
Keck School of Medicine of USC



The Keck School offers numerous opportunities for students to engage in long- or short-term research projects — an important part of their medical education.

The Keck School of Medicine of the University of Southern California was founded in 1885. Located on the university's 30.8-acre Health Sciences campus in northeast Los Angeles, it is adjacent to the Los Angeles County+USC Medical Center, one of the largest teaching hospitals in the United States. Faculty of the school include national leaders in each of its 25 clinical and basic science departments. Library facilities on the campus provide an excellent source of reference materials.

Clinical interaction is provided by the Los Angeles County+USC Medical Center, the Kenneth Norris Jr. Cancer Hospital and Research Institute, USC University Hospital, Doheny Eye Institute, Childrens Hospital of Los Angeles, and by a network of 11 additional USC-affiliated hospitals throughout Southern California.

Well-equipped and extensive research facilities are available in each of the basic science and clinical departments. A number of core facilities is provided by the USC/Norris Comprehensive Cancer Center.

The school has established an interdisciplinary Institute for Genetic Medicine, designed to house new programs in molecular biology and genetics, and gene therapy.

Administration

Stephen J. Ryan, M.D., *Dean, Senior Vice President, Medical Care*

Zach W. Hall, Ph.D., *Vice Dean and Senior Associate Dean, Scientific Affairs*

Fred Sattler, Ph.D., *Senior Associate Dean, Faculty Affairs*

Clive R. Taylor, M.D., Ph.D., *Senior Associate Dean, Academic (Educational) Affairs*

Ronald L. Kaufman, M.D., M.B.A., *Senior Associate Dean, Administration and Finance*

Peter Katsufraakis, M.D., *Associate Dean, Student Affairs and Interim Associate Dean, Finance*

Shri K. Mishra, M.D., *Assistant Dean, Veterans Administration Affairs*

Raquel Arias, M.D., *Associate Dean, Office for Women and Disabled Issues*

Allan V. Abbott, M.D., *Associate Dean, Curriculum*

Phil R. Manning, M.D., *Associate Dean, Continuing Medical Education*

Edward Wong, M.D., *Associate Dean, Graduate Medical Education*

Althea M. Alexander, *Assistant Dean, Minority Student Affairs*

Erin A. Quinn, Ph.D., *Associate Dean, Admissions*

Joel Schechter, Ph.D., *Assistant Dean, Student Affairs and Curriculum*

Darcy Spicer, M.D., *Assistant Dean, Clinical Studies*

Admissions

Doctor of Medicine

Keith Administration Building 100C
1975 Zonal Avenue, Los Angeles 90089-9021
(323) 442-2552
FAX: (323) 442-2433

Associate Dean, Admissions: Erin A. Quinn, Ph.D.

The Keck School of Medicine Committee on Admissions is responsible for selecting members of the entering class of the medical curriculum. The members of the committee represent a cross section of the school — full-time and voluntary faculty, alumni and students. The Committee on Admissions seriously considers candidates whose academic achievement and Medical College Admission Test (MCAT) performance indicate their ability to satisfactorily complete the rigorous curriculum of the medical school. Favorable consideration reflects additional factors which contribute to the breadth and diversity of the entering class. These include but are not limited to motivation and commitment to service, evidence of leadership, personal qualities that are deemed desirable for the study and practice of medicine and potential for significant achievement. This assessment is not influenced by race, creed, gender, nationality, residence, age or disability.

The applicant's undergraduate preparation may have been in any major field from any accredited college or university. Although sound preparation in the basic sciences is

essential, a broad background in the humanities and wide exposure to people and their problems are equally necessary. The administration believes that the medical training obtained at USC will make all graduates superbly dedicated physicians.

General Admissions Information

The Keck School of Medicine offers 160 places in each entering class; since the number of applicants is far greater (almost 5,000 applications were received in 2003), admission is highly selective. Each application is considered individually. The school does not require a minimum grade point average or minimum MCAT score for applicants; nevertheless, intense competition to enter medical school tends to eliminate applicants with a low GPA and/or MCAT scores.

Requirements

All applicants to the 2004 entering class must have completed a minimum of four full years or 120 semester hours of academic work at an accredited college or university at the time of matriculation. Course work must have included two semesters or three quarters of the following subjects: biology, general chemistry and physics — all with laboratory instruction; one semester or two quarters of organic chemistry with laboratory instruction; and one semester or one quarter of biochemistry. Additionally, a course in basic molecular biology is required. Suitable courses may include: molecular biology, molecular genetics, cell

and molecular biology, advanced cell biology, or the equivalent. Thirty semester hours (or quarter equivalent) of course work in the social sciences, humanities and English composition are required. Facility in the principles of college mathematics or calculus and in the use of computers as a tool for independent learning is highly recommended. Applicants are strongly encouraged to have their basic science requirements completed at the time of application.

Students from foreign countries must have taken at least one year of study in the United States prior to application; credits from abroad must be certified by a U.S. college both as to number of hours and course content. Individuals who have discontinued studies in medical school for academic reasons are not eligible to apply to the Keck School of Medicine.

Medical College Admission Test (MCAT)

The MCAT is required of all applicants. Applicants are strongly urged to take the MCAT in the spring of the year of application and to have their basic science requirements completed at the time of application. Applicants to the 2004 entering class are required to take the MCAT no earlier than April 2001 and no later than August 2003. Scores from earlier administrations of the examination will not be acceptable.

Applications

The school participates in the American Medical College Application Service (AMCAS). This agency of the Association of American Medical Colleges reproduces and distributes an application and standardized academic record to participating medical schools designated by the student. The fee charged for this service depends upon the number of schools to which an application is sent. Applications may be obtained from their Web site (www.aamc.org).

Applications are available after June 1 for the class entering in August of the following year. Although applications to USC must be returned to AMCAS before November 1, earlier application is encouraged. Only one class is admitted each year, with registration shortly after the opening of the school year. The Keck School of Medicine participates in the Early Decision Program. Interested applicants apply between June 1 and August 1 and are

M.D./Ph.D. Program

The Keck School of Medicine has developed an M.D./Ph.D. program designed for individuals who aspire to a career in academic medicine or a leadership role within the biomedical industry. Students are expected to acquire the modern skills that are required for physician competence. Additionally, the M.D./Ph.D. program provides an opportunity for the development of research expertise and academic excellence while fulfilling the requirements for a Ph.D. degree.

A joint program between the Keck School of Medicine and the California Institute of Technology (Caltech) was established in fall 1997 for the granting of the M.D./Ph.D. degree. Ph.D. studies may be carried out at Caltech or through collaboration between two laboratories at both institutions. The M.D. will be awarded from the Keck School of Medicine and the Ph.D. will be awarded from Caltech.

The Keck School of Medicine M.D./Ph.D. Committee is responsible for selecting students for the M.D./Ph.D. program. Members of the committee review the qualifications of each applicant, including MCAT and Graduate Record Examinations (GRE) scores available, academic performance, letters of recommendation and research experience. The committee interviews candidates and then selects students for admission to the program.

notified of the Admissions Committee decision by September 1. Additional information is available in the AMCAS material.

The Committee on Admissions reviews all information submitted on the AMCAS form as well as any supplemental data; the school charges a \$90 fee for this review. The most qualified candidates, as determined by this review, are invited to appear for personal interviews.

Personal Interviews

Personal interviews are a required part of the application procedure when initiated by the committee. Invited candidates meet with two interviewers who may be faculty, alumni, administrators, or students. Interviews in Los Angeles are required so that applicants have an opportunity to visit the campus and talk with students and faculty members.

Applicants interested in and found acceptable for the joint program with Caltech must go through a screening and interview process at Caltech as well as at the Keck School of Medicine.

General Information

The M.D./Ph.D. program enrolls a maximum of six students annually; two of these six students are identified for the joint program with Caltech. Each student accepted to the program must also be accepted to the Keck School of Medicine.

Requirements

Admission requirements for the M.D./Ph.D. program are those of one of the graduate programs concerned or Caltech and the Keck School of Medicine. Students select the basic science program of their choice during the first two years of the medical curriculum; descriptions of these programs are available from each department and Caltech.

Graduate Record Examinations (GRE)

To assist the M.D./Ph.D. Committee in its evaluation of candidates, applicants to the M.D./Ph.D. program are encouraged to provide recent GRE scores. The committee does not, however, require GRE scores in order to consider an application.

Applications

Applicants to the Keck School of Medicine are advised to request information about the M.D./Ph.D. program at the time of application. In addition to completing the

Interviews are conducted either on the Health Sciences campus or in an off-campus clinical setting in the Los Angeles area.

Notice of Acceptance

Notice of acceptance will be sent to successful candidates continually until the class is filled. In no case will an acceptance be offered earlier than one year before anticipated enrollment. Applications are mainly considered during the fall and winter, with review usually complete by May.

Candidates must reply to an offer of acceptance within two weeks, enclosing a \$100 deposit (non-refundable after May 15). A letter of withdrawal is required if students wish to relinquish their place in the class; release is granted automatically when the letter is received.

medical school application, applicants should indicate their interest in the M.D./Ph.D. program.

Students who are currently pursuing the medical curriculum at the Keck School of Medicine may apply to the M.D./Ph.D. program by contacting: M.D./Ph.D. Program, Keck School of Medicine, 1975 Zonal Avenue (KAM 314), Los Angeles, CA 90089-9023; (323) 442-2965, FAX: (323) 442-2318.

Personal Interviews

All applicants are screened by members of the M.D./Ph.D. Committee; candidates who meet the basic criteria of the program are then invited to be interviewed by members of the committee.

Notice of Acceptance

Students selected for acceptance to the M.D./Ph.D. program are notified between January and June of each year. Students begin their program in the fall semester and register for courses in the medical curriculum at that time.

Further information about the M.D./Ph.D. program at the Keck School of Medicine may be obtained by contacting: M.D./Ph.D. Program, Keck School of Medicine, 1975 Zonal Avenue (KAM 314), Los Angeles, CA 90089-9023; (323) 442-2965, FAX: (323) 442-2318; email: mdphdpgm@hsc.usc.edu.

Graduate Degree Programs

Admission standards for these curricula are established jointly by the Keck School of Medicine, its participating departments and the Graduate School.

Applicants to graduate degree programs offered by departments of the Keck School of

Medicine must meet the general criteria for acceptance to the Graduate School. Each participating department may have additional requirements for application. The departmental requirements for the Keck School of Medicine's graduate programs are detailed in the Graduate Degree Programs section on page 653.

Further information about graduate degree programs at the Keck School of Medicine may be obtained by contacting: Office of the Senior Associate Dean for Scientific Affairs, Keck School of Medicine, 1975 Zonal Avenue (KAM 110), Los Angeles, CA 90089-9023; (323) 442-1607, FAX: (323) 442-1610.

Tuition and Fees

The tuition and fees listed below are estimated for fall semester, 2004. All fees are subject to change without notice by action of the University of Southern California Board of Trustees. The university reserves the right to assess new fees or charges. Tuition is not refundable; late registration fees are mandatory and cannot be waived.

Tuition for each semester of the medical school curriculum is due and payable at the beginning of the semester. Registration is not permitted after the third week of instruction. Late payment of tuition is subject to a mandatory late fee. Average budgets for medical students will vary according to their year in

the curriculum. Sample budgets for Year I, Year II, and the Junior/Senior Continuum may be requested from the Office of Financial Aid. Tuition, mandatory fees and parking are the same for all years.

Tuition for courses of the graduate curriculum is based upon the number of units assigned to each course. The Graduate Degree Programs section provides a department-by-department list of graduate course titles; the number following each title indicates the number of units for which tuition is charged. Late payment of tuition is subject to a mandatory late fee.

