S**

The structure and function of cells. Cellular control mechanisms, cell division, cell differentiation and specialization. Required core course for all Muir biology majors. Prerequisite: Biology 110B. Three hours lecture.

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).

115A. Biochemistry Laboratory W

Required core course for Muir biology majors to be taken concurrently with Biology 110B. Prerequisite: Biology 110A. Six hours laboratory.

115B. Molecular and Cell Biology Laboratory S

Required core course for Muir biology majors to be taken concurrently with Biology 110C. Prerequisite: Biology 110B. Six hours laboratory.

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. Prerequisites: 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. Prerequisites: senior standing in the major program and consent of the instructor.

195. Introduction in Biology S

Introduction to the teaching of the basic course in biology. A student under the direction of the instructor of the course will be assigned one class section and will meet one time per week with the section. A student will also be required to attend the lecture in the course and to meet at least one time per week with the instructor of the course. Limited to senior students who have a B average or better in their upper division biology courses. Three hours lecture. Prerequisites: 101A-101B-101C; 111A-111B and 112.

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. Advanced Biochemistry (5) F
Mr. Abelson and Staff

A comprehensive course in biochemistry taught on an advanced level by members of the departments of chemistry and biology. The course is primarily intended for entering graduate students of either department; same as Chemistry 211. Prerequisite: elementary physical chemistry and biochemistry.

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. The 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. Cytogenetics (3) S
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.

222. Microbial Genetics (3) F
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) W
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. (Satisfactory/Unsatisfactory grades only.)

228. Virology W
Mr. Green
Molecular aspects of viral structure and development. Three hours lecture. Prerequisite: Biology 111A.

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

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.

240. Seminar in Population Biology (1) F,W,S
Mr. Soulé

Graduate students will report on controversial and pivotal issues in contemporary ecological and evolutionary biology. Critical analysis and synthesis of the literature will be emphasized. Prerequisite: consent of the instructor. Two hours.

250. Seminar in Immunology (1) W
Mr. Dutton, Mr. Singer

The course involves weekly seminars given by faculty, postdoctoral research fellows, advanced graduate students, concerning current research in immunology and immunochemistry. One hour lecture. Prerequisite: approval of instructor.

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: 2112 Urey Hall

James R. Arnold, *Ph.D., Professor of Chemistry*
Martin D. Kamen, *Ph.D., Professor of Chemistry*
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 Chemistry*
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 Chemistry*
John Abelson, *Ph.D., Assistant Professor of Chemistry*
William S. Allison, *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*
Kurt Marti, *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*
John H. Weare, *Ph.D., Assistant Professor of Chemistry*
John C. Wheeler, *Ph.D., Assistant Professor of Chemistry*
Kent Wilson, *Ph.D., Assistant Professor of Chemistry*
Nguyen Huu Xuong, *Ph.D., Assistant Professor of Chemistry*

* * *

Robert W. Holley, *Ph.D., Professor of Chemistry in Residence*
Leslie Orgel, *Ph.D., Professor of Chemistry in Residence*
Robert Bartsch, *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. Since Mathematics 40 or Mathematics 100 are prerequisites for Physical Chemistry 100C it is desirable that the student complete one of these courses before the junior year, although it is possible to take one of these courses in the first or second quarter of that year. The department strongly advises all chemistry majors to take Mathematics 100.

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 the quantitative analysis.

The departmental course requirements for the Bachelor of Arts degree in chemistry are: Chemistry 100A-100B-100C; Chemistry 105A-105B; Chemistry 120A-120B; Chemistry 141A-141B-141C; Chemistry 143A-143B-143C; five additional upper-division or graduate courses, designated with an asterisk in the schedule below, in chemistry or related fields, including at least a half course of upper-division laboratory. 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 enrollment in Chemistry 199.

Major Program in Chemistry (Recommended Schedule)

	Fall	Winter	Spring
Junior Year	Chemistry 100A	Chemistry 100B	Chemistry 100C
		Chemistry 105A	Chemistry 105B
	Chemistry 141A	Chemistry 141B	Chemistry 141C
	Chemistry 143A	Chemistry 143B	Chemistry 143C
	______	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. 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 descriptive inorganic 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 3 units of credit per course. 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.

Teaching experience is required of all chemistry graduate students. Every graduate student is required to perform half-time teaching for one quarter for every three quarters of residence, up to a maximum of four quarters of teaching. Course credit may be obtained for this teaching by registration in Chemistry 295.

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.

GRADUATE PROGRAM IN BIOCHEMISTRY

The Departments of Chemistry and Biology offer an integrated program of research training, courses and seminars leading to the Ph.D. degree in either chemistry or biology. Each student selects a graduate research problem in the field of interest of a member of the faculty of one of the cooperating departments.

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: Natural Sciences.*)

100A-100B-100C. Physical Chemistry **F-W-S**
Mr. Vold, Mr. Arnold

Behavior of ideal and real gases, thermodynamics, statistical mechanics, properties of solutions, electrochemistry, nuclear chemistry, atomic structure, elementary quantum theory, special topics in modern physical chemistry. Three lectures. Prerequisites: Natural Science 2D, Mathematics 2C, or consent of instructor; for Chemistry 100C additional prerequisites: Mathematics 40 or 100. At the level of *Physical Chemistry*, W. J. Moore, Prentice-Hall (3d edition).

102A-102B. Classical and Statistical Thermodynamics **F-W**
Mr. Urey (102A), Mr. Wheeler (102B)

102A: Thermodynamics of chemical systems; first, second, and third laws; chemical equilibria; solutions; non-ideal gases.

102B: Statistical theory; derivations of thermodynamic quantities through partition functions. Three lectures. Prerequisite: Chemistry 100C.

105A-105B. Physical Chemistry Laboratory **W-S**
Mr. Marti, Mr. Clark

Laboratory course in experimental physical chemistry. Six hours laboratory. Prerequisites: Chemistry 100A, 100B (may be taken concurrently).

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, 141B.

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 141A, or consent of the instructor.

141A-141B-141C. Organic Chemistry **F-W-S**
Mr. Bond, Mr. Fahey

Lectures in organic chemistry 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. Three lectures and a one-hour discussion. Prerequisite: Natural Science 2FL (formerly Physical Science 2EL). At the level of *Organic Chemistry*, J. D. Roberts and M. C. Caserio, Benjamin (1964).

143A-143B-143C. Organic Chemistry Laboratory **F-W-S**
Mr. Bond, Mr. Fahey, Mr. Watson

Introduction to laboratory techniques needed in organic chemistry, stressing physical methods including separation and purification, spectroscopy, product analysis and effects of reaction conditions. Six hours laboratory. Prerequisites (or concurrent): for 143A, Chemistry 141A; for 143B, Chemistry 141B; for 143C, Chemistry 141C.

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, 141B.

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

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 141C.

147. Mechanisms of Organic Reactions **S**
Mr. Traylor

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 141C.

150A-150B-150C. Advanced Projects Laboratory **F-W-S**
Mr. Linck (F), Mr. Arnold (W), Mr. Schrauzer (S) and 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, 141C.

160A-160B. General Biochemistry **W-S**
The Staff

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, 141C. (Not offered 1969-70.) See Biology 110A.

170. Cosmochemistry **W**

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 or 100.

195. Chemistry Instruction **W,S**

Mr. Linck and 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 the student is participating. Prerequisites: Chemistry 100C, 141C; 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. Prerequisites: Chemistry 100C and 190 or equivalent.

202A-202B. Classical and Statistical Thermodynamics (3-3) **F-W**

Mr. Urey (202A), Mr. Wheeler (202B)

202A: Thermodynamics of chemical systems; first, second and third laws; chemical equilibria; solutions; non-ideal gases. 202B: Statistical theory; derivation of thermodynamic quantities through partition functions. Prerequisite: Chemistry 100C or equivalent.

203. Molecular Spectroscopy (4) **S**

The Staff

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. Prerequisites: Chemistry 200A, 200B, or equivalent. (Not offered 1969-70.)

204. Statistical Mechanics of Chemical Systems (4) **F**
Mr. Mayer

Fundamental derivation of equilibrium statistical mechanics and its use in chemical problems.

205. Advanced Chemical Kinetics (3) **W**
Mr. Shuler

Discussion of modern theories of chemical rate processes and energy transfer. Microscopic and macroscopic aspects will be developed and applied. Prerequisites: Chemistry 100A, 100B, and 100C.

209. Special Topics in Chemical Physics (1-3) **F,W,S**
Mr. Urey (S) (2)

Topics of special interest will be presented. In spring quarter the topic will be, The Chemistry of the Moon and the Planets.

210. Seminar in Biochemistry (1) **F,W,S**
Mr. Kaplan (W), Mr. Abelson (S) and 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. Advanced Biochemistry (5) **F**
Mr. Abelson and the Staff

A comprehensive course in biochemistry taught on an advanced level by members of the departments of chemistry and biology. The course is primarily intended for entering graduate students of either department. Same as Biology 211. Prerequisites: elementary biochemistry, physical and organic chemistry.

212. Biosynthetic Mechanisms (3) **W**

A discussion of the pathways and mechanisms involved in the biosynthesis of cell components and their integration into the intermediary metabolism of the cell. Three hours lecture. Prerequisite: elementary biochemistry.

213. Chemistry of Macromolecules (3) **S**
Mr. Singer (Dept. of Biology), 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.

214. History of Biochemistry (2) S

Mr. Kaplan

A summary of the contributions which led to the major concepts in the field of biochemistry. Emphasis will be placed on the research approach taken by eminent individuals. Prerequisite: Chemistry 211.

220. Advanced Inorganic Chemistry (3) W

Mr. Schrauzer

Introduction to theoretical inorganic chemistry. Chemistry of typical main group and transition elements; coordination compounds; organometallic chemistry; experimental techniques. Given in two parts every other year. Part II, W 1970: Main Group Element Chemistry.

229. Special Topics in Inorganic Chemistry (1-3) F,W,S

The Staff

Topics of current interest will be presented by staff members. (Not offered 1969-70.)

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 (3) W

Mr. Traylor

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. Traylor

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 (3-3, 1-3) F,W,S

Mr. Traylor (F), Mr. Faulkner (Dept. of SIO) (W), The Staff (S)

Topics of special interest will be presented by staff members. In the fall Mr. Traylor will teach special topics in free radical chemistry. In the winter Mr. Faulkner will teach special topics in natural products chemistry.

250. Seminar in Chemistry (1) F
Mr. Schrauzer, Mr. Shuler

Regularly scheduled seminars by graduate students provide opportunities for practice in seminar delivery and for the exploration of topics of general interest.

251. Research Conference (1,1,1) F,W,S
The Staff

Group discussion of research activities and progress of the group members.

269. Special Topics in Biochemistry (3) W
Mr. Allison, Mr. Kaplan

Topics relating to the mechanism of enzyme action.

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, one or two meetings per week with assigned class section, and lecture of the undergraduate course in which he is 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 412, Matthews Campus (Provost, Muir College)

Michael Langham, *LL.D., Professor of Drama*
(Chairman of the Department)
Eric Christmas, *Art Dip., Senior Lecturer*
Tom McCorry, *M.A., Lecturer*

A program of courses in the drama is being developed. The three-course sequence described below is offered 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 will 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.)

10A-10B-10C. Introduction to the Theatre **F-W-S**
A survey of theory and practice in the contemporary theatre, including its terminology, literature and technical aspects, viewed against historical backgrounds.

20A-20B-20C. Play Production and Presentation **F-W-S**
A course involving the creation of living drama—from reading to performance. Two original theatre works will be presented and the production of these works will involve action, direction, speech classes, improvisational seminars, and instruction in lighting, make-up, scene and costume design. Limited enrollment. Students accepted for this course only on the basis of a full year's commitment.

UPPER DIVISION

199. Special Projects in Drama **F,W,S**
Qualified students will pursue special projects in reading drama, studying drama history, or doing research for a production. Prerequisite: consent of the Department.

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*
Daniel Orr, *Ph.D., Professor of Economics*
(Chairman of the Department)
**Richard E. Attiyeh, *Ph.D., Associate Professor of Economics*
Donald V. T. Bear, *Ph.D., Associate Professor of Economics*
John Conlisk, *Ph.D., Associate Professor of Economics*
(Director of Graduate Studies in Economics)
George R. Morrison, *Ph.D., Associate Professor of Economics*
(Director of Undergraduate Studies in 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*

*On leave Fall Quarter, 1969
**On leave 1969-70

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 2.0 (C) grade point average in economics courses is required of students majoring in economics.

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 110A Minor Elective	Economics 100B Economics 110B Minor Elective	Economics 100C Economics 110C Minor Elective
Senior Year	Two-quarter Economics Sequence Economics Elective Minor Elective	 Two-quarter Economics Sequence Minor Elective	Economics 190C Minor 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 or 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 Economics 220A	Economics 200B Economics 210C Economics 220B
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. Microeconomics **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.

110A-110B-110C. Macroeconomics **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 1969-70.)

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. (Not offered 1969-70.)

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. (120C not offered 1969-70.)

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 1969-70.)

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.

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 (3-3) F-W
Theory of international trade, finance, and monetary relations. Growth, disturbances, and balance of payments adjustment. International economic policy and welfare.

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 (3) 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 (3-3) W-S
An intensive examination of the literature on selected topics of current importance in economic theory. In 1970 the course (213A) will cover demand theory and production theory: the implications of functional form of utility indexes for commodity demand functions; derived demand functions implied by particular production functions. (213B not offered 1970.)

214. Monetary Theory (3) F
Macroeconomic theory related to supply and demand for money. Relationship of money to prices, interest rates and output. Models of monetary and financial structure. Monetary dynamics of inflation, business fluctuation, and economic growth. Prerequisite: Economics 210A or consent of the instructor.

220A-220B. Techniques of Economic Research (3) W-S
The construction and application of stochastic models in economics. This includes both single and simultaneous equation models. Prerequisite: Mathematics 130A.

230A-230B-230C. Public Policy (3-3-3) F-W-S
The application of macroeconomic and microeconomic theory to issues of public policy. In 1969-70 the topics offered are: an examination of the empirical results of dynamic macroeconomic models (fall); monetary theory and policy (winter); and economic development and planning (spring).

250A-250B. Public Finance (3-3)

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. (Not offered 1969-70.)

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 (3-3-3)

The study and development of effective pedagogical materials and techniques in economics. Students who hold appointments as teaching assistants must enroll 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*
(Chairman of the Department)
Curtis Wilson, *Ph.D., Professor of History*
Stanley A. Chodorow, *Ph.D., Assistant Professor of History*
Roger de Laix, *Ph.D., Assistant Professor of History*
Franz G. Nauen, *Ph.D., Assistant Professor of History*
Michael Parrish, *Ph.D., Assistant Professor of History*
Robert C. Ritchie, *Ph.D., Assistant Professor of History*

* * *

John G. Leonard, *M.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. 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

Students will be expected to fulfill a distribution requirement 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. A "C" average is required to graduate with a major in history.

The Graduate Program

The Department currently offers graduate work leading to the Ph.D. degree. Admission is based upon the student's performance as an undergraduate, upon any previous graduate record, and upon letters of recommendation from his professors. Graduate Study Applicants are required to submit Graduate Record Examination scores, as well as proof that they have passed an Educational Testing Service examination in French, German, Spanish or Russian. They are also asked to submit one or two papers written for history courses in which they have been enrolled. The minimum grade-point average for admission is 3.0 but students will be expected to have made a somewhat better average in their undergraduate history courses and in courses in the humanities and the social sciences. Applicants who show exceptional promise as evidenced by their overall grade-point average and by the testimonials of their professors may be admitted to the program without having had an undergraduate major in history. In special cases it may be possible for applicants with deficiencies in undergraduate courses to be admitted as limited students pending admission to the regular program. The deadline for filing applications for the academic year 1970-71 is February 15, 1970.

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:

British Empire
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-10B. Introduction to History **F-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. (Not offered 1969-70.)