Required Fees (Estimated)

Academic Year Tuition (two semesters)	\$37,366
Graduate Tuition (per unit)	1,010.00
Student Health Service Fee (annual)	394.00
Student Programming Fee (graduate)	78.00
Norman Topping Scholarship Fee	12.00
Health Insurance	685.00
Disability Insurance	61.00
Malpractice Insurance	25.00

Optional Fees

Parking fee, per semester (see Tuition and Fees, page 31).

Grading and Evaluation

The Keck School of Medicine employs a system of evaluation and grading designed to encourage student self-reliance, to stimulate the student's independent quest for knowledge and to promote excellence in academic achievement.

For courses of the medical curriculum, the Keck School of Medicine does not award numerical or letter grades. The evaluation process leading to a satisfactory or unsatisfactory report is based on performance of the student in relation to announced course criteria. Throughout medical school, students will be evaluated on their fund of knowledge, problem-solving ability, professional behavior, relevant personality traits and clinical and interpersonal skills. Additional information on grading and evaluation is contained in the

handbook provided to every enrolled medical student.

Faculty instructors are responsible for establishing evaluation criteria appropriate to the objectives of each course, discipline and clerkship, and for specifying the manner in which evaluative information is to be gathered. Instructor comments on student performance form an integral part of a student's total evaluation. For each evaluation, descriptive comments based on the student's overall performance in relation to course criteria are submitted for permanent file to the office of the associate dean for student affairs, together with performance reports of satisfactory, unsatisfactory or honors.

The student's permanent file is used to prepare a letter from the dean of the Keck School

of Medicine, which accompanies student applications for internships and residencies, and to determine scholastic suitability for election to Alpha Omega Alpha, the medical school honor society. These records are maintained by the Office for Student Affairs; students may review their records during regular office hours. During the lifetime of the physician, the permanent student record may be consulted as evidence of completion of the required curriculum and as certification for licensure.

Grading and evaluation policies for graduate degree programs and for joint M.D./Ph.D. degrees are established in conjunction with the Graduate School. In general, courses taken in partial fulfillment of graduate degree requirements receive letter grades that are recorded by the Graduate School.

Degrees and Requirements

The Keck School of Medicine and its departments offer types of curricula leading to award of the Doctor of Medicine, joint M.D./Ph.D., joint M.D./M.B.A. and graduate degrees in conjunction with the Graduate School in Applied Biostatistics/Epidemiology, M.S.; Biochemistry and Molecular Biology, M.S., Ph.D.; Biometry, M.S., Ph.D.; Biostatistics, M.S., Ph.D.; Cell and Neurobiology, M.S., Ph.D.; Clinical and Biomedical Investigations, M.S.; Epidemiology, Ph.D.; Experimental and Molecular Pathology, M.S.; Molecular Epidemiology, M.S., Ph.D.; Molecular Microbiology and Immunology, M.S., Ph.D.; Nurse Anesthesia, M.S.; Pathobiology, Ph.D.; Physiology and Biophysics, M.S., Ph.D.; Psychology and Public Health, Ph.D./M.P.H.; Statistical Genetics and Genetic Epidemiology, Ph.D.

The Department of Family Medicine offers the Master of Physician Assistant Practice. The Department of Preventive Medicine offers a B.S., Health Promotion and Disease Prevention Studies/Master of Public Health; Master of Public Health; Pharm.D./Master of Public Health; Ph.D., Physical Therapy/Master of Public Health; Ph.D., Preventive Medicine (Health Behavior Research); Ph.D. Statistical Genetics and Genetic Epidemiology; M.D./Master of Public Health; and minors in Health Communication, Nutrition and Health Promotion, Public Health and Substance Abuse Prevention.

Doctor of Medicine

The Keck School of Medicine awards the Doctor of Medicine to enrolled students who have satisfactorily completed the four-year curriculum of the school. This curriculum integrates instruction in all departments of the school: Department of Anesthesiology, Department of Biochemistry and Molecular Biology, Department of Cell and Neurobiology, Department of Emergency Medicine, Department of Family Medicine, Division of Medical Education, Department of Medicine, Department of Molecular Microbiology and Immunology, Department of Neurological Surgery, Department of Neurology, Department of Obstetrics and Gynecology, Department of Ophthalmology, Department of Orthopaedics, Department of Otolaryngology – Head and Neck Surgery, Department of Pathology, Department of

In addition, departments of the school have certificate programs in certain medical specialties.

The Educational Policy Committee is responsible for overall planning of the medical school curriculum. Separate curriculum committees plan and supervise the instructional programs for each year of medical school. Each of the committees comprises student representatives and faculty members from the departments involved in each year's teaching program.

The curriculum of medical education at USC continues to emphasize preparation of the student to give optimal patient care. Students are progressively involved in patient care beginning with their first semester. The curriculum is patient-oriented, and students are expected to assume increasing responsibility for patient care as they acquire sufficient knowledge and skills. During the clinical experiences of the Junior/Senior Continuum students eventually attain a level equivalent to that of an intern.

At the same time, the school recognizes that the explosion of knowledge and techniques brought about by the current "biotechnology revolution" is rapidly altering the practice of medicine. During the four years of medical school, students cannot be taught all that will be needed for the practice of medicine — either now or in the years ahead. To a far

greater degree than in the past, the present curriculum encourages students to acquire skills and habits of self-education and self-instruction that will prepare them for lifelong learning.

The faculty of the school recognize that while most students will eventually practice medicine, some will choose an academic research career. The plan of medical education fosters the development of individuals whose careers may be directed along this path. Faculty are available to counsel and encourage research participation by students during their medical school training.

The curricula of the Keck School of Medicine and its departments acknowledge the crucial place of basic medical science in the advance of modern clinical practice. Both basic and clinical science are taught throughout the four years of the undergraduate medical curriculum. Basic science is taught both as pure basic science and in correlation with clinical science. In addition, a number of the school's departments cooperate with the USC Graduate School to offer degree courses leading to the award of the Master of Science and Doctor of Philosophy. Most of these graduate courses may also be taken as part of the school's joint M.D./Ph.D. program.

The sections that follow provide a synopsis of the emphases and organization of this four-year curriculum.

Year I-II Continuum (two calendar years – 76 weeks)

The first year of the Year I-II continuum begins with 19 weeks of Core Principles of Health and Disease followed by 49 weeks of organ system review ending with a nine-week Integrated Case Study section. There is an eight-week summer break between the first and second years. Students also take Introduction to Clinical Medicine and the Patient (described on page 648).

Pediatrics, Department of Physiology and Biophysics, Department of Preventive Medicine, Department of Psychiatry and the Behavioral Sciences, Department of Radiation Oncology, Department of Radiology, Department of Surgery and Department of Urology.

The curriculum is designed to enhance the students' understanding of the basic sciences and their relevance to clinical medicine. The methodology used will improve students' problem-solving and independent study skills. Curriculum themes are delivered in a case-centered format with the integration of small-group learning sessions, directed independent study and newer instructional technologies emphasized.

Each week of the academic year is composed of approximately 20 hours of lecture and small group sessions with an additional 20 hours of independent directed study or Introduction to Clinical Medicine and the Patient. Examinations in all systems throughout the first two years are graded Pass/Fail. Dean's recognition is awarded on the basis of year-end comprehensive examinations and special projects.

Core Principles of Health and Disease

This 19-week introductory system provides the student with the fundamental knowledge necessary for the integrated study of the basic and clinical sciences in the 10 human organ systems. Included in this section are these major themes: cell structure and function; the human organism; disease and the body's responses; prevention and treatment of disease, including evidenced-based medicine; and introduction to clinical medicine and the patient. This section is taught in an integrated fashion and includes the use of clinical case studies.

Gross Anatomy

Cadaver dissection remains a unique teaching tool by which the three dimensional organization of the human body is studied. Gross anatomy will begin in the Core Principles of Health and Disease system continuing in the Hematology/Clinical Immunology system with the dissection of the body wall and major body cavities followed by head and neck dissection in the Neurosciences system and ending with limbs dissection during the Musculoskeletal system. Continued study of gross anatomy by use of prosected anatomical specimens as well as computer programs, selected review lectures, and so on, continues throughout the integrated organ systems.

Introduction to Clinical Medicine and the Patient (ICM)

ICM expresses the strongly patient-centered orientation of the medical school curriculum. The student is introduced to patients and is involved in patient care activities from day one. Students are introduced to the principles of patient care and management and examine what it means to be a physician and how one becomes a physician.

The major content areas of the course include communication in the setting of illness, the unified concept of health and disease (the biopsychosocial model), basic clinical skills and the correlation of basic science with clinical medicine.

ICM emphasizes the systematic acquisition of the clinical skills of interviewing, history taking, physical examination, elementary clinical problem solving, and medical record keeping. Throughout the Year I-II continuum,

the ICM clinical skills curriculum is integrated with basic science instruction. Students can therefore learn and apply basic science knowledge in the clinical setting. By encouraging a thorough understanding of the direct applications of basic science research to modern clinical medicine, instructors motivate the student to learn, use and retain more of the content and concepts presented in the basic science portions of the curriculum.

A group of five or six students spends from four to eight hours each week with an instructor from the clinical faculty who remains with the group for one to two years. As the group deals with basic medical themes (death, pain and helplessness) and issues (patient responsibility, learning to live with ambiguity and uncertainty), instructors help students to cope with their own feelings. This format opens the door for student-faculty interaction and improvement of student-faculty communication.

Instructors encourage students to take advantage of the learning experiences provided by their roles as helping and therapeutic persons. Students develop their ability to communicate with patients in the setting of illness and are guided by patient concerns to enhance their own growing knowledge, skills, abilities and responsibilities. Students are expected to acquire skills and habits of self-education and self-instruction that will prepare them for lifelong learning.

The unified concept of health and disease presented in this course enables students to comprehend the human organism in all its complexity. Using their clinical experiences as a teaching model, students are taught to consider the patient as an integrated whole and to view the patient's illness or disease as more than simply a disruption of physiologic processes or a collection of physical findings.

Additional learning experiences occur through workshops and focus experiences. ICM workshops provide standardized instruction in history taking and physical examination, as well as integrated instruction in areas that cross disciplines. These include physician well being, substance abuse, domestic violence, and ethics. Through focus experiences, students are encouraged to explore a variety of practice environments as well as community-based health and social services. For example, students may visit outpatient clinical settings, a geriatrics long term care facility, a hospice care facility or homeless services organizations.

Organ System Review

A sequence of study presenting integrated basic and clinical science instruction involving 10 human organ systems — Hematology

and Clinical Immunology, Neurosciences, Musculoskeletal, Cardiovascular, Renal, Respiratory, Endocrine/Metabolism, Reproduction, Skin, Gastrointestinal/Liver — follows Core Principles of Health and Disease.

Integrated Case Study

This section completes the second year of the Year I-II continuum and will emphasize patient-centered problems that integrate the basic and clinical science presented in the preceding organ systems. Students will explore the multi-organ effects of disease processes and reinforce diagnostic reasoning skills. In addition, concepts of pathophysiology, evaluation and management that can be applied to any organ system will be included. A review during this section of the important basic science and clinical concepts covered during the previous two years will prepare the students to take the United States Medical Licensing Examination (USMLE) Step 1 examination. This section will also reinforce the appropriate use of medical information resources, effective self-directed learning skills, and interpersonal and group communication skills.

By early spring of the second year of the Year I-II continuum, students are expected to select their academic advisors and to begin arranging the schedule of clerkships to be taken during the junior/senior continuum. By the end of the fall semester, Year II, each student receives information that describes the curriculum requirements of the junior/senior continuum. Students choose the area of medical practice that they are most likely to pursue and an advisor is assigned from that discipline. The advisor counsels the student on clerkships and opportunities in graduate medical education.

Junior/Senior Continuum (two calendar years)

The final two years of medical school are designed as a continuum of two calendar years, beginning in July at the end of Year II. During the spring of their second year, students schedule clerkship rotations to be taken during the two years of the continuum. Each student's program is individually designed with the assistance of faculty advisors and includes 50 weeks of required clerkships, 12 weeks of selective clerkships and 18 weeks of elective clerkships.

All degree candidates are required to take Step I of the United States Medical Licensing Examination (USMLE) prior to entering the junior/senior continuum and pass it before starting their senior year of the continuum. Students must take Step II of the USMLE as a graduation requirement.

During the continuum each student may schedule 16 weeks of vacation for personal convenience, remedial work, funded research work and other non-curricular activities, such as investigating postgraduate training programs. Although every effort is made to provide flexibility in the scheduling of each student's program, some inherent limitations are imposed by the maximum enrollment permitted for each clerkship. Students are a vital part of the university's medical team, which provides health care for patients throughout the year. Vacations are therefore subject to some scheduling adjustments.

Required Clerkships

Family Medicine	6 weeks
General Surgery/Specialty Surgery	12 weeks
Medicine I	6 weeks
Medicine II	4 weeks
Neurology	4 weeks
Obstetrics and Gynecology	6 weeks
Pediatrics	6 weeks
Psychiatry	6 weeks

Selective Clerkships

Students are required to schedule 12 weeks of selective clerkships, chosen from a list of four- or six-week clerkships approved by the Clinical Curriculum Committee. Selective clerkships are carried out at USC-affiliated hospitals and encompass virtually all specialty areas.

Elective Clerkship

The elective period consists of 18 weeks, during which electives may be taken on campus, at USC-affiliated hospitals or at more distant medical schools or medical centers. Approved on-campus electives that are offered regularly are listed in the elective catalogue.

Proposals for other on-campus and off-campus electives are reviewed individually by a committee composed of faculty members and students. All petitions must be submitted at least six weeks before the beginning of the rotation. Off-campus electives require documentation from the off-campus preceptor,

endorsement of the student's medical school advisor, and prior approval and review by the Clinical Curriculum Committee. Credit is not given for electives until an evaluation has been received from the preceptor and a critique of the elective submitted by the student. Students with an academic deficiency may not schedule off-campus electives.

From Bench to Bedside: Basic Science in the Practice of Medicine

The goals of this new required Year IV four-week course are to promote the use of basic scientific principles and knowledge in the everyday practice of medicine. Students obtain advanced instruction in laboratory medicine, molecular medicine and diagnostic imaging through use of clinical vignettes/PPP cases. All students attend and participate in an autopsy experience that includes instruction in indications for autopsy and completion of a death certificate. Students correlate autopsy and clinical findings and present a final report. At least half of the course time is spent completing one of several defined translational basic science projects (e.g., clinical anatomy review, evidence-based medicine literature review, surgical pathology or radiology). Students are evaluated by a written exam and by analysis of their autopsy presentation and project report.

Year I-IV – Humanities, Economics, Art and the Law (HEAL)

This four-year curriculum begins with collaborative discourse about ethical problems to help students learn to identify, analyze and resolve clinical ethical problems. This exercise is followed by interim skill building/maintenance and by instructor facilitated discussion of videotaped ethics cases.

In Year II, the program focuses on ethical discernment and action in simulated settings and the study of the human dimensions of medicine. In the first exercise, standardized patients interact with students to help teach the telling of bad news. Students also learn from the humanities about patients as persons.

The program concludes with a forum theatre in which students must decide what action to take based on their own convictions.

Year III is devoted to ethics education by clinical role models and encompasses instruction in the core clerkship by ethical standard-bearers. Students also participate in home hospice care and pain management cases.

The Year IV program includes a series of retreats that focus on contemporary health care and the physician-in-society. The goal of the retreats is to provide students with the experience of integrating the principles, methods and bedside issues included in Year I-III of the program. Students practice applying the micro-level (individual/clinical) decisions to the ethical dilemmas and policy issues that face physicians at the mezzo-level (health care organizations), and to the macro-level (profession as a whole, state and nation). Topics include issues of professionalism; allocation of resources; the economics, organization and societal oversight of health care; and the care of dying patients.

Fifth Year Research Option

USC offers students the opportunity to take a full year of research experience with either a Keck School of Medicine faculty mentor or an approved faculty mentor at another institution. This program is open to any student in good to excellent academic standing who has completed his or her first year of medical school. Students interested in the option should identify a faculty preceptor and present a description of the proposed research program and funds available in support of the program to the associate dean for curriculum. A stipend, comparable to that received by a graduate student at the postgraduate level, is available. Application for this program is made through the Office for Curriculum (KAM 314) and will be supervised through the Office of the Associate Dean for Student Affairs (KAM 100E).

Baccalaureate/M.D. Program

The focus of this program is to assure these students admission to medical school (based upon the maintenance of their GPAs and requisite MCAT scores) and to allow them the opportunity to enrich their studies with a balanced liberal arts education. It is hoped that these students will explore the diverse educational opportunities the University of Southern California has to offer and become members of the medical profession with a

balance of medicine, science and the arts. The Baccalaureate/M.D. Program is not designed to advance these potential medical professionals with four years of science and medicine prior to attending medical school, but rather to allow them the necessary time to explore and develop into mature and serious students of medicine.

Information and applications are available from the College Admissions Office, College of Letters, Arts and Sciences, University of Southern California, Los Angeles, CA 90089-0152; (213) 740-5930, FAX: (213) 740-1338.

M.D./Ph.D. Program

Departments of the Keck School of Medicine participate in the joint M.D./Ph.D. degree program administrated by the Graduate School and the Keck School of Medicine. This program integrates the medical school curriculum with graduate curricula in the basic sciences, to provide a unified course of study leading to both the M.D. and Ph.D. degrees.

This program is especially designed to prepare highly qualified students for careers in academic medicine and medical research. Formal course work and dissertation research provide the student with in-depth scientific preparation and research experience which enhances the application of basic science information to the diagnosis, treatment and prevention of disease. Conversely, the Ph.D. education becomes more meaningful because of its disease-oriented emphasis.

The curriculum for M.D./Ph.D. students differs from that of Ph.D. graduate students in the basic sciences in that the former take medical school courses as well as selected graduate level basic science courses. The integrated training of the M.D./Ph.D. program enables students to compress their total academic effort by applying some course work toward the requirements of both degrees. On average, completion of the combined program requires a total of eight years.

The following graduate programs at the Keck School of Medicine participate in the M.D./Ph.D. program:

- Biochemistry and Molecular Biology
- Cell and Neurobiology
- Molecular Microbiology and Immunology
- Pathology
- Physiology and Biophysics
- Preventive Medicine

Time limits for qualifying examinations and other procedures are determined by considering M.D./Ph.D. students as medical students for the periods when they are following the medical curriculum and as full-time graduate students during their years of graduate research prior to advancement to the Junior/Senior Continuum.



During the first two years of their program, M.D./Ph.D. students follow the medical school curriculum and gain added exposure to the basic science departments through a special survey course. Students are guided by the M.D./Ph.D. Committee, which outlines the integration of their graduate program with the medical school curriculum and serves as the students' liaison until they have selected a department and graduate research advisor. The graduate programs vary widely in the extent to which they allow credit toward the Ph.D. for courses taken during the first two years of medical school. M.D./Ph.D. students are encouraged to select a graduate department by January of the second year of medical school. Students will be required to apply for admission to the Ph.D. program by the deadline on the graduate application.

Beginning with the third year of the M.D./Ph.D. program, students enter their selected department as full-time graduate students. Although the content of graduate courses required of M.D./Ph.D. students is generally identical to that required of Ph.D. students in the same graduate program, M.D./Ph.D. students are permitted greater latitude in the

scheduling of their graduate courses. Three years are commonly necessary to fulfill departmental requirements for the Ph.D., including course work, qualifying examinations, independent dissertation research, and writing of the dissertation.

After completion of the graduate program, the student is advanced to the Junior/Senior Continuum and completes the final two years of clinical training required by the medical school curriculum. No portion of clinical training is deleted from the joint program.

Keck School of Medicine-Caltech M.D./Ph.D. Program

A joint program between the Keck School of Medicine and the California Institute of Technology was established for the granting of the M.D./Ph.D. degree. Students do their preclinical and clinical work at the Keck School of Medicine and their Ph.D. work with any member of the Caltech faculty, including the biology, chemistry, engineering and applied sciences divisions.

Admission to this joint program is made through the usual Keck M.D./Ph.D. process. Following the interview at USC, a subset of applicants will be invited to interview at Caltech. An average of two students per year will be accepted into the joint program. Ph.D. studies may be carried out at Caltech or through collaboration between laboratories at both institutions. The M.D. degree will be awarded from the Keck School of Medicine and the Ph.D. from Caltech.

Further information about the M.D./Ph.D. programs at the Keck School of Medicine may be obtained by contacting: M.D./Ph.D. Program, Keck School of Medicine, 1975 Zonal Avenue (KAM 314), Los Angeles, CA 90033; (323) 442-2965, FAX: (323) 442-2318.

M.D./M.B.A. Dual Degree Program

In response to the ongoing reorganization of health care delivery systems, and the growing awareness of the impact of business decisions on health care, the Keck School of Medicine and the Marshall School of Business jointly offer an innovative program for individuals seeking knowledge in both medicine and business administration. The program is designed to prepare its graduates to assume leadership in the design and management of health care systems.

The M.D./M.B.A. program spans five-and-one-half years. Interested students apply during their second year of medical school, and begin core M.B.A. courses following successful completion of the first two years of medical school. The last two-and-one-half years are devoted to the clinical clerkships of the Keck School of Medicine and nine units

of elective courses in the Marshall School. At the conclusion of the program, students will have completed 48 units in the Marshall School of Business and four years of courses in the Keck School of Medicine. Dual degree students may not count courses taken outside the Marshall School of Business toward the 48 units.

First and Second Years: Required medicine courses.

Third Year: Required M.B.A. core courses.

Remaining Two and One-Half Years: Keck School of Medicine core, selective, and elective clerkships and nine units of GSBA elective courses.

Admission Requirements

Students who have a baccalaureate degree from an accredited college or university and have successfully completed two years in the Keck School of Medicine will be considered for admission to the Marshall School of Business (see page 110). All requirements for admission to the regular M.B.A. Program (GPA, GMAT score, etc.) must be fulfilled by the medical student for admission to the Marshall School.

The M.D. and the M.B.A. degrees are awarded simultaneously upon completion of their requirements by the Keck School of Medicine and the Marshall School of Business.

M.D./Master of Public Health

The joint M.D./M.P.H. program at the Keck School of Medicine is designed for individuals who envision a medical career that combines public health and medical disciplines. Many individuals entering careers as medical doctors or public health practitioners wish to acquire not only medical practice competencies, but also an understanding of the history, organization, goals and philosophy of public health.

The joint M.D./M.P.H. program offers a broad-based orientation to public health while the student completes medical school requirements. The Master of Public Health degree provides increased knowledge of and sensitivity to the political, historical, economic and social environments of health promotion and health services delivery.

The M.D./M.P.H. program spans five years (four years of medical school and one year of public health courses). Students begin the core M.P.H. courses following the successful completion of the first two years of medical school. The last two years of the program are devoted to clinical clerkships of the School of Medicine and to the completion of the elective courses and practicum (field experience) of the M.P.H. program. At the conclusion of the joint degree program, students will have completed 42-46 units in the Master of Public Health program and four years of courses in the Keck School of Medicine.

Students who are enrolled in the Keck School of Medicine must apply to the Master of Public Health program no later than January

of their second year. All requirements for admission to the regular M.P.H. program must also be fulfilled by dual degree applicants.