30A-30B-30C. United States History **F-W-S**
Mr. Parrish
A lecture-discussion course which will explore the political, social, and economic aspects of American history from the colonial period to the present. Students are not required to complete the course in one year, but the individual quarters must be taken in sequence. The course may be used by Muir College students in fulfilling the humanities requirement of the College.

UPPER DIVISION

102. Research in the Sources **F-W-S**
The Staff
Historical research dealing with a problem of limited scope, and involving critical analysis of historical sources. Several sections will be offered, each dealing with a particular area of historical research. Required of seniors majoring in history. Restricted to majors in history.

103. Historiography **F-W-S**
The Staff
The critical analysis of historical literature in a field of restricted scope. Several sections will be offered, each dealing with a particular area of historical research. Required of seniors majoring in history. Restricted to majors in history.

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 1969-70.)

111A-111B. The Rise of Europe **F-W**
Mr. Chodorow
The development of European society from the decline of the Roman Empire to 1250. Three hours lecture.

132. Tudor-Stuart England, 1485-1688 **S**
Social and political history from Henry VII to the Glorious Revolution with emphasis on social and economic problems, the expansion of central authority, the Puritan Revolution and Restoration.

145A. Russia: 1533-1800 **F**
Mr. Baron
A survey of the development of Russian society and thought from the accession of the Romanov dynasty to Alexander I. Emphasis will be placed 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: 1750-1870 F-S

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.

152A-152B. Europe in the Twentieth Century W-S

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. (Not offered 1969-70.)

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.

160. United States: Colonial Period to 1763 F

Political and social history of the thirteen colonies; European background, settlement and expansion, beginnings of culture and the Imperial context.

161. United States: The New Nation, 1763-1800 W

Political and social history of the American nation, with emphasis on the Revolution, Confederation, and Union, the rise of the west.

164. American Intellectual History to 1860

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

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. (Not offered 1969-70.)

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. (Not offered 1969-70.)

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.

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. (Not offered 1969-70.)

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. (Not offered 1969-70.)

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 1969-70.)

181. History of South Africa

(Not offered 1969-70.)

198. Undergraduate Seminars 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 advise 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
(Not offered 1969-70.)

201B. Rome
Mr. de Laix
(Not offered 1969-70.)

201D. Topics in Medieval History
Mr. Chodorow
(Not offered 1969-70.)

201G. Western Europe, 1815-Present F-W
Mr. Jackson

201H. Readings in 17th and 18th Century Russian History S
Mr. Baron

201I. British Empire S
Mr. Leonard
A comparative study of the problems of colonial rule in the dependent Empire. The course would be of interest to those who wanted to study imperialism, world history, or an area of Africa or Asia.

201J. United States, Colonial Period W

201K. United States, National Period F

202. Research Seminars in the Several Fields of History
(Precise descriptions of the courses below will be provided at the beginning of each quarter.)

202G. Western Europe, 1815-Present F-W
Mr. Nauen

202K. Topics in U. S. Diplomatic History W-S
Mr. Rappaport

202M. Topics in Latin American History F-W
Mr. Céspedes

203. Historiography F
Mr. Baron

An inquiry to historical concepts, methods, and problems. Required of all first year graduate students.

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)
Sige-Yuki Kuroda, *Ph.D., Associate Professor of Linguistics*
Sanford Schane, *Ph.D., Associate Professor of Linguistics*
Paul Chapin, *Ph.D., Assistant Professor of Linguistics*
Ronald W. Langacker, *Ph.D., Assistant Professor of Linguistics*
Margaret H. Langdon, *Ph.D., Assistant Professor of Linguistics*

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, complemented by six other courses directly related to the study of language. For all courses counted toward the major in linguistics, the student must receive grades of C or better.

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 the ETS Graduate School Examination in French, German or Spanish. 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 Physics and Information Science, 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	Linguistics 101A	Linguistics 101B
	Language	Language	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 lingustics 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 two years of graduate study, his basic courses will stress linguistic theory and the structure of English, particularly from the point of view of generative grammar and language analysis. For his advanced work, 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, psycholinguistics, 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 or 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 Language 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, equivalent to a half-time assistantship for three quarters, is an integral part of the linguistics graduate program at UCSD and as such constitutes one of the requirements for the Ph.D.

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 relationship 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 system 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-F

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.

203. Phonetics (3) F

An investigation of the articulatory and acoustic features of speech. Prerequisite: general linguistics or equivalent.

204. The Comparative Method (3) S

The techniques and assumptions of linguistic reconstruction. Types of language changes illustrated by examples from Indo-European and other language families.

205. Ethnolinguistics (3) W

The interrelationships of language and other aspects of human behavior. Language, thought, and reality. Relativity and universals. The origin of language. Languages in contact. Prerequisite: general linguistics or equivalent.

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.

221A-221B. History and Structure of English (3-3) F-W

The phonological, morphological, syntactic, and lexical evolution of the English language. (Not offered 1969-70.)

224A-224B. Modern English (3-3) S-F

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.

242. Romance Linguistics (3) W

The history and structure of Latin and contemporary Romance languages in the context of generative grammar; comparative Romance. Topics and problems will vary from quarter to quarter.

243. Romance Linguistics (3) S

A continuation of 242.

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.

256. Structure of Albanian (4)

The grammatical, phonological and lexical features of Modern Albanian will be studied in detail. Prerequisites: Linguistics 100, 101 and 102.

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, Old Norse 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 (1-4, 1-4, 1-4) 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

Michel Benamou, *Ph.D., Professor of French Literature*
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*
Robert H. Spaethling, *Ph.D., Professor of German 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., 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*
Alain J. J. Cohen, *Ph.D., Assistant Professor of French Literature*
David K. Crowne, *Ph.D., Assistant Professor of English and Comparative Literature*
**Abraham J. Dijkstra, *Ph.D., Assistant Professor of American and Comparative Literature*
§Edwin F. Dolin, Jr., *Ph.D., Assistant Professor of Classical and Comparative Literature*
Keith D. Lowe, *Ph.D., Assistant Professor of English Literature*
James T. Monroe, *Ph.D., Assistant Professor of Spanish and Arabic Literature*
Fred V. Randel, *Ph.D., Assistant Professor of English Literature*
Jonathan Saville, *Ph.D., Assistant Professor of French and Comparative Literature*

George H. Szanto, *Ph.D., Assistant Professor of German and Comparative Literature*

†Martin W. Wierschin, *Ph.D., Assistant Professor of German Literature and Germanic Philology*

Anthony G. 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*

Jeffrey Barnouw, *M.A., Acting Assistant Professor of English and Comparative Literature*

Sam D. Hinton, *A.B., Lecturer in Folklore*

*On leave, Fall and Winter Quarters, 1969-70
†On leave, Winter Quarter, 1970
§On leave, Spring Quarter, 1970
**On leave, 1969-70

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 in classical languages are introductory courses. There is no prerequisite for Greek 1 or Latin 1.

The lower-division courses in modern languages and literatures 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. Lower-division language proficiency is a prerequisite for any of these courses; they are not prerequisite to each other.

Upper-division courses are of two chief kinds: lecture and discussion courses, which are unlimited in enrolment, and seminar courses, which are kept small enough to permit intensive student participation in each session of the class. 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. 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.

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. All students are required to take four seminars in the primary literature and four lecture courses in either literature. Honors students must take at least one seminar in the secondary literature. For all other students, of the three courses in the secondary literature, at least one must be an upper-division course in that literature. No more than one Literature 11 and one course in translation shall count toward this requirement.

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 student majoring in Literature is required to achieve at least a C average in literature courses.

Literature Curriculum: Revelle College

The Literature major in Revelle College requires fourteen courses distributed as follows:

1. Nine upper-division courses in one literature (the "primary" litera-

ture), including the appropriate Literature 151 and the Senior Major Sequence (Literature 191 and Literature 192).

2. Three courses in another, or "secondary," literature taught in the original language. At least one of these must be on the upper-division level. The only lower-division courses which can count toward satisfying the secondary literature requirement are a maximum of two Literature 11 courses; Latin 1 and 2; or Greek 1 and 2.
3. Two upper-division courses in fields related to literature (such as history, linguistics, and philosophy) as approved by the adviser in the major.

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.

The student majoring in Literature is required to achieve at least a C average in literary courses.

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 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 offer 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 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.

Course of Study

Although most students will choose to 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 Qualifying Examination. No specific courses are required—on the contrary, graduate students take those seminars best suited to their individual needs and interest. Students are expected to take two seminars each quarter in their first year and at least one each quarter after that until they pass the Qualifying Examination. Since topics change from year to year, all graduate courses are offered for repeated registration.

Teaching

The Department requires for the completion of the Ph.D. degree that each graduate student have done apprentice teaching as an integral part of his training. The minimum amount required is equivalent to the duties expected of a quarter-time teaching assistant for three academic quarters. The duties of a teaching assistant normally entail grading papers and examinations, conducting discussion sections, and related activities. Each teaching assistant is expected to attend the lectures for the course in which he participates.

Language Requirements

The Ph.D. program for English and American Literature requires either (*a*) demonstrated fluency in reading, writing, and speaking one language in addition to English, or (*b*) working knowledge of two languages in addition to English. Students are expected to take at least two courses in philology or linguistics or otherwise acquire an equivalent background in these fields.

The Ph.D. program in Spanish Literature requires, in addition to the above, a reading knowledge of Latin, to be tested by an examination conducted by the Department. No record of the results of this examination is kept in the Graduate Division. 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.

The Ph.D. program in Comparative Literature requires (*a*) knowledge in depth of two foreign languages, (*b*) a reading ability in French, German, or Italian, (*c*) when the student's field of concentration demands it, a reading ability in a classical or non-Western 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.

The Qualifying Examination

The Qualifying Examination, which the student takes at the end of his third year, is general and comprehensive. It consists of a two-day written and a two-hour oral examination.

The Dissertation

A suitable dissertation is required for the Ph.D. degree. The student concentrates on the dissertation after he has passed the Qualifying Examination.

COURSES

LOWER DIVISION

General Literature

1A-1B-1C. The Interpretation of Literature (Muir College)

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. Must be taken in sequence. (This sequence may be used in fulfilling the Muir College humanities requirement.) Two hours lecture and one hour discussion.

1A.	Poetry and Perception	Mr. Stewart	F
1B.	Narrative Forms	Mr. Fussell	W
1C.	Themes in Modern Literature	Mr. Lowe	S

21, 22, 23. The Literary Imagination (Revelle College)

These courses are designed to acquaint the student with the creative possibilities of the major literary genres. Emphasis will be upon interpretation of important representative works. Foreign texts will be read in translation. May be taken separately. Two hours lecture and one hour discussion.

21.	Lyric Poetry	Mr. Barnouw	S
22.	The Drama	Mr. Szanto	W
23.	The Novel	Mr. Behar	F

Classical Languages and Literatures

Lit/Gr 1. Beginning Greek **F**

The Staff, Mr. Dolin in charge

Fundamentals of Greek grammar, exercises in vocabulary and accidence and in reading. Two hours lecture and one hour discussion.

Lit/Gr 2. Intermediate Greek **W**

The Staff, Mr. Dolin in charge

Continuing instruction in Greek grammar, with reading of simple texts. Two hours lecture and one hour discussion. Prerequisite: Lit/Gr 1 or equivalent.

Lit/La 1. Beginning Latin **F**
The Staff, Mr. Crowne in charge

Fundamentals of Latin grammar, exercises in vocabulary and accidence and in reading. Two hours lecture and one hour discussion.

Lit/La 2. Intermediate Latin **W**
The Staff, Mr. Crowne in charge

Continuing instruction in Latin grammar, with reading of simple texts. Two hours lecture and one hour discussion. Prerequisite: Lit/La 1 or equivalent.

Modern Languages and Literatures

Lit/Ge 1. German Literature: Readings and Interpretations **F**
The Staff

A beginning course with emphasis on the development of reading ability and vocabulary building. Selections from modern and classical authors. Two hours lecture and one hour discussion. Prerequisite: completion of Revelle or Muir College requirement of proficiency in a foreign language, or, in special cases, permission of the instructor. (Students who have met the proficiency requirement and who feel ready to proceed directly to Lit/Ge 11 are encouraged to do so.)

Lit/Fr 11. Readings in French Literature and Culture **F,W,S**
The Staff

Lit/Ge 11. Readings in German Literature and Culture

Fall Quarter: From the Middle Ages to Goethe	The Staff	F
Winter Quarter: From Romanticism to Nietzsche	The Staff	W
Spring Quarter: From Nietzsche to the Present	The Staff	S

Lit/It 11. Readings in Italian Literature and Culture **W**
The Staff

Lit/Ru 11. Readings in Russian Literature and Culture **F,W,S**
The Staff

Lit/Sp 11. Readings in Spanish Literature and Culture **F,W,S**
The Staff

The Literature 11 courses are introductions to the literatures of several of the modern languages other than English. Introductory courses in French, German, Italian, Russian, and Spanish literatures are now available. Students may take one of these courses for three quarters starting with any quarter. The instructor will advise students when they are ready to proceed to upper-division courses in which an ability to read extensive texts in the foreign language is called for. Two hours lecture and one hour discussion. Prerequisite: completion of Revelle or Muir College requirement of proficiency in a foreign language, or, in special cases, permission of the instructor.

Lit/Ge 25. German Composition and Conversation S
The Staff

Lit/Sp 25. Spanish Composition and Conversation W
The Staff

The Literature 25 courses are designed for students who wish to improve their ability to speak and write a foreign language. Three hours. Prerequisite: 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. 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. On the other hand, upper-division courses in the various national literatures are normally taught in the languages in which the works under study were written.)

General Literature

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. Three hours seminar.

111.	Fiction	Mr. Lettau	F
112.	Exposition	Mr. Barnouw	W
113.	Drama	Mr. Szanto	S
114.	Verse	Mr. Yip	F

Prerequisites: submission of original work already completed and consent of the instructor.

120. The Classical Tradition W
Mr. Dolin

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. Two hours lecture and one hour discussion.

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. Two hours lecture and one hour discussion. (Not offered 1969-70.)

127. The Novel

Aspects of the novel, not confined to a single national literature. Texts may be read in English. Two hours lecture and one hour discussion.

1969: The French and American Novel since World War II — Mr. Szanto — F

Lit/Ch/Tr 151. Masterpieces of Chinese Literature in Translation — W

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. Two hours lecture and one hour discussion.

Lit/It/Tr 151. Dante — F

Mr. Fussell

An intensive study of the *Divine Comedy,* working from English translation to an understanding of the original in Italian. Two hours lecture and one hour discussion.

152. Men, Literature, and Ideas

This course will center on writers or movements of international literary, cultural, or ideological significance. Texts may be read in English. Two hours lecture and one hour discussion.

1969: Jorge Luis Borges — Mr. Alazraki — F

Borges' role in the development of the contemporary literary imagination. His short stories will be studied in the context of his essays.

1970: Literature and Cybernetics — Mr. Wilden — S

Readings in cybernetics, communications theory, and general systems theory, directed toward the elaboration of a theory of discourse and communication.

161. The Forms of Folklore — F

Mr. Hinton

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. Two hours lecture and one hour discussion.

190. Seminars

These seminars 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 history of ideas, literary criticism, literature and society, and the like. Texts may be read in English. Three hours.

1969: Comedy as Dramatic Form — Mr. Dolin — F

Readings in Aristophanes, Menander, Plautus, Shakespeare, Ben Jonson, and Moliere.

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. Two hours lecture and one hour discussion.

English and American Literature

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. Two hours lecture and one hour discussion.

1970: Biography Mr. Crowne S

Lit/En 102. English Dramatic Literature

(Not offered 1969-70.)

Lit/En 103. English Poetry

(Not offered 1969-70.)

Lit/En 121. The Medieval Period

Major English literary works of the Middle Ages as seen against the historical and intellectual background of the period. Two hours lecture and one hour discussion.

1969: Chaucer Mr. Saville F

Lit/En 122. The Renaissance

Major literary works of the Renaissance as seen against the historical and intellectual background of the period. Two hours lecture and one hour discussion.

1970: Donne and the Metaphysical Poets Mr. Dunseath S

Lit/En 123. The Eighteenth Century

Major literary works of the eighteenth century. Two hours lecture and one hour discussion.

1970: Restoration and Augustan Poetry Mr. Wright W

Lit/En 124. The Nineteenth Century

Reading in the Romantics and Victorians; the intellectual background of the age. Two hours lecture and one hour discussion.

1969: Romanticism in English Prose Mr. Randel F

A reading of *Frankenstein,* DeQuincey's *Confessions of an English Opium Eater,* the essays of Lamb and Hazlitt, Carlyle's *Sartor Resartus,* and similar works.

1970: Romanticism in English Poetry Mr. Barnouw S

The role of the imagination in poetry from Blake to Yeats.

Lit/En 125. American Literature of the Nineteenth Century

A critical study of major American writers of the nineteenth century. Two hours lecture and one hour discussion.

1970: Emerson, Whitman, Hawthorne, Melville, Henry James	Mr. Behar	W
	Mr. Fussell	S

Lit/En 126. The Modern Period

A critical study of major American and English writers of our period. Two hours lecture and one hour discussion.

1969: Chief Afro-American Novelists: Richard Wright, James Baldwin, Ralph Ellison	Mr. Lowe	F

Lit/En 151. Shakespeare

A critical and historical study of selected plays. Required of Revelle College Literature majors whose primary literature is English. Two hours lecture and one hour discussion.

1970: The Comedies	Mr. Berman	W

Lit/En 190. Seminars

These seminars 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 history of ideas, literary criticism, literature and society, and the like. Three hours. The student may enroll in more than one section in a single quarter.

1970: The Anti-Hero in Modern Fiction	Mr. Lowe	W
1970: Keats	Mr. Randel	W

Lit/En 192. Problems in Interpretation S

Mr. Behar

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.

Lit/En 199. Special Studies F,W,S

Tutorial; individual guided reading in an area not normally covered in courses. May be repeated for credit.

French Literature

Lit/Fr 121. The Middle Ages and the Renaissance

(Not offered 1969-70.)

Lit/Fr 122. The Seventeenth and Eighteenth Centuries

(Not offered 1969-70.)

Lit/Fr 124. The Nineteenth and Twentieth Centuries

Major French Literary works of the period as seen against the historical and intellectual background of their time. Two hours lecture and one hour discussion.

1970: Nouveau Theatre	Mr. Cohen	W

Lit/Fr 130A-130B-130C. Themes in French Intellectual and Literary History

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. Two hours lecture and one hour discussion.

French 130A. Literature and the Self	Mr. Wilden	F
French 130B. To be announced	The Staff	W
French 130C. The Lyric Voice	Mr. Saville	S

Lit/Fr 190. Seminars

These seminars 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 history of ideas, literary criticism, literature and society, and the like. The student may enroll in more than one section in a single quarter. Three hours.

1970: Proust	Mr. Wilden	W

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.

German Literature

Lit/Ge 101. German Literary Prose

The development of major forms and modes of German literary prose. Two hours lecture and one hour discussion.

1969: Romantic Prose Fiction	Mr. Lettau	F

Lit/Ge 102. German Dramatic Literature

The development of the drama in German. Two hours lecture and one hour discussion.

1970: Twentieth Century Drama	The Staff	W

Lit/Ge 103. German Poetry

The development of major forms and modes of German verse. Two hours lecture and one hour discussion.

1970: Political Poetry	Mr. Lettau	S

Lit/Ge 151. Goethe S

Mr. Blume

A study of some major works in the context of Goethe's life and milieu. Required of Revelle College literature majors whose primary literature is German. Two hours lecture and one hour discussion.

Lit/Ge 190. Seminars

These seminars 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 history of ideas, literary criticism, literature and society, and the like. The student may enroll in more than one section in a single quarter. Three hours.

1969:	Walter von der Vogelwende	Mr. Wierschin	F
1970:	Kafka	Mr. Lettau	W

Lit/Ge 192. Problems of 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 Revelle Senior Major Sequence, this course is required of all Revelle College Literature majors whose primary literature is German. Three hours seminar. Prerequisite: Literature 191.

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.

Greek Literature

Lit/Gr 100. Introduction to Greek Literature

Reading and discussion of selections from representative authors. Review of grammar as needed. Prerequisite: Lit/Gr 2 or equivalent. (Not offered 1969-70.)

Lit/Gr 199. Special Studies F,W,S

Tutorial; individual guided reading in areas of Greek literature not normally covered in courses. May be repeated for credit.

Italian Literature

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.

Latin Literature

Lit/La 100. Introduction to Latin Literature S
Mr. Crowne

Readings and discussions of selections from representative authors of the Augustan Age. Review of grammar as needed. Prerequisite: Lit/La 2 or equivalent.

Lit/La 199. Special Studies F,W,S
The Staff

Tutorial; individual guided reading in areas of Latin literature not normally covered in courses. May be repeated for credit.

Russian Literature

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

Lit/Sp 101. Spanish Literary Prose
(Not offered 1969-70.)

Lit/Sp 102. Spanish Dramatic Literature
The development of the drama in Spanish. Two hours lecture and one hour discussion.

1969: A Selection of Golden Age and Twentieth Century Plays	Mr. Blanco	F

Lit/Sp 103. Spanish Poetry
(Not offered 1969-70.)

Lit/Sp 121. The Medieval Period
Major Spanish literary works of the Middle Ages and Renaissance as seen against the historical and intellectual background of the period. Two hours lecture and one hour discussion.

1969: Major literary trends	Mr. Monroe	F

Lit/Sp 122. Renaissance and Baroque
Studies in selected topics in sixteenth and seventeenth century Spanish literature. Two hours lecture and one hour discussion.

1970: Major literary trends	Mr. Casalduero	S

Lit/Sp 124. The Nineteenth Century
Consideration of one or more major figures, texts, or trends in nineteenth century Spanish literature. Two hours lecture and one hour discussion.

1969: Major literary trends	Mr. Casalduero	F

Lit/Sp 125. Spanish-American Literature
(Not offered 1969-70.)

Lit/Sp 126. The Modern Period
Studies in selected topics in modern Spanish literature. Two hours lecture and one hour discussion.

1970:	Generation of '98	Mr. Baker	W
	Contemporary Spanish Literature	Mr. Baker	S

Lit/Sp 151. Cervantes W
Mr. Casalduero
A critical reading of the *Quijote*. Required of Revelle College Literature majors whose primary literature is Spanish. Two hours lecture and one hour discussion.

Lit/Sp 190. Seminars
These seminars 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 history of ideas, literary criticism, literature and society, and the like. The student may enroll in more than one section in a single quarter. Three hours.

1970:	The Spanish-American Novel in the Twentieth Century	Mr. Alazraki	W

Lit/Sp 192. Problems in Interpretation S
Mr. Blanco
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 Spanish. Three hours seminar.

Lit/Sp 199. Special Studies F,W,S
The Staff
Tutorial; individual guided reading in areas of Spanish literature not normally covered in courses. May be repeated for credit.

GRADUATE

200. Teaching in the Humanities (1-3, 1-3, 1-3) F,W,S
Apprentice teaching in interdisciplinary humanities courses. (Satsifactory/Unsatisfactory grades only.)

201. Teaching in Literature (1-3, 1-3, 1-3) F,W,S
Apprentice teaching in literature courses. (Satisfactory/Unsatisfactory grades only.)

202. Teaching in Subject A (1-3, 1-3, 1-3) F,W,S
Apprentice teaching in English composition. (Satisfactory/Unsatisfactory grades only.)

General and Comparative Literature

Lit/CL 206. Romance Philology (4) F
Mr. Sarolli

Lit/CL 207. Germanic Philology (4)
(Not offered 1969-70.)

Lit/CL 208. Textual Criticism (4)
(Not offered 1969-70.)

Lit/CL 210. Classical Studies (4)
(Not offered 1969-70.)

Lit/CL 211. Problems in Classical Arabic Literature (4)
(Not offered 1969-70.)

Lit/CL 215. Medieval Studies (4)
(Not offered 1969-70.)

Lit/CL 241. Romanticism (4)
1970: First Generation Romantics in England and Germany — Mr. Barnouw — W

Lit/CL 252. Modernism (4)
(Not offered 1969-70.)

Lit/CL 253. The New Literatures (4)
1969: Neo-African Literature — Mr. Lowe — F

Lit/CL 261. Comparative Literature: History and Theory (4) S
Mr. Guillén
An introduction to the intellectual origins, the tools of research, and the principal aims of comparative literature.

Lit/CL 262. Comparative Prosody (4)
(Not offered 1969-70.)

Lit/CL 263. Theory and Practice of Translation (4) W
Mr. Yip
Problems in translation as exemplified by English versions of classical and modern texts.

Lit/CL 271. Critical Theory (4,4,4)
1969: Theory of the Imaginary — Mr. Cohen — F
A study of major theories of imagination and psychology of imagination (Sartre, Merleau-Ponty, Bachelard, and Durand) and their modalities of literary application.

1970: Literature of Schizophrenia — Mr. Wilden — W
Readings in both "literary" and "non-literary" schizophrenic texts, attempting to relate asymbolic language to a general theory of discourse and communication.

1970: The Study of Literature and Culture — Mr. Pearce — S

Lit/CL 273. Art and Literature (4)
(Not offered 1969-70.)

Lit/CL 274. Genre Studies (4,4,4)

1969: Long Narrative:
Problems in Structure — Mr. Dolin — F

A study of *The Iliad, Wings of the Dove,* and *Tender is the Night.*

1969: Theory of the Theatre — Mr. Szanto — F

A consideration of twentieth century dramatic theory and its relation to new plays and to the reinterpretation of the modern and ancient classics.

1970: Comedy as Dramatic Form — Mr. Dolin — W

Readings in Aristophanes, Menander, Plautus, Shakespeare, Ben Jonson, and Moliere.

Lit/CL 279. Literary Studies and Linguistics (4) W
Mr. Klima
Fundamentals of linguistics. The relationship of literary theories and current linguistic theories. Examination of formalist and structuralist analyses of literary texts. The contribution of various literary theorists (Jakobson, Ingarden, Spitzer, etc.) to poetics. Structural analysis of selected texts, mostly in English.

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. (Satisfactory/Unsatisfactory grades only.)

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

Lit/En 202. Bibliography and Methods of Research (4)
(Not offered 1969-70.)

Lit/En 211A-211B. Old English Literature (4-4)
Lit/En 211A is a study of Old English language, forms and syntax, and reading of some prose and verse. Lit/En 211B is a study of Old English Poetry. Lit/En 211A or the equivalent is a prerequisite for Lit/En 211B.

Lit/En 211A. Introduction	Mr. Crowne	F
Lit/En 211B. *Beowulf*	Mr. Crowne	W

Lit/En 214. Middle English Literature (4)
1970: Chaucer — Mr. Saville — S

Lit/En 221. Sixteenth Century English Literature (4)
(Not offered 1969-70.)

Lit/En 224. Seventeenth Century English Literature (4,4)
1969: Restoration Drama and Poetry — Mr. Berman — F
1970: Donne — Mr. Dunseath — W

Lit/En 226. Shakespeare (4)
1970: The History Plays — Mr. Berman — S

Lit/En 231. Restoration and Eighteenth Century English Literature (4)
1970: Pope — Mr. Elliott — S

Lit/En 236. Later Eighteenth Century English Literature (4)
1969: The Novel — Mr. Wright — F

Lit/En 241. English Literature of the Romantic Period (4,4)
1969: Romantic Prose: Lamb, Hazlitt, DeQuincey, and Carlyle — Mr. Randel — F
1970: Shelley and Keats — Mr. Randel — S

Lit/En 244. Colonial American Studies (4)
(Not offered 1969-70.)

Lit/En 245. Nineteenth Century American Studies (4,4)
1969: Melville — Mr. Fussell — F
1970: Whitman — Mr. Fussell — W

Lit/En 246. Victorian Literature (4)
1970: The Novel — Mr. Wright — S

Lit/En 251. Twentieth Century English Literature (4)
1970: Forster and Lawrence — Mr. Behar — W

Lit/En 252. Studies in Modern American Literature and Culture (4,4)
1970: Wallace Stevens — Mr. Pearce — F
The American Novel after World War II — Mr. Szanto — S

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. (Satisfactory/Unsatisfactory grades only.)

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

Lit/Fr 203. History of the French Language (4)
(Not offered 1969-70.)

Lit/Fr 211. Old French Language and Literature (4)
1970: The Later Middle Ages Mr. Saville W

Lit/Fr 224. Seventeenth Century French Literature (4)
(Not offered 1969-70.)

Lit/Fr 231. Eighteenth Century French Literature (4)
1970: Political Writing Mr. Cohen S

Lit/Fr 241. Nineteenth Century French Literature (4)
1969: Symbolism The Staff F

Lit/Fr 251. Twentieth Century French Literature (4)
1970: Surrealism Mr. Marcuse and The Staff W

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. (Satisfactory/Unsatisfactory grades only.)

German Literature

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. (Satisfactory/Unsatisfactory grades only.)

Italian Literature

Lit/It 215. Dante (4) W
Mr. Sarolli
A study of the poet, his cultural background and his political-historical mission.

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
The treatment of a special topic in Italian literature. Offered for repeated registration. (Satisfactory/Unsatisfactory grades only.)

Spanish Literature

Lit/Sp 203. History of the Spanish Language (4) S
Mr. Monroe
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.

Lit/Sp 212A-212B. Hispano-Arabic Prose and Poetry (4-4)
A close study of selected Hispano-Arabic texts. Prerequisite: knowledge of Arabic. Must be taken in sequence.

Lit/Sp 212A.	Prose	Mr. Monroe	W
Lit/Sp 212B.	Poetry	Mr. Monroe	S

Lit/Sp 224. Golden Age Studies (4,4,4)

1969:	The Theatre	Mr. Blanco	F
1970:	Baroque Poetry	Mr. Blanco	W
	Renaissance Prose	Mr. Guillén	S

Lit/Sp 226A-226B. Cervantes (4-4)

Lit/Sp 226A.	*Quijote*, Part I	Mr. Casalduero	F
Lit/Sp 226B.	*Quijote*, Part II	Mr. Casalduero	W

Lit/Sp 231. The Eighteenth Century (4)

1969:	A survey of major trends with special attention to Feijoó, Jouellanos, and Goya	Mr. Baker	F

Lit/Sp 241. Romanticism in Spain (4)
(Not offered 1969-70.)

Lit/Sp 248. Nineteenth Century Theatre (4)
(Not offered 1969-70.)

Lit/Sp 252. Studies in Modern Hispanic Literature and Culture (4)
(Not offered 1969-70.)

Lit/Sp 254. Modern Spanish Poetry (4)
(Not offered 1969-70.)

Lit/Sp 255. The Modern Spanish Novel (4)
(Not offered 1969-70.)

Lit/Sp 258. Spanish-American Prose (4)
1970: The Contemporary Novel Mr. Alazraki W

Lit/Sp 259. Spanish-American Poetry (4)
1970: The Poetry of Pablo Neruda Mr. Alazraki S

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. (Satisfactory/Unsatisfactory grades only.)

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: 7313 Building 2A

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*
Hubert Halkin, *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*
Burton Rodin, *Ph.D., Associate Professor of Mathematics*
Allen Altman, *Ph.D., Assistant Professor of Mathematics*
Stephen A. Andrea, *Ph.D., Assistant Professor of Mathematics*
Laughlin A. Campbell, *Ph.D., Assistant Professor of Mathematics*
John D. Donald, *Ph.D., Assistant Professor of Mathematics*
Philip Erdelsky, *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*
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*
John J. Wavrik, *Ph.D., Assistant Professor of Mathematics*
Stanley G. Williamson, *Ph.D., Assistant Professor of Mathematics*
John B. Ferebee, *M.A., Acting Assistant Professor of Mathematics*

* * *

Hans J. Stetter, *Ph.D., Visiting Professor of Mathematics*
Chung-Tuo Shih, *Ph.D., Visiting Assistant Professor of Mathematics*

*On leave Fall 1969
**On leave 1969-70

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, applied mathematics and mathematical logic, 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. Mathematics majors whose main interest is in computer sciences are advised to include in their program "Numerical Analysis" (Mathematics 141A-141B-141C), "Elementary Mathematical Logic" (Mathematics 170A-170B), and "Introduction to Computer Science" (APIS 161A-161B-161C); these last three courses (APIS 161A-161B-161C) are acceptable as restricted electives for mathematics majors.