All students in the M.D./M.P.H. program must meet course requirements, grade point average requirements and program proficiency requirements of both programs. Students must have a grade point average of 3.0 in the M.P.H. curriculum to meet graduation requirements.

The M.D. and the M.P.H. degrees are awarded simultaneously upon completion of the Keck School of Medicine and the Master of Public Health program requirements. For more information, contact the M.P.H. Program Office at (626) 457-6677.

Ph.D. Programs in Biomedical and Biological Sciences (PIBBS)

Keith Administration Building 110
1975 Zonal Avenue
Los Angeles, CA 90089-9023
(323) 442-1609
FAX: (323) 442-1610
Email: pibbs@usc.edu
www.usc.edu/pibbs

Program Director: Debbie Johnson

The USC Ph.D. Programs in Biomedical and Biological Sciences (PIBBS) offer opportunities for graduate studies and research leading to the Ph.D. degree in a broad range of biological and biomedical disciplines. Interdisciplinary studies that span multiple fields have sparked a startling surge in new discoveries that excite intellectually and also promise great benefits to society. The results will be a better understanding of our bodies and our environment.

Students admitted to the PIBBS programs spend two semesters taking courses in disciplines such as biochemistry, cell biology, molecular genetics and physiology; in addition, PIBBS students complete three or more research rotations in any of over 100 different research laboratories. Near the end of the second semester each student chooses a faculty member to serve as a thesis research advisor and chooses a specific Ph.D. program from among the participating programs listed. Subsequently, each student will focus on the completion of course requirements and qualifying examinations for the chosen Ph.D. program and will develop and complete an original research project that will serve as the basis for a doctoral dissertation.

For information on application materials and descriptions of the research interests of participating faculty, see the PIBBS site on USCweb.

Participating Schools and Graduate Programs

College of Letters, Arts and Sciences
Department of Biological Sciences
Marine and Environmental Biology
Molecular and Computational Biology
Neuroscience
School of Dentistry
Craniofacial Molecular Biology
School of Engineering
Biomedical Engineering
Keck School of Medicine
Biochemistry and Molecular Biology
Cell and Neurobiology
Molecular Microbiology and Immunology
Pathobiology
Physiology and Biophysics
Preventive Medicine
Biostatistics, Epidemiology
School of Pharmacy
Molecular Pharmacology and Toxicology
Pharmaceutical Sciences

A detailed description of each of the Ph.D. programs listed here can be found by consulting the catalogue index.

Admission

Applicants to PIBBS must have a bachelor's or master's degree with a major emphasis in the natural sciences. Applicants must have a strong record of academic achievement, satisfactory performance on the general and advanced portions of the GREs and three letters of recommendation. Previous research experience in a related field is expected but not required. Students are admitted for the academic year beginning in the fall. Although there is no formal application deadline, complete applications received before January 15 will have a better chance of acceptance.

Applications and supporting materials should be sent to: PIBBS, University of Southern California, Office of Scientific Affairs, 1975 Zonal Avenue, KAM 110, Los Angeles, CA 90089-9023. Internet applications can also be submitted from the Web site.

Financial Support

Admitted students are supported by research assistantships or fellowships during their two semesters in the PIBBS program. Tuition, health insurance and standard fees are also covered. After the student completes the PIBBS program and enters a specific Ph.D. program, similar support mechanisms are generally provided by the Ph.D. granting program.

Curriculum

Most students will take the following courses during a two-semester period:

REQUIREMENTS		UNITS
BIOC 790	Research (taken in conjunction with the rotation plan described below)	1-12
INTD 504	Molecular Biology of Cancer, or	
INTD 555	Biochemical and Molecular Bases of Disease, or	
PHBI 562	Systems and Integrative Physiology	4
INTD 531	Cell Biology	4
INTD 561	Molecular Genetics	4
INTD 571	Biochemistry	4

However, the list of courses for individual students may vary from this plan with permission of the program director. As part of the BIOC 790 course, each student will complete research rotations with three or more faculty members in participating Ph.D. programs. Near the end of the second semester, each student will choose a faculty member to serve as dissertation advisor and will choose a specific Ph.D. program from the list of participating programs.

Graduate Degree Programs

In conjunction with the Graduate School, the Keck School of Medicine offers graduate curricula on the Health Sciences campus leading to the Doctor of Philosophy with majors in biochemistry and molecular biology, cell and neurobiology, molecular microbiology and immunology, pathobiology, physiology and biophysics.

The Departments of Preventive Medicine and Cell and Neurobiology along with the School of Policy, Planning, and Development offer the Master in Public Health with concentrated study in one of four tracks:

health promotion and disease prevention, biostatistics/epidemiology, nutrition, and health communication.

The Department of Preventive Medicine also offers graduate curricula leading to Ph.D. degrees in biostatistics, epidemiology, or health behavior research.

Graduate credit is provided for some courses included in the Years I and II curriculum of the medical school.

The following sections provide an overview of the departmental graduate studies programs. The requirements listed are those of the individual departments and must be taken in conjunction with the general requirements of the Graduate School. For further information regarding graduate studies in the medical sciences, consult the specific departments or contact: Office of the Associate Dean for Scientific Affairs, Keck School of Medicine, 1975 Zonal Avenue (KAM 110), Los Angeles, CA 90089-9023; (323) 442-1607, FAX: (323) 442-1610.

Courses of Instruction

INTERDEPARTMENTAL (INTD)

The terms indicated are *expected* but are not *guaranteed*. For the courses offered during any given term, consult the *Schedule of Classes*.

462 Physiology for the Health Professions (4, Sp) (Enroll in PHBI 462)

500 Ethics and Accountability in Biomedical Research (1, Sm) The purpose of this course is to engage current (and potential) research trainees in discussions about the responsible conduct of science. The course is designed as an option for meeting current federal regulations which require that all predoctoral and postdoctoral fellows paid from federal contracts and grants have a component of ethical training.

504 Molecular Biology of Cancer (4) Epidemiology, pathobiology, carcinogenesis, tumor biology and heterogeneity; retroviruses, oncogenes, cell cycle control, genetics of cancer, tumor immunology; treatment strategies. *Prerequisite:* MICB 501.

504 Molecular Biology of Cancer (4, 2 years, Sp) Epidemiology, pathobiology, carcinogenesis, tumor biology and heterogeneity; retroviruses, oncogenes, cell cycle control, genetics of cancer, tumor immunology; treatment strategies. *Prerequisite:* MICB 501.

522 Infection and Host Responses (4, Sp) Overview of microbes, their life cycles and the host response they elicit, evade or exploit, including the manipulation and the malfunction of the immune system.

531 Cell Biology (4, Fa) Current perspectives on major research areas in cell biology. Emphasis will be on in-depth examination of cellular structures, regulatory processes, intra-cellular routing and targeting, and cell/environmental interactions.

535 Continuing Introduction to Clinical Medicine for M.D./Ph.D. Students (1, FaSp) Course for M.D./Ph.D. students in Ph.D. years designed to allow maintenance and improvement of clinical skills prior to re-entry in clinical rotations in the Year III medical curriculum. Open only to medical students who have completed Years I and II. Graded CR/NC.

549 Protein Chemistry – Structure and Function (4, Sp) Chemistry of peptides and proteins; protein structure and folding; molecular basis of protein action. (Duplicates credit in former BIOC 549.) *Prerequisite:* general biochemistry.

550 Introduction to Pathology (6, Fa) Three separate series of lectures: one on normal histology, one on basic principles of microbiology, and the other on basic principles of immunology. Emphasis on normal aspects of biological processes important in disease pathogenesis. (Duplicates credit in former PATH 550aL.)

551 Advanced Pathology (6, Sp) Mechanisms of disease processes including inflammation, tissue injury and cell death, atherosclerosis, infectious diseases, diseases of the immune system, cancer, diseases of aging, and pollution. (Duplicates credit in former PATH 550bL.) *Prerequisite:* INTD 550.

555 Biochemical and Molecular Bases of Disease (4) Biochemical and molecular abnormalities in disease states. *Prerequisite:* general biochemistry.

561 Molecular Genetics (4, Sp) Prokaryotic and eukaryotic molecular genetics: DNA and RNA structure and function; biochemistry and molecular biology of replication, transcription, RNA processing, translation, and regulation of gene expression. (Duplicates credit in former BIOC 561.) *Prerequisite:* INTD 571.

562 Systems and Integrative Physiology (4) (Enroll in PHBI 562)

571 Biochemistry (4, Sp) Physical-chemical basis of life processes: protein structure and enzyme function; synthesis and metabolism of carbohydrates, lipids, amino acids, and nucleotides. (Duplicates credit in former BIOC 441.) *Prerequisite:* open to qualified students.

620 Medical Students Elective Program (0) Opportunities for medical students as preceptors in research laboratories or in field medical service under guidance of sponsors approved by faculty committees. Graded CR/NC.

Department of Anesthesiology

Nurse Anesthesia Program

1540 Alcazar Street
Suite 223
Los Angeles 90089-9012
(323) 442-2037
FAX: (323) 442-1701
Email: uscnap@usc.edu
www.usc.edu/medicine/anesthesia

Program Director: Michele E. Gold

Assistant Program Director: Teresa Norris

Faculty

Chair and Professor: Philip Lumb

Professor of Pediatrics and Anesthesiology:
Randall Wetzel

Professors of Clinical Anesthesiology: Mary Joseph; Ronald Katz; Vladimir Zelman

Associate Professor: Wynne Waugaman

Associate Professors of Clinical Anesthesiology:
Jeffrey Lee; Rajesh Patel; David Raphael;
Earl Strum

Assistant Professors of Clinical Anesthesiology:
Rudolfo Amaya; Dimiter Arnaudov; Armin Azad; Jack Berger; Maxim Benbassat; Kari Cole; James Daniel; Gligor Gucev; Ralph Harding; William Loskota; Jana Planner

Instructors of Clinical Anesthesiology: Gabriel Aron; Roberta Ashley; James Carey; Jennilyn Casalme; Nancy Christiano; Charlotte Garcia; Monique Jabbour; Chris Winckler

The nurse anesthesia program prepares qualified nurses in the specialty of nurse anesthesia and qualifies the graduate to sit for the certification examination given by the Council on Certification of Nurse Anesthetists. The graduate attains a high level of clinical competence with an extensive body of didactic knowledge relevant to the specialty and advanced practice nursing.

Students enrolling in the M.S., Nurse Anesthesia course of study must complete the nurse anesthesia core curriculum and specialty practicum. The program consists of 44-49 units and is completed in 24 months of continuous enrollment (six semesters). There is an optional one-semester clinical fellowship offered in the seventh semester of enrollment to provide specialty training in a clinical area of choice: critical care, cardiovascular, neuro, ambulatory anesthesia or pain management. Students may sit for the certification examination during this semester.

The program is based in the Department of Anesthesiology, and classroom instruction is provided by nurse anesthesia program faculty and faculty from the Department of Anesthesiology and the Department of Physiology and Biophysics within the Keck School of Medicine, as well as clinical faculty from the program clinical sites. Clinical training occurs at Los Angeles County+USC Medical Center, Arrowhead Regional Medical Center, Harbor-UCLA Medical Center, Long Beach Veterans' Administration Medical Center and West Los Angeles Veterans' Administration Medical Center for the primary rotations. Advanced rotations occur at those sites, as well as Cedars-Sinai Medical Center, Childrens Hospital of Los Angeles, Hudson Comprehensive Care Center and Northridge Pain Management and Surgery Center.