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. A minimum of a "C" average in the major is required 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.

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 or teaching 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 Analytical 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 fulfill 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 1969-70.)

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 1969-70.)

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 1969-70.)

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. (Not offered 1969-70.)

10E. Computer Sciences **W**
Numerical algorithms, algorithms for games, algorithm for finding paths in a labyrinth, the wood problem, computing machine with automatic

control programs, Turing machines, realization of algorithms in Turing machines, the universal Turing machine, algorithmically unsolvable problems; fundamentals of Fortran computations, transfer of controls, double precision, subscripped variables, the DO statement, input and output. (Not offered 1969-70.)

10F. Groups in Geometry **S**
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 isometries, geometrical crystallography, discrete groups. (Not offered 1969-70.)

10G. Elementary Logic and Set Theory **F**
Connectives, truth tables, tree diagrams, logical relations, variants of the conditional, valid arguments, indirect method of proof, switching circuits, introduction to set theory, operations on subsets, laws of set operations, two-digit number system.

10H. Approximation Theory **W**
Polynomials, evaluation of polynomials, linear approximations, zeros of functions, zeros of polynomials, basic sets of polynomials, polynomial approximations, divided differences, ordinary differences, polynomial interpolation, the π-factor, evaluation of functions, numerical differentiation, numerical integration, remainder in numerical integration.

10I. Projective Geometry **S**
Projective plane, Desargue's theorem, projective transformations, the theorem of Pappus, coordinates for the projective plane, cross ratio, synthetic definition of conic, Pascal's theorem, tangents, polarities, complex projective plane.

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 theorems 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.

123A-123B. Ordinary Differential Equations **F-W**

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.

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 integral 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**

Probablity 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.

144A-144B. Mathematical Programming **F-W**

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-155B. Introduction to Analysis and Topology **F-W**

Set theory, Zorn's lemma, metric spaces, continuous mappings, completions, fixed-point theorems, Baire's theorem, compactness, Lebesgue number, connectedness. Uniform convergence on subsets, function algebras, Ascoli's theorem, Stone-Weierstrass theorems, structure of function algebras. Four lectures. Prerequisite: Mathematics 102.

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.

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.

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.

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. Altman, Mr. Donald, and Mr. Flanigan

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.

201A-201B-201C. Number Theory (3-3-3) F-W-S

Mr. Flanigan

Elementary number theory, divisibility, continued fractions, quadratic reciprocity, quadratic forms. Algebraic and analytic methods applied to Diophantine equations, representation and distribution of prime numbers, transcendental numbers, partitions. Prerequisites: Mathematics 110A-110B-110C and advanced calculus, 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 1969-70.)

203A-203B-203C. Algebraic Geometry (3-3-3) **F-W-S**
Mr. Altman

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 1969-70.)

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 1969-70.)

207A-207B. Topics in Algebra (3-3) **F-W**
Mr. Donald

Advanced material in special areas of Algebra to be selected by the instructor. Prerequisite: consent of instructor.

208. Seminar in Algebra (3) **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) **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. (211C not offered 1969-70.)

212A. Mathematical Methods in Physics and Engineering (4) F
Mr. Thiess, 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-215C. Mathematical Theory of Process Optimization (3-3-3) F-W-S
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 described by nonlinear difference equations, applications to the theory of optimal economic growth. Prerequisites: Mathematics 144 or 212A-212B-212C, or 240A-240B-240C, or Economics 212, or AMES 255A-255B, or consent of instructor.

220A-220B-220C. Complex Analysis (3-3-3) F-W-S
Mr. Warschawski
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 1969-70.)

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. (Not offered 1969-70.)

227A-227B-227C. Topics in Complex Analysis (3-3-3) **F-W-S**
Mr. Rodin

Prerequisite: consent of the instructor.

228. Seminar in Complex Analysis (3) **F,W,S**
The Staff

Prerequisite: consent of instructor. (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 1969-70.)

231A-231B-231C. Partial Differential Equations (3-3-3) **F-W-S**
Mr. Shenk

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. (Not offered 1969-70.)

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. Carathéodory's approach to calculus of variations. Prerequisites: Mathematics 240A-240B-240C or 210A-210B-210C, or consent of the instructor. (Not offered 1969-70.)

240A-240B-240C. Real Analysis (3-3-3) **F-W-S**
Mr. Getoor
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 1969-70.)

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: Lebesgue integration, or consent of the instructor. (Not offered 1969-70.)

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. (Not offered 1969-70.)

248. Seminar in Real Analysis (3) **F,W,S**
The Staff
Prerequisite: consent of the instructor. (Satisfactory/Unsatisfactory grades permitted; not offered 1969-70.)

250A-250B-250C. Differential Geometry (3-3-3) **F-W-S**
Mr. Wavrik
Differential manifolds, Sard theorem, tensor bundles, Lie derivatives, De-Rham theorem, connections, geodesics, Riemannian metrics, curvature tensor and sectional curvature, completeness, characteristic classes. Dif-

ferential manifolds immersed in Euclidean space. Prerequisites: Mathematics 110A-110B-110C, 166, or consent of the instructor.

258. Seminar in Differential Geometry (3) **F,W,S**
Mr. Frankel

Advanced material in special areas of differential geometry to be selected by the instructor. Prerequisite: consent of the instructor.

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: Mathematics 110A-110B-110C or consent of the instructor.

268A-268B-268C. Seminar in Formal Languages (3-3-3) **F-W-S**
Mr. Bishop

Advanced material in special areas of formal languages to be selected by the instructor. Prerequisite: consent of the instructor.

270A-270B-270C. Numerical Analysis (3-3-3) **F-W-S**
Mr. Gragg

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. Stetter

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.

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; nonparametric inference. Prerequisite: advanced calculus and consent of the instructor. (Not offered 1969-70.)

282A-282B-282C. Stationary Processes and Prediction Theory (3-3-3) F-W-S

Mr. Rosenblatt

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: Lebesgue integration.

286A-286B. Topics in Probability Theory (3-3) F-W

Mr. Getoor

Prerequisite: consent of the instructor. (Satisfactory/Unsatisfactory grades permitted.) (Not offered 1969-70.)

288. Seminar in Probability Theory and Mathematical Statistics

The Staff

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

289A-289B-289C. Teaching of Mathematics (1-3) F-W-S

The Staff

Teaching and tutorial services connected with courses and seminars. Prerequisite: consent of Department Chairman.

290A-290B-290C. Topology (3-3-3) F-W-S

Mr. Röhrl

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.

292A-292B-292C. Differential Topology (3-3-3) F-W-S

The Staff

Differential manifolds and submanifolds. Mappings and approximations. Smoothing maps. Manifolds with boundary. Triangulation of differential manifolds. Non-degenerate smooth functions. Morse inequalities. Calculus of variations. Applications to Lie groups and symmetric spaces. Prerequisites: Mathematics 250B, 290B, 290C, or consent of instructor. (Not offered 1969-70.)

297A-297B-297C. Topics in Topology (3-3-3) **F-W-S**
Mr. Andrea

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*
Roger Reynolds, *M.M., 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 serve various purposes:

1. Enable students to begin a major consisting of eighteen courses or less, according to the students' previous preparation or abilities.
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.

Courses required for the B.A. in music include the following:

1. Lower-division courses Music 3, 4, and 5.
2. The six-course sequence, Music Theory and Practice (101A-101B-101C, 102A-102B-102C).
3. Three selected music literature lecture courses (Music 112, 114, 115, etc.), each supplemented by an appropriate weekly seminar.
4. One three-quarter seminar sequence in either chamber music or composition, equivalent to one course.
5. A continuing departmental seminar that includes concerts, lectures, and departmental discussions.
6. A senior comprehensive seminar, taken in the final quarter prior to graduation, equivalent to one course.
7. 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 consent of the instructor prior to enrollment. Other opportunities for musical performance include participation in the University-Civic Symphony and Chorus, the University Reading Orchestra, the Revelle and Muir Chamber Choruses, and other 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.

THE GRADUATE PROGRAM

The department offers the degree of Master of Arts in Music, according to Plan I: 36 course units and a research thesis.

In addition to fulfilling the University's general requirements for admission to graduate status, the student, during his first quarter of residence, will be asked to confirm appropriate levels of musicianship and of theoretical-historical knowledge of the field.

The candidate for the M.A. degree will elect a minimum of three tracks of study, each consisting of a minimum of three courses in one of several possible areas. Approved sequences could be formed in composition, theoretical studies, music communications and electronics, music literature and analysis, conducting and performance, or in another complementary discipline approved by the department (e.g., visual arts, physics, history, literature, etc.). The remaining requirement, beyond any non-credit remedial course work determined by the department or the Graduate Division, and the thesis, would be a three-unit candidate's tutorial, taken as a three quarter sequence during the first year of graduate study. This tutorial is intended to serve two functions: (1) the supervision of independent remedial studies and (2) the guided preparation for thesis research.

The department will require a reading ability in one or more foreign languages if the student's research area calls for such proficiency.

The department's proposal for a Ph.D. degree in music is under consideration and will be incorporated into the music curriculum upon University approval.

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. Prerequisites: 2A for 2B; 2B for 2C; or proficiency certified by course committee.

3. Music Reading **F**
An intensive course in the reading of music presenting progressively more problematic relationships of pitch, rhythm, and other factors. Prerequisite: Music 2C or its equivalent by examination.

4. Physics of Musical Sounds **W**
A practical analysis of the physical nature of music through discussion and individually assigned projects. This course is a prerequisite for Music 104A. 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. Two units per 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 3 or consent of the instructor.

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 enroll 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 or equivalent by examination or consent of instructor.

105B. Advanced Use of Electronics in Music S

Projects seminar. Prerequisite: Music 105A or equivalent by examination.

106A-106B-106C. Seminar in Experimental Music Theory F-W-S

Individual and group problems and projects in experimental music theory. An elective course for qualified undergraduates. Prerequisites: Music 3, 4, and 5 and instructor's consent.

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.

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.

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.

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.

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. Three meetings.

130A-130B-130C. Seminar in Chamber Music Performance (2-2-2) **F-W-S**
Performance of representative chamber music literature. Two units per quarter. Prerequisite: proficiency on a musical instrument and consent of the instructor through audition.

131. Projects in Chamber Music Performance **F-W-S**
Individual projects in the preparation of chamber music for performance. Three consecutive quarters are equivalent to one undergraduate course. Students enroll in the fall and receive a grade at the end of the spring quarter.

135. Concert Orchestra **F,W,S**
Activity. Audition required. One three-hour rehearsal weekly.

136. Reading Orchestra **F,W,S**
Activity. One three-hour rehearsal in alternate weeks.

140. Concert Chorus **F,W,S**
Activity. Audition required. One three-hour rehearsal weekly.

141. Chamber Chorus **F,W,S**
Activity organized separately for each college.

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.

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**
(Satisfactory/Unsatisfactory grades permitted.)

202. Problems and Projects in the Specialized Use of Electronics in Performance (3) **S**

203A-203B-203C. Advanced Problems and Projects in Composition (3,3,3) F,W,S
(Satisfactory/Unsatisfactory grades permitted.)

204. Projects Seminar in Electroacoustic Transmission of Music Information (3) W
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.

206A-206B-206C. Seminar in Theoretical Studies (3,3,3) F,W,S
Theory seminars offered by faculty including 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
A detailed and comparative analytic study of selected operas in production in San Diego, Los Angeles, or San Francisco.

214. Seminar in Twentieth-Century Music (3) W
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
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
Problems of style and performance in selected music of the thirteenth, fourteenth, and fifteenth centuries.

217. Seminar Studies in Late Renaissance and Early Baroque Music (3) S
The study of early music as it has to do with theoretical systems, critical analyses, music and documentary source materials.

223. Seminar Studies in Orchestral Literature (3) S
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) S
A critical and historical study of selected works and repertory.

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.

297. Candidates Tutorial (1) **F-W-S**
A course requirement for all prospective M.A. and Ph.D. candidates, the tutorial is taken with the student's graduate advisor and provides for supervised independent remedial music studies and guided preparation for thesis research. Students are encouraged to enroll during the fall quarter of his first year of residence.

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 enroll 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**
(Satisfactory/Unsatisfactory grades permitted.)

NATURAL SCIENCES
See *Interdisciplinary Courses*.

NEUROSCIENCES

Office: Basic Science Building

The Graduate Program

The Department of Neurosciences accepts for the Ph.D. degree candidates with undergraduate majors in such disciplines as biology, chemistry, engineering, microbiology, mathematics, physics, psychology and zoology. A desire to understand how nervous systems function is more important than previous background and training.

Doctor's Degree Program

No specific course requirements exist. Each student, in consultation with a faculty committee, devises his individual program of study. This will include formal courses selected from the UCSD *General Catalogue* and informal seminars offered by the Department. A regular schedule of rotation through the laboratories of faculty members is a feature of the first year; the student works on research projects and is exposed to the various approaches, techniques and disciplines represented in the Department. Close association among the student, faculty and other research personnel is encouraged in order to achieve an informal, tutorial type of instruction. A period of study at one of the other campuses of the University of California can be arranged by mutual agreement between the Neurosciences Department and neuroscientists in those locations.

Dissertation

During the second year each student is expected to propose and initiate work on a thesis problem under the guidance of a faculty preceptor. The Department is presently particularly well equipped for human and animal research in neurochemistry, neuropharmacology, neuroanatomy, neurophysiology and neural modeling. Outstanding facilities for research on marine forms, vertebrate and invertebrate, are available.

Foreign Languages

Competence is required in one foreign language; this is ordinarily demonstrated by acceptable translations of samples of scientific writing selected from the contemporary literature of neuroscience. A language other than French or German will be accepted where appropriate.

Examinations

Frequent oral and written exercises and defense of propositions in laboratory and seminar settings can be expected; the aim is to sharpen student skills in the presentation of scientific material. By the end of the second year the oral examination to qualify for candidacy for the Ph.D. degree is taken. Following the preparation of the dissertation an oral defense of the thesis completes the requirements.

Teaching

The Department provides experience in instruction. Generally, this involves assisting in laboratory exercises and demonstrations in relation to teaching Basic Neurology. Other types of teaching opportunity also exist since the Department is deeply committed to innovations in education. Students are encouraged to develop their own talents for the creation and evaluation of learning resources.

OCEANOGRAPHY

See *Departments of Instruction: Scripps Institution of Oceanography.*

PHILOSOPHY

Office: 3112 Humanities-Library Building

Herbert Marcuse, *Ph.D., Professor of Philosophy*
Stanley Moore, *Ph.D., Professor of Philosophy*
Richard H. Popkin, *Ph.D., Professor of Philosophy*

Avrum Stroll, *Ph.D., Professor of Philosophy*
(Chairman of the Department)
Piero Ariotti, *Ph.D., Assistant Professor of Philosophy*
Rudolf Makkreel, *Ph.D., Assistant Professor of Philosophy*
Stanley Malinovich, *Ph.D., Assistant Professor of Philosophy*
(Undergraduate Adviser)
David Fate Norton, *Ph.D., Assistant Professor of Philosophy*
(Graduate Adviser)
Giorgios H. Anagnostopoulos, *Acting Assistant Professor of Philosophy*
Alan L. Reeves, *Acting Assistant Professor of Philosophy*

* * *

**Raziel Abelson, *Visiting Professor of Philosophy (Professor of Philosophy, New York University)*
*Paul Dibon, *Visiting Professor of Philosophy (Professor of Philosophy, Sorbonne)*
*Roger Ruffin, *Lecturer in Philosophy (Judge, Superior Court of California)*

*Fall and winter quarters
**Winter and spring quarters

The Undergraduate Program

Students who wish to major in philosophy must have satisfied the general 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, or, with the written approval of the undergraduate adviser, from fields of study that are closely related to the individual student's major philosophical interests.

The total is fourteen courses—ten in philosophy, four in related fields. Requirements can be met by examination. An overall average of 2.00 must be obtained in courses fulfilling the requirements for major before certification of completion will be granted.

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 leading to the M.A. and Ph.D. There is no sequence of required courses in either program. Courses of study are arranged according to the need, interest, and experience of the individual student.

It is the intention of the graduate program to enable the student to obtain an understanding of divergent philosophical traditions and to develop as a philosopher in his own right. To this end, the Department offers courses and seminars in the history of philosophy, and in the study, from a variety of perspectives, of traditional and contemporary philosophical issues.

Master's Degree Program

An M.A. is offered under the Comprehensive Examination Plan. Under this plan, credit must be obtained for 36 quarter units; at least 14 units must be from graduate courses in philosophy; no more than 9 units may be from upper-division courses. In addition, a comprehensive written examination must be passed prior to the conclusion of the seventh quarter in residence. This examination is identical to the written examination required of Ph.D. candidates.

Candidates for an M.A. degree must demonstrate reading proficiency in one foreign language (Classical Greek, Latin, French or German) before the comprehensive examination is attempted and before the beginning of the fourth quarter in residence.

Doctor's Degree Program

From the time of his initial enrollment until advancement to candidacy the student will be expected to take in each year of residence *at least* twelve units in graduate philosophy courses (specifically, those numbered 201-295). The balance of the student's course work, which will normally total 36 units per year, may be made up from upper-division courses in philosophy, upper-division and graduate courses in other departments, and, if the student is a Teaching Assistant, Philosophy 200.

Prior to the conclusion of the seventh quarter in residence all students must pass a written comprehensive examination administered by the Department. This examination is in three parts:

I. History of philosophy: ancient, medieval, renaissance, early modern, and nineteenth century.

II. Metaphysics and epistemology: traditional metaphysics and epistemology, contemporary metaphysics and epistemology, logic and philosophy of science.

III. Value theory: aesthetics, ethics, philosophy of religion, political and social philosophy.

Students are allowed three or four hours to complete Part I, three hours to complete Parts II and III. All three parts of the written comprehensive examination must be attempted during one (three-day) examination period. The student will be expected to write on only two of the subjects listed in Part II and in Part III. This examination serves to determine: (*a*) whether the student qualifies for an M.A. in Philosophy, and (*b*) whether the student shall be encouraged to continue work for a Ph.D. Each student who attempts the examination will receive from the Graduate Adviser official and written evaluations of his performance.

Students failing any part(s) of the examination shall be required to retake only the part(s) failed. No part of the examination may be attempted more than twice. Those students who pass the examination will be informed as to whether they are encouraged or permitted to begin preparation for the Oral Qualifying Examination. Such encouragement can be given only if the student's work in the Department and performance on the exams is of such a quality that staff members indicate a willingness to assist the student in the preparation of his prospectus and, eventually, to serve on his doctoral committee.

After passing the written comprehensive examination, the student must submit a prospectus of his dissertation to his Doctoral Committee. This committee will then orally examine the student on the subject of his intended research. This examination will seek to establish that the thesis proposed is a satisfactory subject of research, and that the student has the preparation and abilities necessary to complete the research. This oral qualifying examination must be passed before the beginning of the tenth quarter in residence. Students who are passed will be Advanced to Candidacy for the Ph.D.

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.*)

Participation in undergraduate teaching is one of the requirements for a Ph.D. in Philosophy. The student is required to serve as a Teaching Assistant for the equivalent of one-quarter time for three academic quarters. The duties of a Teaching Assistant normally entail grading papers and examinations, conducting discussion sections, and related activities, including attendance at the lectures for the course in which he is assisting.

Candidates for a Ph.D. degree must demonstrate reading proficiency in one foreign language before the comprehensive examination is attempted and before the beginning of the fourth quarter in residence. Reading proficiency in a second foreign language must be demonstrated before the oral qualifying examination is attempted and before the end of the ninth quarter in residence.

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
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
An introduction to value theory, dealing with questions about morality, politics, religion and art. Two hours lecture, one hour discussion.

12. Introduction to Logic
An inquiry into the nature of argument, inference and proof, fallacies, etc. Two hours lecture, one hour discussion.

20. Theories of Society **F**
An introduction to the concept of authoritarianism in social and political theory. Analysis and critical examination of texts, largely devoted to recent and contemporary studies in political thought and institutions. Two hours lecture, one hour discussion.

21. Theories of Society **W**
An introduction to the concept of authoritarianism in social and political theory. Analysis and critical examination of texts, largely devoted to ancient, mediaeval and renaissance studies in political thought and institutions. Two hours lecture, one hour discussion.

22. Theories of Society **S**
An introduction to the concept of authoritarianism in social and political theory. Analysis and critical examination of texts, largely devoted to 18th

and 19th century studies in political thought and institutions. 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
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
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
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
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
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
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
Introduction to mathematical logic. Three lecture-discussions.

112. Philosophy of Science
The development and systematic methods of epistemology in the light of the historical development of science. Two or three lecture-discussions.

120. Political Philosophy
An examination of problems and theories concerning the nature of the state, society, and government. Three lecture-discussions.

121. Aesthetics
An inquiry into the nature of human artistic experience and works of art. Three lecture-discussions.

122. Philosophy of Religion
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
An inquiry into the nature of human conduct. Three lecture-discussions.

131. Contemporary Anglo-American Philosophy
Some main problems found in the literature of recent and contemporary Anglo-American philosophy. Two or three lecture-discussions.

132. Contemporary European Philosophy
Some main problems found in the literature of recent and contemporary European philosophy. Two or three lecture-discussions.

199. Individual Study
Prerequisite: permission of departmental adviser.

GRADUATE

200. Studies and Teaching in Philosophy and the Humanities (1-3)
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 (4)
An intensive examination of propositional and quantificational logic as a basis for further deductive development.

202. Topics in the History of Philosophy* (4)
A course of studies designed to prepare students for advanced work in seminars.

203. Topics in Contemporary Epistemology and Metaphysics* (4)
A course of studies designed to prepare students for advanced work in seminars.

204. Topics in Moral and Political Philosophy* (4)
A course of studies designed to prepare students for advanced work in seminars.

250. Seminar in Contemporary Analytic Philosophy* (4)
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* (4)
An analysis of some important problems in recent and contemporary Continental philosophy as illustrative of major movements of thought.

252. Seminar in Ancient Philosophy* (4)
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 (4)
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.

254. Seminar in Social and Political Philosophy* (4)
An analysis of social philosophies and ideologies as they emerge from basic types of social structure.

255. Seminar in Medieval Philosophy* (4)
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 (4)
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.

257. Seminar in Philosophy of Religion (4)
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 (4)
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.

260. Seminar in Renaissance Philosophy (4)
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* (4)
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 (4)
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* (4)
An examination and critique of representative theories of mind, reality, knowledge and perception.

264. Seminar in Philosophy of History (4)
An examination of basic concepts, categories, and presuppositions of historical experience in the context of representative philosophies of history.

265. Seminar in Nineteenth-Century Philosophy* (4)
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.

269. Departmental Colloquium (1-4)
Special topics submitted by visiting philosophers for critical appraisal by staff and students. (Satisfactory/Unsatisfactory grades permitted.)

270. Seminar on Special Topics* (1-4)
A seminar for examination of a specific philosophical problem. (Satisfactory/Unsatisfactory grades permitted.)

290. Directed Independent Study* (1-4)
Supervised study of individually selected philosophical topics. (Satisfactory/Unsatisfactory grades optional.)

295. Research Topics* (1-12)
Advanced, individual research studies under the direction of a member of the staff. (Satisfactory/Unsatisfactory grades optional.)

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)
Howard F. Hunt, *M.A., Assistant Supervisor*
Richard N. Johnson, *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.

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 and intermediate 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.

22. First Aid **F,W,S**

Standard and Advanced course. Upon successful completion of the course, a Red Cross certificate is awarded. Prepares student to render effective First Aid in treatment of wounds, burns, breaks, fractures, dislocations, artificial resuscitation and other emergency conditions.

23. Basketball **F,W**

Instruction in fundamentals is combined with opportunities for team play. Some pre-knowledge of the game is desirable since emphasis will be on vigorous competition.

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**	**F,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**
40.	**Gymnastics**	**F,W,S**
41.	**Soccer**	**F,S**
42.	**Fencing**	**W,S**

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*
(Acting Provost of Third College)
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)
Joseph C. Y. Chen, *Ph.D., Associate Professor of Physics*
John M. Goodkind, *Ph.D., Associate Professor of Physics*
Robert J. Gould, *Ph.D., Associate Professor of Physics*
Francis R. Halpern, *Ph.D., Associate Professor of Physics*
Laurence E. Peterson, *Ph.D., Associate Professor of Physics*
Sheldon Schultz, *Ph.D., Associate Professor of Physics*
Lu Jeu Sham, *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*
Donald R. Fredkin, *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 Ma, *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*

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 sub-atomic 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 100A Restricted Elective (Math) Free Elective	Physics 110B Physics 100B Physics 101A Math 121 Free Elective	Restricted Elective Physics 100C Physics 101B Free Elective Free Elective
Senior Year	Physics 130A *Physics 131A or 171 Physics 140 Free Elective Free Elective	Physics 130B *Physics 131B Physics 141 Free Elective Free Elective	Physics 130C *Physics 170 Restricted Elective Free Elective Free Elective

*Students are expected to take two laboratory courses from the group Physics 131A or 171, 131B, 170. Physics 199 may be substituted by individual arrangement with a member of the faculty and approval of the Department. Enrollment in Physics 170 and Physics 171 will be limited.

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 is required to have a sound knowledge of undergraduate mechanics, electricity and magnetism; to have had senior courses or their equivalent in atomic and quantum physics, nuclear physics, thermodynamics, and solid state physics; and to have taken upper-division laboratory work. An introductory course in solid state physics is desirable. Upper-division courses numbered 130 and higher are available for students with minor deficiencies in undergraduate training.

In view of the language requirement for the Ph.D. (see below), it is advantageous for an entering student to have proficiency in a foreign language.

Master's Degree Program

Requirements for the Master of Science degree can be met according to Plan II (comprehensive examination). (See *Graduate Division: The Master's Degree.*) The comprehensive examination is identical to the first-year written examination for Ph.D. students. A list of acceptable courses is available in the Physics Department office. There is no foreign language requirement.

Doctor's Degree Program

The Ph.D. program consists of three components: graduate courses, apprenticeship in research, and thesis research. In addition, opportunities for teaching are provided. The Department has developed a flexible program which provides a broad, advanced education in physics while at the same time giving the student opportunity for emphasizing his special interests.

An entering student is assigned a faculty adviser to guide him in his program. Many students spend their first year as teaching assistants or fellows and begin apprentice research in their second year. After two years of graduate study, or earlier, they complete the departmental examinations and begin thesis research. Typically, thesis work takes two or three years.

Entrance Testing

An entrance test covering undergraduate physics is given to every entering graduate student during registration week for the purpose of enabling the faculty to give him better guidance in his graduate work. Performance on this test has no bearing on the student's status in graduate school.

First Year Written Examination

A student is required to take a written examination after completing *one* year of graduate work at UCSD. The examination is on the level of material usually covered in undergraduate courses and the following first-year graduate physics courses. It is offered twice a year, at the beginning of the Fall and Spring quarters, and lasts two days, four hours per day. The examination may be repeated once, the next time it is offered.

First Year Graduate Courses

Fall: Physics 200A (Theoretical Mechanics)
Physics 203A (Adv. Classical Electrodynamics)
Mathematics 212A (Mathematical Methods)

Winter: Physics 200B (Theoretical Mechanics)
Physics 212A (Quantum Mechanics)
Mathematics 212B (Mathematical Methods)

Spring*: Physics 203B (Adv. Classical Electrodynamics)
Physics 212B (Quantum Mechanics)
Mathematics 212C (Mathematical Methods)

*Students who have not had an introductory course in solid state physics may take Physics 152.

Second Year Oral Examinations

A student is required to take two oral examinations after completing *two* years of graduate work or earlier.

General.—The general oral examination, administered by a faculty committee, tests general mastery of advanced physics. Students are asked to indicate areas in which they have special competence and are questioned more intensively in these areas. The examination is offered twice a year, at the beginning of the Fall and Spring quarters, and lasts approximately one hour.

This examination will be waived for students who obtain credit (*C* or better) in 7 advanced courses selected from the following groups, provided that they obtain at least a 3.0 average in 6 out of the 7. The selection must include all of Group I and at least one course from each of Groups II and III.

Second Year Graduate Courses

Group I:

Physics 212C (Quantum Mechanics) Fall
Physics 212D (Quantum Mechanics) Winter
Physics 210A (Statistical Mechanics) Fall
Physics 210B (Statistical Mechanics) Winter

Group II:

Physics 213 (Theoretical Nuclear Physics) Winter
Physics 215 (High Energy Nuclear Physics) Spring

Group III:

Physics 211 (Solid State Physics) Spring
Physics 216 (Atomic and Molecular Theory) Fall

Group IV:

Physics 219 (Introductory Astrophysics) Fall
Physics 218 (Introductory Plasma Physics) Spring

Oral Presentation of a Topic.—This examination is held two weeks following the general oral examination and lasts approximately one hour. Three topics of current interest in physics, together with relevant references, are made available to students. Each student presents to a faculty committee a one-half hour talk on the topic he has chosen. This is followed by approximately one-half hour of questioning related to the topic.

The oral examinations may be repeated once the next time they are offered.

Qualifying Examination

After a student has passed the departmental examinations, he should obtain a faculty research supervisor. When he is ready to demonstrate his ability to engage in thesis research and has met the foreign language requirement (see below), he may take the Qualifying Examination.

Thesis Defense

When a student has completed his thesis, he is asked to present and defend it before his doctoral committee.

Foreign Language Requirements

A graduate student may satisfy the departmental language requirements by demonstrating either (*a*) reading knowledge of two languages (one language must be German or Russian; the second may be German, Russian, French, Italian, or Spanish) or (*b*) 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.)

Advanced Courses and Seminars

In addition to the above-listed basic courses, the Department offers a weekly general departmental colloquium, advanced courses for students doing specialized research, and seminars in the main departmental areas of interest. Students are strongly urged to enroll for credit in appropriate advanced courses and seminars.

Course Credit by Examination

Students have an option of obtaining credit for a physics graduate course by taking the final examination without participating in any class exercises. They must, however, officially register for the course and notify the instructor and the Department office of their intention no later than the first week of the course.

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 1969.)

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 1969-70.)

199. Special Project F,W,S

Independent reading or research on a problem by special arrangement with a faculty member. Four hours. Prerequisites: consent of the instructor and approval of Department.

GRADUATE

200A. Theoretical Mechanics (4) F

Lagrangian mechanics with applications to linear and non-linear 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

Application 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 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 Schroedinger 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 system. Prerequisite: Physics 212C.

213. Theoretical Nuclear Physics (3) 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, Physics 212C; co-registration 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 and 213.

216. Atomic and Molecular Physics (3) F
Structure of atoms, the Hartree-Fock method, correlation energy and relativistic corrections. Structure of molecules, the Born-Oppenheimer method, the molecular electronic state, the stability and build-up of molecules, molecular orbital theory. The interaction of atoms and molecules with external fields. Atomic and molecular collisions. Prerequisite: Physics 212C.

218. Introductory Plasma Physics (3) S
Elementary properties of plasma; occurrence of plasma; positive column; magnetized plasma; magnetohydrodynamics; high frequency behavior of plasma; collisionless kinetic theory; application of plasma physics.