Master of Science (in Nurse Anesthesia)

General requirements for admission include a minimum 3.0 undergraduate grade point average, a minimum score on the verbal and quantitative sections of the Graduate Record Examinations of 1000, current licensure as a Registered Nurse, a bachelor's degree in nursing or a related field from an accredited university or college, submission of an essay describing the applicant's career goals, professional resume and three letters of reference. Competitive applicants will be interviewed and must demonstrate an acceptable understanding of the roles and responsibilities of certified registered nurse anesthetists. Selections are made on the basis of the formal interview and consideration of a variety of factors that include academic record, type and amount of clinical experience and professionalism.

Academic and Scientific Prerequisites

The admission requirements also include appropriate undergraduate course work in biology, anatomy, physiology, chemistry, biochemistry, physics and statistics (or nursing research). A minimum of one year of experience in critical care nursing as a registered nurse is required. Licensure as an RN in California and current BCLS, ACLS and PALS certifications are required prior to enrollment. Conversational Spanish is strongly recommended.

Computer Skill Requirements

During the program, students must have a personal computer or notebook with Internet access. The primary mode of program communication is email. Computer accounts are provided by the university to all students and can be activated online.

Advisement

Prospective students should contact the program's admission office, (323) 442-2037 or uscnap@usc.edu for evaluation of previous course work and clinical background.

Admission

Admission procedures follow the information in the Admission section of this catalogue. The applicant can obtain the USC application online at www.usc.edu/admission or from the Office of Admission at (213) 740-1111. A supplemental nurse anesthesia program application must be completed and can be obtained from the program office at (323) 442-2037.

DEGREE REQUIREMENTS		UNITS
<i>Academic Courses</i>		
ANST 500	Human Anatomy	3
ANST 501	Pharmacology of Anesthesia Practice	4
ANST 502	Principles of Nurse Anesthesia Practice	4
ANST 503	Advanced Pharmacology of Anesthesia Practice	3
ANST 504	Pathophysiology Related to Anesthesia Practice	4
ANST 506	Advanced Principles of Nurse Anesthesia Practice	4
ANST 508	Research: Investigative Inquiry	2
ANST 510	Professional Aspects of Nurse Anesthesia	3
ANST 512	Research Integration: Capstone Experience	1
PHBI 562	Systems and Integrative Physiology	4
<i>Residency Courses</i>		
ANST 505	Clinical Residency in Nurse Anesthesia I	3
ANST 507	Clinical Residency in Nurse Anesthesia II	2
ANST 509	Advanced Clinical Residency in Nurse Anesthesia I	3
ANST 511	Advanced Clinical Residency in Nurse Anesthesia II	3-8
ANST 513	Advanced Clinical Residency in Nurse Anesthesia III	1
Total Units		44-49
<i>Optional Course</i>		
ANST 514	Specialty Fellowship	2

All students will take the Self-Evaluation Examination (SEE) administered by the Council on Certification of Nurse Anesthetists at the end of the first clinical year. Student scores must be above the national mean for advancement into the research capstone experience.

Courses of Instruction

NURSE ANESTHESIA (ANST)

500 Human Anatomy (3, Fa) Lectures and laboratory simulation in anatomy emphasizing structure and function of major organs to include brain, cardiovascular, lungs, liver, kidneys and musculoskeletal system. Open to nurse anesthesia students only.

501 Pharmacology of Anesthesia Practice (4, Fa) Pharmacokinetic and pharmacodynamic principles, uptake and distribution of inhalational anesthetics, and pharmacology of respiratory and cardiovascular drugs. Application of pharmacologic principles to anesthetic management. Open to nurse anesthesia students only. (Duplicates credit in NURS 573.)

502 Principles of Nurse Anesthesia Practice (4, Fa) Basic theory of anesthesia administration, preanesthetic assessment, physical examination, monitoring. Case management including airway and blood/fluid management, anesthesia machine, and postoperative pain. Lecture/case study format. Open to nurse anesthesia students only. (Duplicates credit in NURS 572.)

503 Advanced Pharmacology of Anesthesia Practice (3, Sp) Pharmacokinetic/pharmacodynamic principles of drugs covering different organs systems (CNS, hematology, endocrine), herbal therapies, chemotherapeutics, and antimicrobials. Application of pharmacology to anesthetic management using problem-based learning. *Prerequisite:* ANST 501, ANST 502.

504 Pathophysiology Related to Anesthesia Practice (4, Sp) In-depth study of cardiovascular, respiratory, renal, liver, endocrine and neuropathophysiology with application of these principles to anesthetic case management using problem-based learning. (Duplicates credit in NURS 574.) *Prerequisite:* ANST 501, ANST 502.

505 Clinical Residency in Nurse Anesthesia I (3, Sp) Correlation of techniques of anesthesia administration with application of scientific and pharmacologic theory in the clinical setting with observation and supervised clinical residency. *Prerequisite:* ANST 501, ANST 502.

506 Advanced Principles of Nurse Anesthesia Practice (4, Sm) Advanced theory of anesthesia management for general and specialized procedures, diagnostic procedures, pediatrics and obstetrics. (Duplicates credit in NURS 576.) *Prerequisite:* ANST 503, ANST 504, ANST 505.

507 Clinical Residency in Nurse Anesthesia II (2, Sm) Correlation of techniques of anesthesia administration with application of scientific and pharmacologic theory in the clinical setting with observation and supervised clinical residency. *Prerequisite:* ANST 505.

508 Research: Investigative Inquiry (2, Fa) Utilization of research, which includes the evaluation of research, problem identification within the practice setting, awareness of practice outcomes and the clinical application of research. (Duplicates credit in NURS 550.) *Prerequisite:* research course, basic statistics.

509 Advanced Clinical Residency in Nurse Anesthesia I (3, Fa) Correlation of techniques of anesthesia administration with application of scientific and pharmacologic theory expanded to geriatric, obstetrical, and pediatric anesthesia; anesthetic management to include medically compromised patients. *Prerequisite:* ANST 506, ANST 507.

510 Professional Aspects of Nurse Anesthesia (3, Fa) Emphasis on the professional components of nurse anesthesia practice including socialization, regulation, culture, ethics, law, employment, advocacy, and contemporary practice issues. Open to nurse anesthesia students only. (Duplicates credit in NURS 562.)

511 Advanced Clinical Residency in Nurse Anesthesia II (3-8, Sp) Correlation of techniques of anesthesia administration with application of scientific and pharmacologic theory expanded to neuroanesthesia, cardiac anesthesia, trauma anesthesia, critical care and pain management. *Prerequisite:* ANST 509.



512 Research Integration: Capstone Experience (1, Sm) A capstone course requiring students to demonstrate ability to integrate theory, research and practice through a mentored research experience with direct relevance to graduate specialization. (Duplicates credit in NURS 551.) Open to nurse anesthesia students only.

513 Advanced Clinical Residency in Nurse Anesthesia III (1, Sm) Correlation of advanced techniques of anesthesia administration with application of scientific and pharmacologic theory in diverse specialty anesthesia rotations. *Prerequisite:* ANST 511.

514 Specialty Fellowship (2, Fa) Optional internship to develop advanced skills and critical assessment of anesthesia specialty or clinical research. Graded CR/NC. *Prerequisite:* ANST 513; graduate of an accredited nurse anesthesia program.

Department of Biochemistry and Molecular Biology

Clinical Science Center – IGM 204

2250 Alcazar Street,
Los Angeles 90089-9075
(323) 442-1145
FAX: (323) 442-1224
Email: annvazqu@hsc.usc.edu

Faculty

Michael R. Stallcup, *Acting Chair and Professor of Biochemistry and Molecular Biology*

Deborah Johnson, *Vice Chair for Doctoral Education*

Zoltan A. Tokes, *Vice Chair for the Master's Degree Program*

Robert H. Stellwagen, *Vice Chair for Medical Education*

Judy and Larry Freeman Chair in Basic Science Research: Amy S. Lee

H. Leslie Hoffman and Elaine S. Hoffman Chair in Cancer Research: Peter A. Jones

William M. Keck Chair in Biochemistry: Laurence H. Kedes

J. Harold and Edna L. La Briola Chair in Genetic Orthopaedic Research: Baruch Frenkel

Salerni Collegium Professorship in Medicine: Robert E. Maxson

Professors: W.F. Anderson; N. Arnheim (*Biological Sciences*); E. Cadenas (*Molecular Pharmacology and Toxicology*); P.V. Danenberg; Y.A. De Clerck (*Medicine*); R. Farley (*Physiology and Biophysics*); D. Johnson; P.A. Jones; V.K. Kalra; L.H. Kedes; A.S. Lee; D. Levy; M. Lieber (*Pathology*); F.S. Markland, Jr.; R.E. Maxson; M.E. Nimni (*Pediatrics*); P. Roy-Burman (*Pathobiology*); M. R. Stallcup (*Pathology*); R.H. Stellwagen; Z. Tokes; A. Warshel (*Chemistry*)

Associate Professors: Z. Borok (*Medicine*); D. Broek; I.S. Haworth (*Pharmacy*); C.L. Hsieh (*Urology*); B. Frenkel (*Orthopaedics*); P. Laird (*Surgery*); R.D. Mosteller; S. Reddy; J. Reichardt; H. Sucov (*Cell and Neurobiology*)

Assistant Professors: A. Bhushan (*Pediatrics*); P. Cannon (*Pediatrics*); J. Hacia; P. Laird (*Surgery*); I. Laird-Offringa (*Surgery*); R. Langen; S. Reddy; J. Rice; H. Sucov (*Cell and Neurobiology*)

Associate Professor of Research: Q.S. Zhu

Assistant Professors of Research: N. Makridakas; C. Poizat; P. Sarkar

The USC Department of Biochemistry and Molecular Biology prides itself on maintaining a broad-based approach to various aspects of biochemical and molecular biological research. Each year, the department receives approximately \$3 million in research and fellowship support for its 24 primary faculty members.

Altogether, the department numbers 41 primary and joint-appointment faculty members, who offer specialized guidance in a variety of areas including: molecular biology and genetics of development and cell differentiation; membrane biochemistry and cell-cell recognition; kinetics and mechanism of enzyme action; protein structure-function interrelationships; carcinogenesis and cancer chemotherapy.

The department has major research programs in the molecular basis of control and regulation of gene expression, molecular mechanisms of signal processing and transduction, detailed analysis of macromolecular structure and function, the biochemistry and molecular biology of the brain, and genetic medicine including gene therapy.

The department's exceptionally strong research into various aspects of the biochemistry and cell biology of cancer is internationally recognized. Ongoing research programs in this area include chemical carcinogenesis, mechanism of action of cancer chemotherapeutic agents, tumor cell invasion and metastasis, and regulation of gene expression.

The department supports an internationally recognized program in gene therapy, which includes faculty from the affiliated Institute for Genetic Medicine under the directorship of Dr. Laurence Kedes and the Gene Therapy Laboratories under the directorship of Dr. W. French Anderson, both of whom are pioneers in basic and translational research on therapeutic gene transfer methodologies. The Gene Therapy Laboratories also maintain an FDA-certified clinical-grade vector production facility that supports the work of more than 30 approved clinical trial protocols at USC for gene therapy of cancer and hereditary disorders.

Several members of the department are members of the USC/Norris Comprehensive Cancer Center, including Drs. Anderson, Broek, Cannon, Danenberg, De Clerck, Farley, Haworth, Johnson, Jones, Kedes, Laird, Laird-Offringa, Lee, Markland, Maxson, Mosteller, Reichardt, Rice, Roy-Burman, Stallcup and Tokes.

Several members of the department are members of the USC/Institute for Genetic Medicine (IGM), including Drs. Frenkel, Hacia, Kasahara, Kedes, Reddy, Reichardt and Sucov.

The Norris Comprehensive Cancer Center maintains a microchemical core facility that includes capabilities for gas phase protein sequencing, amino acid analysis, peptide synthesis, DNA synthesis and sequencing. Other facilities available to support the research of members of the department include bio-reagent and cell culture, genomics, microarray, confocal microscopy, transgenic, flow cytometry and biostatistical core facilities.

The primary offices and laboratories of the department are located on the Health Sciences campus. Faculty of the department maintain offices and research facilities in the Norris Comprehensive Cancer Center, Institute for Genetic Medicine, Cancer Research Laboratory, the Edmondson and Hoffman Medical Research Buildings, School of Pharmacy and Children's Hospital of Los Angeles. Members of the faculty are supported by 35 research fellows and a clerical staff.

Graduate Programs

Admissions

The prerequisite for applicants to the graduate program in biochemistry and molecular biology is a bachelor's degree with an undergraduate major in one of the natural sciences. Undergraduate course work should have included organic chemistry, the physics and mathematics required of a chemistry major and some courses in the biological sciences. A course in general biochemistry is also required, but may be taken during the period of graduate study. Previous course work in physical chemistry is strongly recommended. A minimum GPA of 3.0 in the natural sciences (including mathematics) is normally required.

Applicants must pass satisfactorily the general and advanced (chemistry, biology or molecular biology) portions of the Graduate Record Examinations. In addition, the department requires at least three letters of recommendation from faculty members who can evaluate the applicant's potential for graduate work and independent research.

Applications can be requested from either the department or from the Ph.D. Program in Biomedical and Biological Sciences Web site (www.usc.edu/medicine/pibbs).

Applications should be submitted as early as possible in the academic year preceding the desired date of admission. Although students are normally admitted for the fall semester, exceptions are occasionally granted. In addition to the university application, a supplemental departmental application must be completed and returned with transcripts, GRE scores and letters of recommendation to: Graduate Admissions Committee, Department of Biochemistry and Molecular Biology, 2250 Alcazar Street, CSC/IGM 204, Los Angeles, CA 90089-9075.

Fellowships

Students admitted to the doctoral program in biochemistry are generally awarded departmental fellowships which pay for tuition and provide a stipend.

Master of Science

The Department of Biochemistry and Molecular Biology offers a program for the Master of Science degree. The primary objectives of this program are to provide the necessary theoretical preparation for biochemical careers and to expose students to biochemistry and molecular biology related research activities culminating with the Master of Science degree. Goals of the program are to train students in preparation for (1) further doctoral study, (2) advanced biochemical research positions in industry and academia and (3) teaching positions at the community college level.

In general, admission requirements are the same as for the Doctor of Philosophy degree. The prerequisite for applicants to the graduate program in biochemistry is a bachelor's degree with an undergraduate major in one of the natural sciences. A minimum GPA of 3.0 in the natural sciences (including mathematics) is normally required. Applicants must satisfactorily pass the general and advanced (chemistry, or biology or molecular biology) portions of the Graduate Record Examinations. In addition, the department requires at least three letters of recommendation from faculty members who can evaluate the applicant's potential for graduate work and independent research. Demonstrated proficiency in the English language is required. Special circumstances may provide consideration for conditional admission.

The master's degree in biochemistry and molecular biology requires 34 units of elective graduate study to be determined by the student's Advisory Committee. Fourteen or more course units must be taken in biochemistry and molecular biology; eight units may be pursued outside the department and, upon approval, a maximum of 10 units of directed research in biochemistry will be applied to the degree. Master of Science candidates are required to complete a thesis.

Each student's program will be tailored to suit individual needs and background.

Master of Science, Molecular Epidemiology

A joint program with the Department of Preventive Medicine offers an M.S. degree in Molecular Epidemiology that requires 37 units of graduate study (see page 680 for course requirements). Students must also complete a master's thesis. Students can register for up to 10 units of master's research units. Interested students should contact Anne Vazquez (annvazqu@usc.edu) or the Department of Preventive Medicine.

Doctor of Philosophy

The Department of Biochemistry and Molecular Biology offers graduate degree courses directed toward the Ph.D. degree in this discipline. The objective of this program is to prepare students for careers as independent investigators and instructors in biochemistry, molecular biology and related fields.

The program consists of both course work and research and is intended to provide students with a broad conceptual background as well as focused research training. The flexibility of the program is designed to meet the interests of individual students and to prepare them for specialization in any of the major subdivisions of biochemistry.

Course Requirements A total of 60 units of graduate credit is required for the Ph.D., including course work, research and dissertation units. At least 24 of these units must be from courses numbered 500 or higher; at least 12 of these units must be taken in biochemistry, while the remaining 12 units may be taken in various related disciplines. Students are expected to take the three seminar courses and additional courses may be required by the Graduate Advisory Committee or by the student's guidance committee. Students must complete all courses with a cumulative GPA of not less than 3.0 and must maintain this average in order to remain in the graduate program. Students are expected to spend full time during the academic year and summer on course work or research.

Screening Procedure The department's Graduate Advisory Committee, consisting of four faculty members, assesses the educational objectives and research interests of each student admitted to the graduate program. The committee then recommends a program of graduate courses and research suited to the individual student. The advisory committee evaluates the student's performance throughout the first year and must approve the student's progress prior to his or her selection of a research advisor.

Guidance Committee To assist students in selecting their research advisors, doctoral students rotate through four research laboratories during their first year in the graduate program. By the first summer of graduate study, each student is expected to have selected a research advisor. Shortly afterward the student should form a five-member guidance committee. Members of the committee must include the student's research advisor, at least three faculty members from the Department of Biochemistry and Molecular Biology and at least one member from outside the department.

Qualifying Examination

Students in the Ph.D. program must pass both the written and oral portions of a comprehensive qualifying examination on the major areas of biochemistry. The written portion consists of a comprehensive examination given annually, which must be passed before the oral portion can be taken. The oral portion must be scheduled within three months of the successful completion of the written examination. The proposition will be focused on the student's dissertation research and is intended to test the student's depth and breadth of knowledge in his or her area of research. The student will be asked to prepare a short summary of the dissertation research proposal and submit it within one week of the oral defense. The oral examination consists of a defense of both propositions and can include questions dealing with the written examination and other areas of biochemistry. The oral examination will give applicants the opportunity to unravel complex problems and will also test their overall knowledge of biochemistry and molecular biology.

Recommendations for advancement to candidacy for the Ph.D. degree are made on the basis of the successful completion of these requirements and the student's maintenance of at least a 3.0 GPA. A student who has not been recommended for advancement to candidacy at the end of three years will be terminated unless given permission to terminate graduate work with an M.S. degree.

Dissertation and Oral Defense The student's dissertation committee consists of the research advisor, one other member from the department and one member from outside the department. The dissertation must represent an original contribution to biochemistry and should indicate the ability of the student to undertake independent investigation. The defense of the dissertation includes the presentation of a seminar that is open to the public.

Ph.D. in Molecular Epidemiology

For admission information and degree requirements, see the Department of Preventive Medicine, page 682.

Courses of Instruction

BIOCHEMISTRY (BIOC)

The terms indicated are *expected* but are not *guaranteed*. For the courses offered during any given term, consult the *Schedule of Classes*.

401ab Medical Biochemistry (5, 3) Introduction to biochemistry emphasizing human and medical aspects, including the specific biochemistry of various human organ systems. Discussion groups in fall semester.

501 Recent Advances in Biochemistry (2-4, max 16, Fa) Lectures on areas of intermediary metabolism and the chemistry of natural products. *Prerequisite:* BISC 435, CHEM 430ab.

502 Biochemistry Seminar (1, max 12, FaSp) Formal presentations and discussion by students of material from research literature.

504 Molecular Biology of Cancer (4) (Enroll in INTD 504)

506 Enzyme Kinetics and Mechanisms (2, 2 years, Sp) Theory and application of kinetic methods to the investigation of the mechanism of enzyme action. *Prerequisite:* general biochemistry. (Danenberg, Fife)

510 Introductory Molecular Biology (2, Sp) Principles of molecular biology with applications to the medical sciences. Nucleic acid structure, function, and analysis. *Recommended preparation:* a course in biochemistry.

512 Molecular Basis of Cell Proliferation and Differentiation (2, Sp) An advanced seminar course in molecular cell biology, discussing current literature with significant impact on the understanding of the cell cycle and differentiation of various cell types. *Recommended preparation:* basic cell biology and molecular biology.

531 Cell Biology (4) (Enroll in INTD 531)

536 Biochemistry of Cell-Cell Recognition (2, Irregular) Cell surface-related biochemical events during developmental stages; cell-cell communication through certain receptors; liposomes as models for cellular interactions. *Prerequisite:* one year general biochemistry. (Tokes)

542 Cellular and Molecular Basis of Animal Development (4, Fa) Processes of cell type specification, determination, and morphogenesis in metazoans from vertebrates to insects. Genetic, paragenetic and molecular biological approaches to developmental processes. *Prerequisite:* INTD 571. (Maxson)

543 Human Molecular Genetics (4) Comprehensive course covering basic principles of human genetics, genetic disease, the Human Genome Project, and gene therapy. *Recommended preparation:* undergraduate genetics. (Reichardt)

551 Prokaryotic Molecular Genetics (4, Fa) (Enroll in MICB 551)

555 Biochemical and Molecular Bases of Disease (4) (Enroll in INTD 555)

561 Molecular Genetics (4, Sp) (Enroll in INTD 561)

562 Systems and Integrative Physiology (4) (Enroll in PHBI 562)

571 Biochemistry (4, Fa) (Enroll in INTD 571)

573 Optimal Research Presentations by Ph.D. Students (1, FaSp) Students will attend lectures by peers, write an abstract about their own work, prepare and present their presentation to an audience of faculty and peers. Open to Ph.D. students in Biochemistry and Molecular Biology and Molecular Epidemiology only. Graded CR/NC. *Recommended preparation:* overview of own research.

590 Directed Research (1-10, FaSpSm) Research leading to the master's degree. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

594abz Master's Thesis (2-2-0, FaSpSm) Credit on acceptance of thesis. Graded IP/CR/NC.

599 Special Topics (2-4, max 8)

601 Molecular Biology of Gene Regulation (2, max 8, FaSp) Current techniques and systems in molecular biology from an interdisciplinary perspective: microbiological, biochemical, and pharmaceutical.

602 Current Topics in Human Molecular Genetics (2) Current research in human genetics, including positional cloning of genes, mutational analysis of disease genes, construction and characterization of animal models, and gene therapy. *Prerequisite:* BIOC 551, BIOC 561. (Reichardt, Anderson)

604 Current Topics in Animal Development (2, Sp) (Enroll in CNB 604)

790 Research (1-12, FaSpSm) Research leading to the doctorate. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

794abcdz Doctoral Dissertation (2-2-2-2-0, FaSpSm) Credit on acceptance of dissertation. Graded IP/CR/NC.

Department of Cell and Neurobiology

Bishop Medical Teaching and Research Building 401
 1333 San Pablo Street,
 Los Angeles 90089-9112
 (323) 442-1881
 FAX: (323) 442-3466
 Email: cnb@hsc.usc.edu

Graduate Advisor: Thomas McNeill
 (323) 442-1625

Faculty

Professor and Chair: Cheryl M. Craft

Mary D. Allen Chair in Vision Research:
 Cheryl M. Craft, Doheny Eye Institute

Professors: C.M. Craft; Z.W. Hall; T.H. McNeill* (*Gerontology*); J.E. Schechter*; J. Shih (*Pharmacy*); M. Snow

Associate Professors: G.H. Albrecht*; N.S. Bradley (*Biokinesiology and Physical Therapy*); J. Chen (*Ophthalmology*); J.A. Garner*; W. Gilmore (*Neurology*); R. Gopalakrishna*; J.D. Miller; B.G. Slavin*; H. Sucov* (*Biochemistry*); J.E. Turman (*Biokinesiology and Physical Therapy*); R. I. Wood*; S.Y. Ying

Assistant Professors: R. Bart (*Pediatrics*); P. Elyse Schauwecker; M.A. Selleck; M. Winfield; D.Y. Wu (*Ophthalmology*); N. Yamashita

Assistant Professor of Research: M. Jakowec (*Neurology*)

Emeritus Professors: N. Ahmad; D.A. Berman*; S.P. Bessman (*Pediatrics*); N.C. Jain; L.V. Johnson; R.L. Wood; W.C.T. Yang

Emeritus Associate Professors: B.L. Newman; R.L. Binggeli; C.K. Haun*; W.J. Paule

*Recipient of university-wide or school teaching award.