219. Introductory Astrophysics (3) **F**
Fundamentals of radiative transfer: theory of gray and non-gray stellar atmospheres; Eddington's approximation, principles of invariance. Formation of absorption lines, curve of growth, resonance radiation. Convection theory. Stellar structure: polytropes, nuclear reactions, stellar models. Stellar evolution. Prerequisites: Physics 130C, 141, or equivalent.

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.

221. Advanced Mechanics (3) **S**
Advanced topics such as general relativity, hydrodynamics and shock waves, elasticity.

222. Advanced Nuclear Physics (3) **S**
Nuclear structure; the collective model; radiation theory; β decay; introduction to the many-body problem.

223A. Advanced Astrophysics (3) **F**
Stellar spectroscopy (line, molecular, and continuum), stellar atmospheres, determination of abundances of elements in stars. Prerequisites: Physics 130C; 141 or equivalent; Physics 219.

223B. Advanced Astrophysics (3) **W**
Stellar structure, degenerate matter, stellar evolution (theoretical and empirical), nuclear energy and nucleosynthesis. Prerequisite: Physics 223A.

223C. Advanced Astrophysics (3) **S**
Galactic structure, stellar populations, star cluster, interstellar medium, radio emission from galaxies. Prerequisite: Physics 223A.

224. 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.

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) **F-W**
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) W
Current problems in elementary particle theory, especially the theory of strong interactions. Prerequisite: Physics 215.

234. High Energy Experimental Physics (4) S
Current elementary particles research. Techniques used in experiments with high energy accelerators. Prerequisite: Physics 215.

235. Numerical Methods in Theoretical Physics (3)
Approximation of functions, interpolation and smoothing of data, numerical solution of ordinary and partial differential equations, and integral and integro-differential equations of particular interest to physicists. (Not offered 1969-70.)

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; screening; superconductivity and superfluidity; Green's function method; the self-consistent field; interacting systems of magnetic moments, ferromagnetism. Prerequisites: Physics 210C and 212D.

239. Special Topics (1-2)
From time to time it will be possible to give a self-contained short course on an advanced topic in special areas of research. (Satisfactory/Unsatisfactory grades permitted.)

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 1969-70.

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, *D.Phil., Professor of Psychology*
David M. Green, *Ph.D., 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*
J. Edward Russo, *M.S., Acting Assistant Professor of Psychology*

* * *

Ursula Bellugi-Klima, *Ed.D., Assistant Professor of Psychology in Residence*
Robert Galambos, *Ph.D., M.D., Professor of Neurosciences*
John H. Taylor, *Ph.D., Research Psychologist, Lecturer in Psychology*

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. The Department emphasizes modern research in the experimental and theoretical analysis of human and animal behavior. Students who major in psychology can expect to develop a knowledge of a broad range of content areas as well as basic skills in experimental and analytic procedures.

The normal sequence of courses for the major in psychology includes a basic series in laboratory and quantitative methods (Psychology 101, 102, 103, 104), seven upper-division psychology electives selected from Psychology 130-150, and a research project to be completed during a three-course sequence in the senior year (Psychology 198). Three of the upper-division electives may be a sequence in some field other than psychology, if these courses will aid the student in his particular area of interest.

Psychology 101, 102, 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 scientific requirements of their college by the end of their sophomore year. (Muir College students should see the statement below.)

Ordinarily at least one of the psychology electives is taken during the junior year. During the course of his studies—particularly during the research project, Psychology 198—the student may wish to take courses from other departments which are related to his specialized area of psychology. For these purposes three of the elective courses may be in departments other than psychology. These related electives may be taken in areas taught by the Departments of Anthropology, Applied Physics and Information Science, Biology, Economics, Linguistics, Mathematics and Sociology.

Within the general requirements, students may take a wide variety of courses to fulfill 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 enroll in psychology in order to fulfill 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 Muir College Science Requirement for Psychology Majors

Muir College students planning to major in psychology will be required to fulfill their science option by taking five courses out of the following list:

Applied Physics and Computer Science 10
Science 2A through 2E
Science 3A through 3E
Biology 11 and 12

These courses should normally be completed by the end of the sophomore year.

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.*)

Master's Degree 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 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.

Doctor's Degree Program
Qualifying Examination

By the end of the second year a student proceeding to the Ph.D. degree will be examined by a doctoral committee on (*a*) the specific area in which the student expects to submit a doctoral dissertation, (*b*) problems, experiments, and interpretations which the student expects to encounter in research, and (*c*) the fields of psychology with which the student has become familiar during the first two years of study at UCSD.

Course of Study

All students are expected to take the sequence in quantitative methods (Psychology 201A-201B). Other courses are divided into areas according to content. The areas include developmental, human learning and memory, learning and motivation, mathematical models, physiological, sensory, social and human judgment. Within areas, courses are divided into basic seminars and advanced seminars. *Basic seminars* (Psychology 202-219) are intended to cover current psychological knowledge and to provide the basis for more intensive and specialized study. *Advanced seminars* (Psychology 220-239) focus on specific areas of current knowledge and research. Certain graduate and upper-division courses in other departments may be considered as advanced seminars with the approval of the Department.

In the first year of study, the student is required to take at least six courses from within the department. The courses must be chosen from at least four different areas, and at least one course must be an advanced seminar. Course work in the second year will usually be confined to advanced seminars and 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 for one quarter 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.

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. Three hours lecture, one hour recitation.

11. Perception and Information Processing **S**
An introduction to basic principles of perception, learning, and information processing. Three hours lecture, one hour recitation.

14. Social Psychology **W**
An introduction to concepts and methods in social psychology. Three hours lecture, one hour recitation.

UPPER DIVISION

101. Experimental Psychology
Mr. Fantino
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 laboratory, two hours lecture and recitation. Prerequisite: Mathematics 130A (concurrent registration is permitted).

102. Experimental Psychology **W**
Mr. Norman
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.

105. Quantitative Methods in Psychology **W**
Continuation of Psychology 104. (Not offered 1969-70.)

133. Physiological Psychology F

Mr. Deutsch

Intensive introduction to current knowledge of 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: Mathematics 130A or equivalent.

137. Developmental Psychology W

Mr. Munsinger

Intensive survey of current knowledge of cognitive and intellective factors in human development. Prerequisite: Psychology 104.

138. Introduction to Mathematical Psychology

Mr. Rumelhart

An introduction to mathematical models in learning, perception, memory, and sensory processes. Prerequisite: Psychology 103.

140. Motivation and Learning S

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. Green, Mr. Anderson

An intensive course in statistical methods and the mathematical treatment of data, with special reference to research in psychology.

202. Sensory Mechanisms (3) W
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) F
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.

209. Judgment and Decision Making (3) F
Mr. Anderson
Survey of principal problems of judgment as they relate to decision making, psychophysics, social and personality psychology. Seminar.

220. Detection Theory in Psychology (2) F
Mr. Green
The application of detection theory to human information processing. Advanced seminar.

221. Judgmental Processes (2) W
Mr. Anderson
The psychology of judgments and information integration. Advanced seminar.

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 (2) 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.

231. Advanced Topics in Human Information Processing (2) F
Mr. Norman
Selected discussions of advanced topics. Advanced seminar.

260. Advanced Topics W
Advanced seminar on special topics in theoretical and experimental psychology. (Not offered 1969-70.)

280. Seminar in Communication and Information Research (1,1,1) F,W,S
The Staff and Visiting Lecturers
(Satisfactory/Unsatisfactory grades permitted.)

290. Teaching in Psychology (1-4, 1-4, 1-4) F,W,S
The Staff
Supervised participation in departmental teaching activities.

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.

202. Sensory Mechanisms (3) W
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) F
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.

209. Judgment and Decision Making (3) F
Mr. Anderson
Survey of principal problems of judgment as they relate to decision making, psychophysics, social and personality psychology. Seminar.

220. Detection Theory in Psychology (2) F
Mr. Green
The application of detection theory to human information processing. Advanced seminar.

221. Judgmental Processes (2) W
Mr. Anderson
The psychology of judgments and information integration. Advanced seminar.

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 (2) 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.

231. Advanced Topics in Human Information Processing (2) F
Mr. Norman
Selected discussions of advanced topics. Advanced seminar.

260. Advanced Topics W
Advanced seminar on special topics in theoretical and experimental psychology. (Not offered 1969-70.)

280. Seminar in Communication and Information Research (1,1,1) F,W,S
The Staff and Visiting Lecturers
(Satisfactory/Unsatisfactory grades permitted.)

290. Teaching in Psychology (1-4, 1-4, 1-4) F,W,S
The Staff
Supervised participation in departmental teaching activities.

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*
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*
Robert M. Garrels, *Ph.D., Professor of Geology*
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*
John D. Isaacs, *B.S., Professor of Oceanography*
Douglas L. Inman, *Ph.D., 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*
George G. Shor, Jr., *Ph.D., Professor of Marine Geophysics*
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*
(Chairman of the Department)
Warren S. Wooster, *Ph.D., Professor of Oceanography*
Claude E. ZoBell, *Ph.D., Professor of Marine Microbiology*
Milton A. Bramlette, *Ph.D., Professor of Geology, Emeritus*
Carl H. Eckart, *Ph.D., Professor of Geophysics, 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*
Robert R. Hessler, *Ph.D., Associate Professor of Oceanography*
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*
D. John Faulkner, *Ph.D., Assistant Professor of Oceanography*
Carl H. Gibson, *Ph.D., Assistant Professor of Aerospace Engineering*
Joris M. T. M. Gieskes, *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*
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*
Bruce A. Taft, *Ph.D., Assistant Professor of Oceanography*
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., 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*
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 and applied ocean sciences.

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, natural products, high-pressure physical chemistry of seawater, 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 to 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.

Applied Ocean Sciences is concerned with man's purposeful and useful intervention into the sea. The curriculum is interdepartmental, combining the resources of the Scripps Graduate Department, the Department of Aerospace and Mechanical Engineering Sciences, and the Department of Applied Physics and Computer Science to produce oceanographers who are knowledgeable of modern engineering and engineers who know about the oceans. Instruction and research are not restricted to structural, mechanical, material, electrical, and physiological problems of operating within the ocean but include the applied environmental science of the sea as well. Since physical, chemical, geological, and biological aspects of the oceans and all forms of engineering may be involved, the curriculum provides maximum flexibility in meeting the needs of each individual student.

Present research activities within the curricular group include studies of: deep circulation and deep fish populations; deep-sea autonomous vehicles, instruments, basic control devices and special collecting gear; seismic surveys of the mantle; ocean bottom microseisms and crustal displacements associated with earthquakes; surveys of bathymetric-magnetic trends; deep-sea drilling; design and construction of special purpose ocean vehicles (ships, submarines, platforms) such as FLIP; remotely operated cable-connected vehicles and stations on the sea floor; sonar systems and sonar signal processing equipment; underwater communication and signal detection; underwater photography and television; visibility by swimmers; underwater lasers; remote sensing of sea-surface temperature, roughness, and marine resources from aircraft and orbital spacecraft; meteorology above the oceans; turbulent flows, formation of barrier beaches; mechanisms of currents, sand transport and sediment transport in the surf zone, the shelf, and in submarine canyons; diving and hyperbaric physiology.

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).
7. Applicants for admission are required to submit scores on the verbal and quantitative tests of the Graduate Record Examinations given by the Educational Testing Service of Princeton, New Jersey.

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, enroll 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 one of the earth sciences. 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.

Applied Ocean Sciences—major in physical science or engineering science, including three years of physics or applicable engineering and three years of mathematics at college level.

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 student's 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, 270, 271A-271B, 275A-275B, 276A-276B, 288, 288L, and either 282A or 283. Other course work ordinarily will be recommended by the student's 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, 280A-280B, 288 and 288L, as well as any other course work recommended by his advisory committee. All students are expected to enroll 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 288). Additional courses to be taken in oceanography and related areas will be based on the needs of the individual student, as determined in consultation with his advisory committee. No more than 3 units per quarter of SIO 299 are permitted prior to passing the qualifying examination. In some cases these requirements may also include course work in selected subject areas at other campuses.

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. Each student, in the winter quarter of his second year of residence, must take a curricular examination (departmental). The examination is prepared and given by a committee composed of five members of the Geophysics curricular group. The examination covers the areas of the student's formal training, including undergraduate training, through the fall quarter of the second year of residence. There are no formal language requirements. However, a student's thesis adviser may require the student to demonstrate proficiency in foreign languages. Any student who can demonstrate the ability to translate, at sight, any two of French, German, or Russian into English cannot be required to demonstrate greater proficiency.

Physical Oceanography

Students in this curricular program will be expected to have a reading knowledge of German or Russian and to demonstrate proficiency in the following courses: SIO 210A, 211A, 212A-212B, 214, 216A, 220, 223, 225, 240, 260 and 288. Additional requirements chosen from oceanography or other fields will be based on the students' need and objectives.

Applied Ocean Sciences

Students must: (*a*) take or demonstrate their knowledge of four basic courses: SIO 210A, 240, 260 and 288; and (*b*) attend the Applied Ocean Sciences Seminar throughout their entire period of enrollment. Any additional course requirements will depend upon the needs and interests of each individual student and will be set by his advisory committee.

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 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 student presents an original research problem, in the form of a written proposition, to his candidacy committee. The student's oral presentation and defense of his proposition completes the examination.

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) **F,W,S**
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.

213A-213B. Radiative Transfer in the Sea (2-3) F-W

Geometrical radiometry; radiant energy measurements; example of light fields; effects of air-sea boundary and scattering-absorbing on underwater light fields; experimental and theoretical determination of optical constants in the sea. Application: underwater visibility, marine biology, radiant energy transport problems. Prerequisite: consent of the instructor.

214. Introduction to Fluid Mechanics (3) W

Mr. Davis

A survey of classical problems in laminar flow and approximate techniques of analysis. Topics include the equations of motion; parallel viscous flows; low Reynolds number flow; inviscid flow and boundary layers; wave motion. Prerequisite: SIO 220 or 212A.

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 homogenous 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.)

229. Geomagnetism (3) W
Mr. Parker
Survey of the application of electromagnetic theory to the solid earth, the main geomagnetic field, the dynamo model of its source, implications of the dynamo theory, induction by external variations, the electrical conductivity inverse problem and its solution, electromagnetic anomalies, induction in simple bodies, induction in the oceans, magnetotelluric theory. Prerequisites: advanced calculus, differential equations, complex variables and familiarity with Maxwell's equations, or consent of instructor.

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.

241. Continental Margin Sediments (3) S
Mr. Curray
Lectures, reading, and discussion of Quaternary sediments, environments of deposition, and physiography of the continental margin, including the coastal plain, shoreline, continental terrace, deep sea fans, and continental rise. Prerequisite: 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 Geophysical Exploration (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

251. 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.)

252A. 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.)

252B. Nuclear Geophysics (3) S

Mr. Lal

Natural radioactivity on the earth; artificial radioactivity on the earth; radioactive nuclei as tracers or tools for studying earth sciences and meteoritics; experimental data and information to date.

253A. Igneous and Metamorphic Petrology (3) F

Mr. Hawkins

Physical, chemical and mineralogic properties of igneous and metamorphic rocks. Emphasis is on the origin and genetic relationships as interpreted from field occurrences, theoretical studies and experimental data. Prerequisites: physical geology, geochemistry, mineralogy, physical chemistry (may be taken concurrently).

253B. Mineralogic and Petrographic Laboratory (2) F

Mr. Peterson, Mr. Curray, Mr. Hawkins, Mr. Winterer

Principles of optical mineralogy and their application to the study of rocks and minerals. Principles of X-ray diffraction and fluorescence, mineral separation techniques, sample preparation. Emphasis is placed on practical application of techniques to the study of sediments, rocks, and minerals. Prerequisites: physical geology, geochemistry, mineralogy, physical chemistry (may be taken concurrently).

254. Advanced 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.)

256A. Field Geology (6) W

Mr. Engel

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. Prerequisite: consent of the instructor.