The Department of Cell and Neurobiology provides interdisciplinary training in molecular, cellular and systems biology. Ongoing programs explore basic mechanisms in molecular and cellular neurobiology, neurogenetics, endocrinology, pharmacology, embryogenesis, skeletal muscle plasticity, cell biology, vertebrate evolution, and nutrition/drug interactions. Disease-oriented research, bridging basic and clinical disciplines, investigates inherited or acquired disorders in vision, liver metabolism and endocrinology. The challenge is to weld interdisciplinary activities into a conduit for transferring basic science discoveries into advances in technology which support clinical innovation.

The Department of Cell and Neurobiology has 36 faculty members, including 19 with primary appointments and six with dual appointments in other departments of the Medical School or a joint appointment with other schools within the university.

The graduate program of the Department of Cell and Neurobiology is dedicated to excellence and state-of-the-art training and education in molecular and cellular aspects of normal function and in acquired or genetic disorders that cause human disease. Highly qualified students are selected for admission each year from a pool of domestic and international applicants. Professional and intellectual development is fostered through a broadly based curriculum from which students can tailor a menu of specialization and by a supportive environment of faculty interactions. Graduate education is designed to prepare the student for a lifetime of learning, exploring the limits of research, teaching and creative activities. Teaching experience and expertise can be developed in several areas including cell biology, histology, gross anatomy, neuroanatomy, embryology, and pharmacology.

Master of Science and Certificate Program in Clinical and Biomedical Investigations

Refer to the Department of Preventive Medicine, page 679, for certificate and degree requirements.

Cell and Neurobiology Graduate Program

The graduate program offered in cell and neurobiology provides a flexible, individualized course of study directed toward developing independent, resourceful scholars. The major thrust of this program is devoted to students training for the Ph.D. degree but study toward the M.S. degree is also possible.

Admissions

The prerequisite for applicants to the graduate program in cell and neurobiology is a bachelor's degree with a science major or equivalent. Applicants should have a superior undergraduate record at an accredited college or university. Additional requirements include three letters of recommendation and satisfactory performance on the general and advanced (biology or chemistry) portions of the Graduate Record Examinations. Students are normally admitted for the academic year beginning in the fall; the application deadline for the following academic year is March 1.

Master of Science

The Master of Science degree is awarded for demonstrated competence in the cell biological sciences, broadly defined. Two options are available: (1) a non-thesis M.S. program based

entirely on course work followed by a comprehensive examination; and (2) a thesis M.S. program that includes fewer courses but requires a written thesis based on original laboratory research. Students take courses both from the Department of Cell and Neurobiology and other departments to obtain a broad appreciation of structure and function. Students must maintain a minimum GPA of 3.0. The Master of Science candidate may engage in teaching if this is beneficial to the individual program.

Students in the non-thesis program must complete a minimum of 34 units of graduate level courses (500 or higher) beyond the baccalaureate degree.

Non-thesis students must take 16 units from the following list of courses: BISC 421, CNB 501ab, CNB 511abL, CNB 512L, CNB 513, CNB 521, CNB 525, CNB 534, INTD 504, INTD 531, INTD 555, INTD 561, INTD 571, NEUR 524, NEUR 525, PHBI 562. All students must pass additional courses totaling 18 units. All course work must be approved by the student's graduate advisor and the chair of the graduate program.

Students in the thesis program must complete a minimum of 38 units of graduate level courses (500 or higher) beyond the baccalaureate degree.

The regulations for thesis students are the same as specified above, except the student is required to take only 12 units from the course list and an additional 16 units from other departmental or non-departmental courses. Students will also take 6 units of CNB 590. The thesis M.S. student is required to take at least 4 units of Master's Thesis (CNB 594). All course work must be approved by the student's graduate advisor and the chair of the graduate program.

Doctor of Philosophy

The Ph.D. student develops background knowledge in cellular, molecular and structural biological sciences. The objective of the Ph.D. program is rigorous, original research experience obtained by design and execution of a dissertation project. Active research areas for which guidance is available include cell and molecular biology, neurobiology of circadian rhythms, visual neuroscience, neuropharmacology, neurodegenerative and neurogenetic diseases, developmental and cellular neuroscience, neuroendocrinology, reproductive endocrinology and evolutionary biology.

Research Tool-Statistics

Each student must demonstrate competence in statistics. The student must demonstrate competence in the theory and use of statistics including at least a knowledge of regression, correlation and analysis of variance. A student who has prior experience in statistics should consult the faculty advisor and petition the Graduate Advisory Committee to waive the research tool requirement. This requirement may be fulfilled by obtaining a grade of B (3.0) or higher in specified courses. This requirement must be fulfilled before the qualifying examination.

Course Requirements

A minimum of 60 units of course credit is required for the Ph.D. Course requirements vary according to the specific needs of the student. Graduate students must take at least 16 units from the following list of courses: BISC 421, CNB 501ab, CNB 511abL, CNB 512L, CNB 521, CNB 525, CNB 534, INTD 504, INTD 531, INTD 555, INTD 561, INTD 571, NEUR 524, NEUR 525, PHBI 562. Ph.D. students must take additional classes or research units totaling 44 units from other departmental or non-departmental courses. All course work must be approved by the student's graduate advisor and the chair of the graduate program.

Prior to the qualifying examination, each student must complete at least three, eight-week periods of introductory research in the laboratories of departmental faculty. The purpose of

the laboratory rotations is to encourage one-on-one interactions between new students and departmental faculty while at the same time providing an introduction to research in a sampling of departmental laboratories.

Course work outside of the departmental offerings is often encouraged and may be required by the student's guidance committee. In most instances, a program will include extradepartmental courses such as physiology, biochemistry and molecular biology. A grade point average of at least 3.0 (A = 4.0) must be maintained in both departmental and overall course work.

Communication Skills Requirement

The department considers teaching experience to be an important part of graduate education. Students in the Ph.D. program are required to serve a teaching practicum during at least one semester of their graduate training.

Screening Procedure

The Graduate Affairs Committee conducts a screening for each student at the end of one full year in the program. The committee reviews thoroughly all facets of the student's performance in the graduate program. The student's progress must be judged satisfactory before a guidance committee can be nominated.

Guidance Committee

Students are expected to select a general area of research interest and a dissertation advisor as soon as possible but no later than 18 months

after entering the graduate program in this department. The dissertation advisor and the Graduate Affairs Committee consult with the student to select a guidance committee. After the student has successfully completed the first-year screening, the guidance committee's nomination is forwarded to the Graduate School.

Qualifying Examination

Before the end of their fifth semester of graduate standing, students in the Ph.D. program must pass both the written and oral portions of a qualifying examination. The examination is intended to reveal the student's insight and understanding of general concepts and the ability to design and defend a dissertation research project. The examination is designed and administered by the student's guidance committee.

Dissertation and Oral Defense

After the student has passed the qualifying examination, a dissertation committee (commonly comprising the former guidance committee) is appointed to advise the student regarding the research project and to supervise writing of the dissertation. The dissertation must be an original contribution giving evidence of the student's ability to perform independent and innovative research. The final oral defense shall be open to the public and the dissertation advisor will entertain questions from the dissertation committee and assembled audience.

Courses of Instruction

The terms indicated are *expected* but are not *guaranteed*. For the courses offered during any given term, consult the *Schedule of Classes*.

CELL AND NEUROBIOLOGY (CNB)

462 Physiology for the Health Professions (4, Sp) (Enroll in PHBI 462)

501ab Gross Human Anatomy (3-4, FaSp)

A complete dissection of the adult human body. Supplementary lectures and demonstrations. Emphasis on correlating development, structure and function. *Prerequisite:* departmental approval.

511abL Microscopic Anatomy (3-3, FaSp)

Lectures and laboratory in microscopic anatomy emphasizing embryonic origin of the basic body plan, cells, tissues, and organs; ultrastructural and functional correlations. *Prerequisite:* departmental approval.

512L Pharmacology I (5, Fa) Actions, chemical properties, bodily distribution, and toxicology of drugs. Laboratory. (Duplicates credit in former PHNU 510L.) *Prerequisite:* departmental approval.

513 Pharmacology II (3, Sp) Continuation of 512L. (Duplicates credit in former PHNU 511.) *Prerequisite:* CNB 512L.

521 Neuroanatomy (3, Sp) Structure and function of the human nervous system with emphasis on central conduction pathways, especially those of clinical significance. *Prerequisite:* departmental approval.

525 Neural Development (3, Fa) Cellular, molecular, and physiological features of development and plasticity in the nervous system. Lecture and student presentations and discussion of classic and current research literature. *Prerequisite:* BISC 524. *Recommended preparation:* Background in neurosciences.

530 Anatomy for the Artist (1-2, Irregular)

This course includes lectures and demonstrations of human anatomy specifically for the artist, and art instruction on drawing the human figure. Requires departmental approval.

531 Cell Biology (4, Fa) (Enroll in INTD 531)

534 Molecular Aspects of Neuropharmacology (2, FaSp) Current advances in selected areas of molecular neuropharmacology, e.g., mechanisms by which drugs affect neurotransmitter systems, neural plasticity, treatment of neurological and psychiatric diseases. *Prerequisite:* departmental approval.

550 Cell and Neurobiology Seminar (1, max 6, FaSp) Reports and discussion on recent advances in anatomy. Graded CR/NC. (Duplicates credit in former ANCB 550.)

551ab Approaches to Teaching and Research in Cell and Neurobiology (1-1, 2 years, Fa)

Sequence of seminars devised to supplement graduate training in literature analysis, oral communication, research techniques and philosophy of teaching. (Duplicates credit in former ANCB 551.) *Prerequisite:* departmental approval.

561 Molecular Genetics (4, Sp) (Enroll in INTD 561)**562 Systems and Integrative Physiology (4)** (Enroll in PHBI 562)**571 Biochemistry (4, Fa)** (Enroll in INTD 571)**590 Directed Research (1-12, FaSpSm)**

Research leading to the master's degree. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

594 Master's Thesis (2-2-0, FaSpSm) Credit on acceptance of thesis. Graded IP/CR/NC.**598 Introductory Laboratory Rotations (1-3, FaSp)**

Introductory laboratory rotations wherein students are directed in individualized research, reading and discussion to provide perspective and supplemental background in areas of faculty research interests.

599 Special Topics (2-4, max 8, FaSp) Special topics provides background for instruction and research in the Department of Cell and Neurobiology through lectures, discussions, assigned readings, and student presentations. (Duplicates credit in former ANCB 599 and PHNU 599.)

600 Literature Tutorial (1, max 3, FaSp)

Individualized readings and discussions culminating in a literature-review paper; to promote the acquisition of critical thinking skills in the evaluation of scientific problems. *Prerequisite:* departmental approval; *recommended preparation:* background in biological sciences.

601L Advanced Regional Dissections (2, FaSp)

Advanced dissection of various anatomical regions of the adult human body. Lab, 8-12 hours a week. *Prerequisite:* CNB 501ab.