256B. Earth Sciences Spring Field Trip (1) S

The Staff

Classical areas of the southwest United States, such as the Colorado Plateau, Mojave Desert, Sierra Nevada and the Peninsular Range, are examined in successive years during six-day field trips. Normally required of all first and second-year graduate students in marine geology.

256C. Earth Sciences Summer Field Course (6) F
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, the western Mediterranean and Melanesia.

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. Gieskes
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 atmosphere, 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) W
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 impor-

tant crystals and glasses, order and disorder. Band and optical properties of solids, with particular consideration of geological systems. Prerequisite: consent of the instructor.

265. Chemistry of Natural Products (3) **W**
Mr. Faulkner
The classification of natural products, a summary of the methods used to determine their structures and biosynthetic pathways, the relationship between biosynthesis and chemical synthesis. Prerequisite: basic organic chemistry.

269. Special Topics in Marine Chemistry (1-4, 1-4, 1-4) **F,W,S**
The Staff

270. 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, 288 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 288 (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 270 (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 270 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 288. (Offered in alternate years.)

276A-276B. Applied Statistics (3-3) **W-S**
Mr. Fager
Methods of statistical analysis, including both parametric and nonparametric procedures; 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. Marine Biology (3-3) **W-S**
Mr. Rosenblatt, Mr. Newman; Mr. Holland, Mr. Lasker; Mr. Enns, Mr. Benson
Fundamental aspects of marine biology. Included are studies of 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, 288 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.

288. Marine Organisms, Communities, and Environments (3) F
Mr. McGowan, Mr. Mullin, Mr. Newman, Mr. Rosenblatt
Marine environments and their effects on ecological processes and community structure; distribution patterns, adaptations, and evolution of marine organisms. Prerequisites: bachelor's degree in science or consent of the instructor; concurrent registration in SIO 288L required for students in marine biology and biological oceanography curricula.

288L. Laboratory in Marine Organisms (2) F
Mr. Fleminger and the Staff
Laboratory and discussion of the phylogeny, comparative morphology and taxonomy of the major groups of marine organisms. Prerequisite: registration in SIO 288.

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. Pre-

requisites: preparation in biology and biochemistry; consent of the instructor. SIO 291A-291B and Biology 201 are recommended as background.

291A. Marine and Comparative 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 or physiology; consent of the instructor. SIO 260 is 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.

292. Physiology of Marine Animals (4) 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 508, Matthews Campus

Joseph R. Gusfield, *Ph.D., Professor of Sociology*
(Chairman of the Department)
Jerome Skolnick, *Ph.D., Professor of Sociology*
Jack D. Douglas, *Ph.D., Associate Professor of Sociology*
Randall Collins, *M.A., Acting Assistant Professor of Sociology*
William Wilde, *M.A., Acting Assistant Professor of Sociology*

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*Warner Bloomberg, Jr., *Ph.D., Visiting Professor of Sociology*
(Professor of Sociology, University of Wisconsin)
**Alvin W. Gouldner, *Ph.D., Visiting Professor of Sociology*
(Professor of Sociology, Washington University)

*Winter quarter
**Spring quarter

The Department of Sociology is in its initial year of development and both undergraduate and graduate programs are being formulated. The emphasis of the Department will be on the study of human interaction and the comparative analysis of social change. Courses will include work on the analysis of contemporary social issues, forms of conflict and deviance, methods of field work and observation, social change and modernization in American and non-Western societies. Opportunities will be made available for students to participate in supervised field research. Additional courses will be announced during Spring, 1969.

The Major Program

During 1969-70 the following major program is in operation:

Required Courses:

1. Sociology 10, 11, and 12.
2. Twelve (12) upper-division courses in sociology.

It is *strongly* recommended that all majors take the following courses:

(a) Sociology 101 (Sociological Investigations), a course concerned with the basic methods of field research.

(b) Sociology 199 (Independent Studies) in the senior year. The student would be responsible for writing a paper in this course in consultation with individual professors or in a senior seminar.

COURSES

LOWER DIVISION

Sociology 10-11-12. An Introduction to Modern Sociology **F-W-S**

Sociology 10-11-12 is a series of related courses, each of which may be taken separately. Together they provide the theoretical and conceptual framework for understanding of human interaction and the persistence of its products through time. Sociology 10 will emphasize the nature of American society, its institutions and group divisions; Sociology 11 will emphasize human interaction and the social development of the person; Sociology 12 will emphasize processes of social change and conflict in modern and modernizing societies.

UPPER DIVISION

Sociology 100. Sociology of Everyday Life **F**

A general introduction to the objective observation, description and analysis of everyday life. The aim of the course is to demonstrate the theory and method of observation by which studies of everyday experience become information basic to the study of society. Prerequisites: Sociology 10, 11, or 12, or consent of instructor.

Sociology 101. Sociological Investigations **W**

A basic course on the relations between sociological theory and field research. There is a strong emphasis on the theory and methods of participant observation. Students will write a paper using these methods. Prerequisite: one sociology course or consent of instructor. (Sociology 100 would be especially valuable.)

Sociology 102. Explaining Human Behavior **S**

An investigation of the fundamental, theoretical issues in sociology. There will be special consideration of the theoretical issues concerning change and conflict in a complex, pluralistic society such as American society. Prerequisite: one sociology course. (Sociology 100 or 101.)

Sociology 110. The Family **F**

The institution of family in the United States and other societies. Types of family and kinship systems and their relation to social change and social structures; functions of families in modern and pre-modern societies; related topics. Prerequisite: Sociology 10, 11, or 12, or consent of instructor. (Not offered 1969-70.)

Sociology 120. Urban Social Problems **W**

Concerns the facts and theories of contemporary social problems in urban America. The emphasis will be on social problems, not on urbanism. Prerequisite: any sociology course.

Sociology 121. Sociology of Deviance, Law and Crime **S**

Concerns the fundamental problems of rule-making and the uses of rules, especially laws. Such subjects as addiction, marijuana use and suicide will be considered. Prerequisite: one sociology course.

Sociology 130. Modernizing Societies and New Nations F
Analysis of social change in contemporary societies undergoing transformation from peasant to industrial forms and from colonial to national status. Relationship between economic development and cultural change. Special reference to political institutions, social movements and class-caste structure in contemporary Asia. Prerequisite: one sociology course.

Sociology 191. Youth in American Society S
A seminar on recent research in the development of youth as a social category, including the analysis of student and youth movements and subcommunities and generational conflict in the United States and elsewhere. Prerequisite: one upper-division sociology course.

Sociology 199. Independent Study F,W,S
Prerequisite: permission of departmental adviser.

SUBJECT A
See *Interdisciplinary Courses.*

VISUAL ARTS

Office: Building 407, Matthews Campus

David Antin, *M.A., Assistant Professor of Visual Arts*
John Baldessari, *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*
Jehanne Teilhet, *M.A., Assistant Professor of Visual Arts*
Michael Todd, *M.F.A., Assistant Professor of Visual Arts*

* * *

Harold Cohen, *Diploma of Fine Arts, Visiting Professor of Visual Arts*

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.

Muir College Humanities Elective

The following two courses will complete the Visual Arts Humanities sequence:

10. Introduction to Art (one quarter, four units)
20. Beginning Studio Practice (two quarters, eight units)

Revelle Fine Arts Requirement

Students can fulfill this requirement in one of two ways:

10. Introduction to Art (one quarter, four units)

or

20. Beginning Studio Practice (two quarters, eight units)
This course *must* be taken for two quarters. A grade will be given at the end of the second quarter.

A combination of these two courses can also be used toward fulfilling the Revelle minor in art.

Art Majors

Majors in the Visual Arts Department are required to complete eighteen courses in their major before graduation. Required courses are:

10. Introduction to Art (one quarter, four units)
20. Beginning Studio Practice (two quarters, eight units)
30. Beginning Painting (two quarters, eight units)
40. Beginning Sculpture (two quarters, eight units)
Six quarters of Art History

The remaining four courses can be either Advanced Painting or Advanced Sculpture. Majors are also required to take either photography or computer programming for the humanities.

Prospective majors should submit a portfolio of their work to the Department after having completed 10, 20 and either 30 or 40.

Art Minors

Art minors (both from Revelle and Muir) are required to complete the following courses:

10. Introduction to Art (one quarter, four units)
20. Beginning Studio Practice (two quarters, eight units)
30. Beginning Painting (two quarters, eight units)

or

40. Beginning Sculpture (two quarters, eight units)
Two quarters of Art History (two quarters, eight units)

The Graduate Program

A two year Master of Fine Arts program in studio work will begin in the fall of 1969. Please see the *Graduate Bulletin* for further details.

COURSES

LOWER DIVISION

10. Introduction to Art **F,W,S**

Mr. Antin (Fall), The Staff (Winter), Miss Teilhet (Spring)

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.

20. Beginning Studio Practice **F,W,S**

Mr. Lewallen (section 1, fall and winter), Mr. Harrison (section 2, fall and winter), The Staff (section 3, winter and spring), Mr. Todd (section 4, winter and spring)

A *two-term* course dealing with the fundamental aspects of the visual arts. Specific problems to be investigated will be determined by individual professors. Six hours studio.

(The Fine Arts requirement for Revelle students can be satisfied by either 10 or 20—it should be noted that 20 is a *two-term* course in studio work and that a grade will be given only at the completion of the second term. Muir students electing to enroll in the Visual Arts Humanities sequence are required to complete both 10 and 20. (Art majors and minors are also required to take these courses.)

30. Beginning Painting

Mr. Baldessari (section 1, fall and winter), Mr. Lewallen (section 2, winter and spring)

This two-term studio course will focus on the problems involved in transferring information and ideas onto a two-dimensional surface. Specific assignments will be determined by the professors. Six hours studio. Prerequisites: 10 and 20.

40. Beginning Sculpture

Mr. Todd (section 1, fall and winter), Mr. Harrison (section 2, winter and spring)

The two-term studio course will focus on the problems involved in transferring information into three-dimensional objects. Specific problems to be investigated will be determined by the individual professors. Six hours studio. Prerequisites: 10 and 20.

(Art minors are required to choose one of the two above courses: 30 or 40. Art majors are required to complete both two-term courses before graduation.)

UPPER DIVISION

110. Art History **F**

The Staff

The subject of this course is yet to be determined. Prerequisite: introduction to Art 10 or equivalent.

111. History of Sculpture **W**

The Staff

A history of sculpture from ancient times through the present. Prerequisite: introduction to Art 10 or equivalent.

112. 19th Century Art History **S**

The Staff

A survey of nineteenth-century art in Europe and America, stressing stylistic developments from Neo-Classicism to Post-Impressionism. Three hours lecture. Prerequisite: introduction to Art 10 or equivalent.

130. Advanced Painting **F**
The Staff

A studio course in painting, stressing individual creative problems. Six hours studio. Prerequisites: 10, 20, 30, 40.

131. Advanced Painting **W**
Mr. Cohen

A studio course in painting, stressing individual creative problems. Six hours studio. Prerequisites: 10, 20, 30, 40.

132. Advanced Painting **S**
Mr. Baldessari

A studio course in painting, stressing individual creative problems. Six hours studio. Prerequisites: 10, 20, 30, 40.

133. Advanced Painting **S**
Mr. Cohen

A studio course in painting, stressing individual creative problems. Six hours studio. Prerequisites: 10, 20, 30, 40.

140. Advanced Sculpture **F**
Mr. Todd

A studio course in sculpture, stressing individual creative problems. Prerequisites: 10, 20, 30, 40.

(Art majors are required to complete four advanced studio courses before graduation.)

170. Beginning Computer Programming for the Fine Arts and Humanities **S**
The Staff

Requiring no mathematical or scientific training, this is an introduction to programming in a higher level language. Exercises dealing with specific problems of the arts are emphasized. Open *only* to art majors.

190. Photography **F**
The Staff

A general course, largely technical in its orientation, aimed at a working knowledge of a range of cameras, lighting equipment and photographic materials, and at competence in darkroom techniques. Open *only* to art majors.

(Art majors are required to take either Photography 190 or Computer Programming for the Fine Arts and Humanities 170 before graduation.)

199. Individual Tutorial **F,W,S**
The Staff

Independent reading, research, or creative work under direction of a faculty member. Prerequisite: consent 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 enrollment 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

Every candidate for a higher degree is required either to register each quarter until all degree requirements are fulfilled (including the thesis or dissertation and final examination) and the degree is awarded or to obtain a formal leave of absence. (See *Leave of Absence.*)

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 following quarter. During the interim between the completion of all requirements for the degree and the date of its award, Certificates of Completion (required for employment or other purposes) are issued by the Registrar to certify the student's eligibility for the degree.

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 for authorization 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*).

Identification Card

At the time of registration each student will receive an identification 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 card provides, for the undergraduate, identification for Associated Student 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 courses must be listed on the student's official study-list card in 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. (See *Change of Program: Undergraduates* and *Change of Program: Graduates* for procedures required for altering study-lists.)

Study-List Limits: Undergraduates

The normal *undergraduate* program consists of an average of four courses each quarter for four years. However, a student may enroll 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 enroll 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*).

Study-List Limits: Graduates

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.

Study lists exceeding these limits require approval of the Dean of Graduate Studies on either the study-list card or on the *Change in Study-List* form.

Credit for residence for advanced degrees in a given quarter requires a graduate student to complete satisfactorily six or more units in that quarter.

Change of Program: Undergraduates

After an official study-list card has been filed with the Office of the Registrar, an undergraduate may add or drop courses or change sections of a course by executing a *Change in Study-List* available from the Office of the Registrar. In making such changes the student must adhere to the following time and fee 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 the approval of the instructors involved and of the Provost. Permission to change sections within a course requires only the approval of the instructors involved.

Properly executed *Change in Study-List* must be deposited in the Office of the Registrar if an undergraduate student is to be relieved of responsibility for dropped courses and credited for added courses.

Change of Program: Graduates

After an official study-list card has been filed with the Office of the Registrar, a graduate student may add or drop courses or change sections of a course during the first and second week of classes without fee and by executing a *Change in Study-List* available from the Office of the Registrar. Approval for these changes requires only the approval of the instructors involved and the student's adviser.

During the third and subsequent weeks of classes a graduate student may alter his official study-list by paying a $3 fee and by executing a *Change in Study-List* which must be accompanied by a petition explaining the circumstances involved. The petition must be approved by the student's adviser, by the chairman of the student's major department and by the Dean of Graduate Studies.

Properly executed *Changes in Study-List* and petitions as required must be deposited in the Office of the Registrar if a graduate student is to be relieved of responsibility for dropped courses and credited for added courses.

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.

Undergraduates may repeat courses only when grades of *D*, *F*, or *NP* were received. Degree credit for courses so repeated will be given only once but the grade assigned at each enrollment shall be permanently recorded. In computing the grade point average of an undergraduate with repeat courses, in which he received a *D*, *F*, or *NP* only the most recently received grades and grade points shall be used for the first 16 units repeated. In the case of further repetitions, the grade point average shall be based on all grades assigned and on total units attempted.

Repeat registration of graduate students for formal courses in which the content does not change is discouraged. However, repeat registration for teaching courses, special topic courses, seminars, independent study, and research occurs regularly in graduate study.

Graduate students desiring to alter their grade point averages by repetition of courses must petition the Dean of Graduate Studies to replace all grades in such courses by Satisfactory/Unsatisfactory. Approval of the petition must be obtained from the student's major department.

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: Graduates

If a graduate student receives an Incomplete grade *E,* the grade will be ignored temporarily in calculating the scholastic status of the student, i.e., the units are omitted in the unit total 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 for reasons beyond his control, e.g., illness.

An *Incomplete* which has not been removed by the end of the next quarter after it was incurred shall lapse into an *F* and shall enter the computation of the student's grade-point average.

To remove an *E* grade, the student must complete a petition (available from the Office of the Registrar) and pay a fee of $5 at the Cashier's Office. This completed petition must be received by the Registrar's Office no later than 5:00 p.m. on the *day instruction ends* in the quarter following that in which the course is taken.

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*. Enrollment 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 fulfillment of the minor. All courses taken as electives may be taken on a *Passed/Not Passed* basis consistent with the restrictions above.

Special Grade Options: Graduates

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. Enrollment 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 2-4 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, NR*, and *E* grades are excluded in computing grade-point average.

Credit by Examination

With the instructor's approval, undergraduate 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.)

AMERICAN HISTORY AND INSTITUTIONS

A knowledge of American history and of the principles of American Institutions under the federal and state constitutions is required of all candidates for the bachelor's degree. This requirement may be met in any *one* of the following ways:

1. By passing any *one* quarter course of instruction accepted as satisfactory by the Committee on American History and Institutions.

Courses suitable for fulfilling the requirement are: History 30A, 30B, 30C, 160, 164, 165, 167A, 167B and Political Science 10, 11 or 12.

2. By passing an examination to be conducted twice each year by the Committee on American History and Institutions. The student will have no more than two opportunities to pass the examination. A student who fails in the second attempt will be obliged to satisfy the requirement by passing one of the designated courses.
3. By presenting proof of having received a grade of 3 or higher on the Advanced Placement Test in American History administered by the Educational Testing Service of Princeton, New Jersey.
4. By presenting proof of having satisfied the present requirement as administered at another collegiate institution within the state.
5. By presenting proof of successful completion of a one quarter or one semester course in either American History or American Government at a junior college within the state.
6. By presenting proof of successful completion of a one quarter or one semester course in either American History or American Government at a recognized institution of higher education, junior colleges included, in another state.

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.

APPLICATION FOR READMISSION

The deadline for all returning students to file an application for readmission is eight weeks prior to the first scheduled day of the quarter (see *Academic Calendar*). Transcripts for work taken at other institutions must be submitted as part of the application.

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

INTERCAMPUS VISITOR

An undergraduate student in good standing currently registered on this campus may apply for intercampus visitor status at another campus of the University, however, he must return to his home campus upon completion of the quarter.

Forms and instructions are available at the Office of the Registrar.

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, the chairman of the host department and of the two Deans of Graduate Study involved. He is not admitted to the graduate division at the host campus, but continues to be considered a graduate student 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 ENROLLMENT

Concurrent enrollment 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 therefor are available from the Office of the Registrar and require the approval of the student's Adviser, of the department chairman and of the Dean of Graduate Studies. Graduate students on a leave of absence are exempt from all fees.

In lieu of registration during a given quarter a graduate student must file a petition for a leave of absence with the Office of the Registrar prior to the end of the first two weeks of instruction in that quarter. Otherwise, the student will be considered to have withdrawn and must apply formally for readmission.

OFF-CAMPUS STUDY

The research and study programs of registered graduate students may require them to be off-campus for extended periods. Approval for periods beyond five weeks during one quarter must be obtained from the Dean of Graduate Studies by a petition endorsed by the student's adviser.

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. If a student intends to return to UCSD, he should petition for a leave of absence as well. Otherwise, he must later apply for readmission.

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 transcript 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 identification 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 enroll.

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
Student Center 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	$665.00	$665.00	$665.00	$1,995.00

*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. In addition, there is a Student Center Fee of $6 per quarter to be used for the construction and operation of one or more student centers in the near future.

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 by petition, which must be approved by the Dean of Graduate Studies.
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, Fees, Fines and Penalties

Books and stationery average about $50 per quarter. However, students should also be aware of the following possible expenses:

Acceptance of Admission Fee	$50.00
Application Fee	10.00
Changes in Study List after Announced Dates	3.00
Duplicate Registration and/or Other Cards from Registration Packet	3.00
Duplicate Student Card	3.00
Reinstatement Fee	10.00
Removal of Grade E or I	5.00
Special Course Subject A	45.00
Subject A Examination	5.00
Transcript of Record	1.00
Late Filing of Announcement of Candidacy for A.B., B.S., B. of Arch., B. Land. Arch., or D. Opt.	3.00
Late Filing of Study List	10.00
Late Payment of Fees	10.00
Returned Check Collection	5.00

Parking Fee

Students who park on the campus are charged a parking fee of $36.00 for a car or $9.00 for a motorcycle or motor scooter for the nine-month academic year.

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.*

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 Regent's 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 January 15. Applications postmarked or presented in person after January 15 will be considered on a late priority.

Parents' Confidential Statement

To permit an evaluation of need, parents of all entering and continuing 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 December 1 with the College Scholarship Service, P.O. Box 1025, Berkeley, California 94701 (or P.O. Box 176, Princeton, New Jersey 08540), and must indicate 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', President's, and Chancellor's Scholarships

The highest honor that may be conferred upon an undergraduate student is the awarding of a Regent's, President's, or Chancellor's Scholarship.

Regents' Scholarships are granted by the President of the University of California and the Chancellor of the San Diego campus, consideration being given to academic excellence and promise without reference to financial need. Regents' Scholars receive an initial honorarium of $100, dormitory assignment preference, and an annual stipend to cover the difference between student resources and the yearly standard cost of education.

President's Scholarships, granted by the President of the University of California, are awarded to students of exceptional academic achievement who demonstrate financial need. A President's Scholar receives a $500 renewable award.

Chancellor's Scholarships are awarded to exceptional students without regard to financial need. Scholars receive a $100 honorarium and are assigned a Faculty Fellow who serves as an adviser in the student's major field of interest.

All scholarship applicants are reviewed for these three major awards. An applicant who wishes to be considered for an honorarium only need not submit 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. 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 June 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 $1000 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 $1.60 to $2.42 per hour.

University of California Grant Program

The University of California Grant-in-Aid Program provides non-repayable grants-in-aid to students with demonstrated financial need without reference to grade point average.

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 the *Graduate Division Announcement* which may be obtained from the 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 or fee scholarships, 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' Intern-Fellowships
2. National Defense Education Act, Title IV, Graduate 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 may obtain a tax refund upon application to the Internal Revenue Service. Assistantships do not include payment for tuition and fees, but a few assistants receive tuition or fee scholarships. 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 part-time teaching or 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 sometimes forthcoming upon application.

Nonresident Tuition or Registration Fee Scholarships

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 tuition or fee scholarships in varying amounts. 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 or fee scholarships. 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, traineeship, or graduate scholarship 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 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 similar awards 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.

Federally Insured Loans

The Federally Insured Loan Program provides student loan insurance for students who do not have reasonable access to either state or other non-profit loan programs. Federally Insured Loans are considered loans of accommodation, not loans of need.

Loans carry an interest rate of 7% per annum. Interest shall accrue during the entire term of the note, but students from families having an adjusted gross income of $15,000 or less shall qualify for interest payment while in school.

Students may borrow from any participating lending institution (banks, credit unions, savings and loan companies, etc.). Application forms are available from the Financial Aids Office and from participating banks.

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 recommended that freshmen not work during their first quarter. Freshmen who must work during the first quarter are asked to confer with the Student Employment Office.

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

The goal of the counselor's work is to provide yet another setting, and resource, for student growth: to listen and to provide substance; to aid the student in wrestling with his own decisions, plans, or academic problems; to face his fears and anxieties with his own resources. Students are invited to visit the counselors with a crisis, or a choice, a dilemma, a hope or simply an interest or curiosity.

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.

Departments are urged to advise the Office of International Education whenever either a new foreign faculty member is due on campus or a new foreign student has been accepted.

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, and the Graduate Division. At present, the program is established on campuses in Jerusalem, Beirut, Gottingen, the United Kingdom, Dublin, Bordeaux, Madrid, Hong Kong, Lund, Padua, Tokyo, Mexico and Nairobi and Accra. A new program for teachers of French will open in Paris in 1969-70. Additional international centers may be established in future years.

NOTE: A participant who wishes to make normal progress towards graduation should counsel *in advance* with his departmental adviser and the Provost of his college in order to ascertain how participation will affect his academic program and his plans for graduation. While all approved courses are University of California credit courses, each department retains the right to determine the extent to which it will accept the units so earned in fulfillment of the requirements for its own major.

Other Overseas Programs

Information about other overseas study, travel or work opportunities is available in the Office of International Education.

HOUSING

Several brochures describing all types of living accommodations at or near the University are available through the Housing Office. These brochures automatically accompany each admissions application forwarded to prospective students.

Students returning the applicable housing application cards included with the brochures, should read the instructions on the card and the entire brochure. Applications for all types of campus housing are accepted and filed according to the chronological date of receiving. 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 $1,110 for the academic year, with an additional charge of $100 per year for single accommodations. Room without board is not available.

Limited accommodations may be available for single graduate students in the Matthews residence halls. Graduate students will be assigned to graduate suites identical to those described above. The Coast apartment complex maintains 19 studio units for graduates at $80.00 per month for one, or $90.00 per month for two residents. Presently a few Mesa two-bedroom apartments are available for two single students to share.

Apartments for married students consist of 56 one-bedroom units and 31 two-bedroom units in the Coast complex, and 256 two-bedroom units in the new Mesa group. All two-bedroom apartments are reserved for students with children. The apartments in both complexes are unfurnished except for stoves, refrigerators, disposals, and living room drapes. Only the Mesa units are carpeted. Coin-operated washers and dryers are supplied in the community buildings on the apartment grounds. Monthly rental prices, including utilities, are $100 for the one-bedroom units, $110 for the Coast two-bedroom units, and $120 for the Mesa two-bedroom apartments.

The Housing Office will assist others in finding suitable accommodations in the surrounding communities of Clairemont, Del Mar, La Jolla, or Pacific Beach. There are 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.

THE OFFICE OF RELIGIOUS AFFAIRS

The Office of Religious Affairs is the cooperative venture of the religious community to provide religious counseling, help coordinate the activities of the various religious student groups, arrange speakers and programs of interest to the general campus, and serve as a theological resource for the educational enterprise.

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

One of the primary functions of the Office of Special Services is to serve the students in all matters pertaining to the Selective Service System. Certification of enrollment is forwarded to local Selective Service boards upon the request of any male student. Counseling is available to assist the student in understanding his rights, obligations, and options under the Selective Service law and in establishing his entitlement to applicable deferments of classifications (e.g., I-O, I-Y, II-A, II-S, etc.). Questions about the student's eligibility for statuses as diverse as Conscientious Objection and Reserve Officer Training should all be directed 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 nights, weekends and holidays to cover emergencies 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 insurance program.

Psychiatric consultation is available by appointment at the Health Center.

Each entering student is required to have a physical examination and a tuberculin skin test not more than six months prior to his arrival on campus. The physical examination form is mailed in advance of registration (e.g., in June for fall registrants).

Each student re-entering UCSD after an absence of two or more consecutive quarters is required to complete the first two pages of the medical history and have a tuberculin skin test within six months prior to his arrival on campus.

A comprehensive and economical insurance policy is available for students for any one unregistered quarter. Students may purchase this same policy for their dependents; it is mandatory for dependents of foreign students. Applications can be obtained at the Health Center after arrival on campus.

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Chancellor at Santa Cruz

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA

REGENTS EX OFFICIO

RONALD REAGAN
Governor of California
State Capitol,
Sacramento, California 95814

ED REINECKE
Lieutenant-Governor
State Capitol, Room 209
Sacramento, California 95814

ROBERT T. MONAGAN
Speaker of the Assembly
State Capitol, Room 3164
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

JOSEPH A. MOORE, JR.
President of the
Mechanics' Institute
351 California Street,
San Francisco, California 94104

WENDELL W. WITTER
President of the Alumni
Association of the University
of California
45 Montgomery Street
San Francisco, California 94104

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. RANDOLPH A. HEARST (1974)
233 W. Santa Inez Avenue,
Hillsborough, California 94010

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

W. GLENN CAMPBELL (1984)
Hoover Institution,
Stanford, California 94305

WILLIAM FRENCH SMITH
634 S. Spring Street,
Los Angeles, California 90014

ROBERT O. REYNOLDS
10889 Wilshire Boulevard
Suite 1601
Los Angeles, California 90024

DEAN A. WATKINS
3333 Hillview Avenue
Stanford Industrial Park
Palo Alto, California 94304

CHRISTIAN E. MARKEY, JR. (REGENT DESIGNATE)
606 S. Hill Street
Los Angeles, California 90014

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RONALD REAGAN
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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

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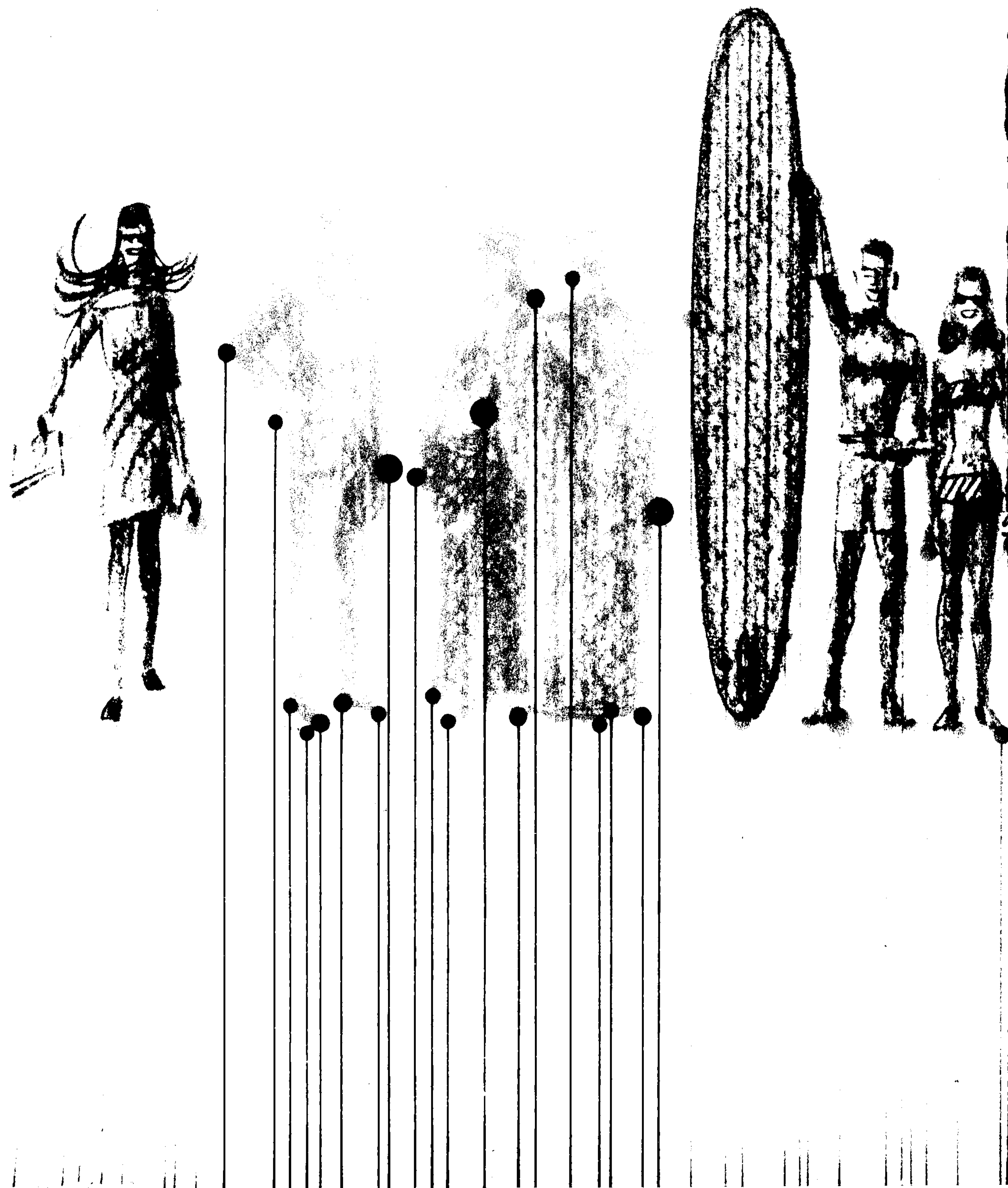

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