603 Current Topics in Vision Research (2, Sp)

Basic science (e.g., anatomy, cell biology, electrophysiology) and clinical aspects of the eye: cornea, lens, retina, and optic nerve. USC faculty and authorities from other institutions will lecture. *Prerequisite:* departmental approval.

604 Current Topics in Animal Development (2, 2 years, Sp)

Current research in selected aspects of mammalian and nonmammalian developmental biology, including the molecular genetics and molecular biology of organogenesis, morphogenesis, lineage specification, and differentiation. *Prerequisite:* INTD 561 and CNB 542 or departmental approval.

631 Morphogenesis and Regeneration (2, 2 years, Sp)

Analysis of developing and regenerating systems: historical and recent interpretations of morphogenetic movements, tissue interactions, fields, gradients, differentiation, and determination. *Prerequisite:* departmental approval.

641 Brain-Endocrine Interactions in Reproduction (2, 2 years, Fa)

Past and current experimental approaches to morphology and endocrinology at hypothalamic, pituitary, and gonadal levels in both males and females. *Prerequisite:* CNB 511abL or a general endocrinology course or departmental approval.

790 Research (1-12, FaSpSm) Research leading to the doctorate. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

794abcdz Doctoral Dissertation (2-2-2-2-0, FaSpSm) Credit on acceptance of dissertation. Graded IP/CR/NC.

PHARMACOLOGY AND NUTRITION (PHNU)

573 Advanced Nutrition: Proteins, Carbohydrates and Lipids (3) An in-depth discussion of the energy-providing macronutrients (plus dietary fiber) covering their metabolism, functions, interrelationships and roles in health and disease.

Department of Family Medicine

Primary Care Physician Assistant Program
1000 South Fremont Avenue
Unit 7

Building A6, Room 6429
Alhambra, CA 91803
(626) 457-4240
FAX: (626) 457-4245
www.usc.edu/medicine/pa

Program Director: Theresa A. Woehrl, M.D.

Medical Director: Ignacio DeArtola, M.D.

Faculty

Ricardo Hahn, M.D. *Chair and Professor*

Assistant Professors of Clinical Family Medicine:

M. Blesofsky; R. Byous; I. DeArtola; J. Forman; L. Landry-Taylor; J. Mabee

Instructor of Clinical Family Medicine: M. Lucio

Clinical Instructors in Family Medicine:

R. Bradley; L. Kirakosian; J. Tramel

The faculty listed are core faculty with the Primary Care Physician Assistant Program.

The Primary Care Physician Assistant Program prepares students to practice medicine under the supervision of a physician. Students earn a Master of Physician Assistant Practice (MPAP) upon completion of the program.

Based in the Department of Family Medicine, classroom instruction is provided by physician assistant program faculty and faculty from other departments within the Keck School of Medicine, the USC School of Pharmacy, divisions within the Health Sciences campus, as well as clinicians from the surrounding communities. Emphasis is placed on primary care. Clinical training occurs at dozens of clinical sites throughout the greater Los Angeles region, including Los Angeles County+USC Medical Center,

Arrowhead Regional Medical Center (San Bernardino County Medical Center), Ventura County Medical Center, and a range of private offices and managed care settings, community based clinics, VA facilities and specialty settings. Opportunities to train in selected off-site settings serving Native American populations in the Southwest are available to some students.

Students complete clerkships in emergency medicine and urgent care, family medicine, internal medicine/geriatrics, women's health, orthopaedics/occupational medicine, pediatrics and general surgery. Throughout these clerkships emphasis is placed on obtaining necessary clinical skills as well as learning to provide primary care services as part of a health care team. The physician assistant program is committed to recruiting disadvantaged applicants and to preparing graduates to practice in medically underserved areas.

The USC Primary Care Physician Assistant Program is accredited by the Accreditation Review Committee on Education for the Physician Assistant which is sponsored by seven medical national associations including the American Medical Association. The program is approved by the Physician Assistant Committee of the Medical Board of California. Graduates must pass a National Certifying Examination to qualify for licensure in California.

Master of Physician Assistant Practice

Admission Requirements and Procedures

Application to the Physician Assistant Program requires completion of a bachelor's degree (in any discipline) from an accredited four-year institution and completion of academic prerequisite requirements.

Admission to the program is for the fall semester only. Admission is granted by the physician assistant faculty after careful review of all applications. Selections are made on the basis of a formal interview (for competitive applicants) and consideration of a variety of factors which include: academic record, type and amount of clinical experience, multicultural sensitivity, community service experience and personal and professional experience.

Applicants are required to submit a main application through the Centralized Application Service for Physician Assistants as well as a USC Supplemental Application by December 1 of each year. Further details regarding admission procedures are provided in the program information packet.

Transfer Students

Transfer students from other U.S. accredited physician assistant programs or medical schools as well as from foreign medical schools are required to complete the full Master of Physician Assistant Practice curriculum in residence at USC. No waivers or substitutions are permitted.

Preparation in Education Program

The Preparation in Education Program (PEP) is designed to enhance the mission of the USC Physician Assistant Program by strengthening the application of students who are from educationally or economically disadvantaged backgrounds. For further information, contact the PEP coordinator at (626) 457-4247 or (626) 457-4272 (FAX).

Registration

Students receive information regarding registration procedures during an orientation program held the week before classes begin.

Advisement

A monthly information session is available for prospective students who would like to receive more information in preparation for the program. Students who are interested in applying to the program are encouraged to visit the PA Program Web site at www.usc.edu/medicinelpa or call the PA Admission Office at (626) 457-4247.

Degree Prerequisites

A bachelor's degree from an accredited institution and completion of all prerequisite course work are required for admission to the Physician Assistant Program.

Science Prerequisites

Six semester units or nine quarter units each: general biology with lab; general chemistry with lab.

Three semester units or four quarter units of each of the following: human anatomy with lab; physiology with lab; microbiology with lab; intermediate algebra; and elementary statistics.

Students are expected to have a strong competency in medical terminology.

Non-Science Prerequisites

Six semester units or eight quarter units each: English composition (6) or English composition (3) and critical thinking (3) or logic (3); social sciences (e.g., psychology, sociology, anthropology); humanities (e.g., art, music, philosophy, religion).

Three semester units or four quarter units each: general psychology (does not count toward six semester or eight quarter units of social sciences listed above); foreign language (Spanish is strongly recommended).

Students who intend to apply to the Physician Assistant Program should contact the admission office for evaluation of previous baccalaureate and/or post-baccalaureate course work.

Standardized Tests

The GRE (Aptitude) or the MCAT are required.

Clinical Experience Prerequisite

A minimum of 1,000 hours of "hands-on" patient care experience is required. Successful applicants often have worked as one of the following: emergency medical technician, licensed vocational nurse, medical technologist, military medical corpsman, paramedic, psychiatric technician, radiologic technician, respiratory therapist, registered nurse or medical assistant. Other health care experience is equally acceptable as long as the experience is "hands-on" in nature.

Community Service Prerequisite

Community service activities/projects are required of all applicants. Service which benefits medically underserved or disadvantaged groups is highly desirable.

Curriculum Requirements

The completion of a three-year professional curriculum is required to earn the Master of Physician Assistant Practice degree. Students do not have choices of courses to take nor are they permitted to drop any course or courses during the semester. Progress is permitted only when the prior semester is completed in full. Students should view the curriculum outlined here as advisory only and subject to modification.

Degree Requirements

All students in the Master of Physician Assistant Practice degree program must meet course and grade point average requirements. All course requirements must be completed with a grade of "B" or better. The degree will not be conferred until the student has successfully completed all degree requirements. Students are subject to the degree requirements in the catalogue current for the semester of their admission into the program.

Upper Division Requirements

Physician assistant students are enrolled in a standard curriculum during their three years in the program. The following courses must be successfully completed in order to earn the Master of Physician Assistant Practice. Only physician assistant students may enroll in these courses. Departmental clearance is required to enroll.

YEAR I, FALL SEMESTER		UNITS
PCPA 503	Behavioral Sciences I	4
PCPA 523	Clinical Skills I	4
PCPA 530	Basic Medical Sciences	6
PCPA 543	Topics in Medicine I	4
		18

YEAR I, SPRING SEMESTER		UNITS
PCPA 506	Behavioral Sciences II	4
PCPA 526	Clinical Skills II	6
PCPA 546	Topics in Medicine II	6
		16

YEAR II, FALL SEMESTER		UNITS
PCPA 509	Behavioral Sciences III	4
PCPA 529	Clinical Skills III	6
PCPA 549	Topics in Medicine III	6
		16

YEAR II, SPRING SEMESTER			YEAR II, SUMMER SESSION			YEAR III, SPRING SEMESTER		
		UNITS			UNITS			UNITS
PCPA 561	Clinical Assignment I	3.5	PCPA 564b	Clinical Assignment IV	0	PCPA 532	Clinical Skills IV	3
PCPA 562	Clinical Assignment II	3.5	PCPA 565b	Clinical Assignment V	0	PCPA 583	Advanced Topics in PA Studies: Education	4
PCPA 564a	Clinical Assignment IV	3.5				PCPA 586	Advanced Topics in PA Studies: Research	4
PCPA 565a	Clinical Assignment V	3.5				PCPA 589	Advanced Topics in PA Studies: Medical Care Organization	4
		14						15

Requests for further information may be addressed to: USC Physician Assistant Program, Keck School of Medicine, University of Southern California, 1000 South Fremont Avenue, Unit 7, Building A6, Room 6429, Alhambra, CA 91803.

Courses of Instruction

PRIMARY CARE PHYSICIAN ASSISTANT (PCPA)

The terms indicated are *expected* but are not *guaranteed*. For the courses offered during any given term, consult the *Schedule of Classes*.

503 Behavioral Sciences I (4) First of three-semester sequence in current topics in behavioral medicine, psychological and cultural factors in health and illness, interpersonal and sociological aspects of patient care, and competencies for PA practice. Open to physician assistant practice majors only.

506 Behavioral Sciences II (4) Second of three-semester sequence in current topics in behavioral medicine, psychological and cultural factors in health and illness, interpersonal and sociological aspects of patient care, and competencies for PA practice. Open to physician assistant practice majors only. *Prerequisite:* PCPA 503.

509 Behavioral Sciences III (4) Last of three-semester sequence in current topics in behavioral medicine, psychological and cultural factors in health and illness, interpersonal and sociological aspects of patient care, and competencies for PA practice. Open to physician assistant practice majors only. *Prerequisite:* PCPA 506.

523 Clinical Skills I (4) Laboratory experiences with basic clinical skills essential to medical practice. First of four courses. Open to physician assistant practice majors only.

526 Clinical Skills II (6) Laboratory experiences with basic clinical skills essential to medical practice. Second of four courses. Open to physician assistant practice majors only. *Prerequisite:* PCPA 523.

529 Clinical Skills III (6) Laboratory experiences with basic clinical skills essential to medical practice. Third of four courses. Open to physician assistant practice majors only. *Prerequisite:* PCPA 526.

530 Basic Medical Sciences (6, Fa) A one-semester overview of clinical anatomy, physiology, pathophysiology, and pathology essential to understanding disease mechanisms commonly encountered in primary care and specialty practices of medicine. Open to physician assistant practice majors only.

532 Clinical Skills IV (3, SpSm) Laboratory experiences with basic clinical skills essential to medical practice. Last of four courses. Open to physician assistant practice majors only. *Prerequisite:* PCPA 529.

543 Topics in Medicine I (4) Basic instruction in normal/abnormal states of organ systems in the study of human disease. The first of three courses that includes instruction in pathophysiology, pharmacology, diagnostic studies, and medicine. Open to physician assistant practice majors only.

546 Topics in Medicine II (6) Basic instruction in normal/abnormal states of organ systems in the study of human disease. The second of three courses that includes instruction in pathophysiology, pharmacology, diagnostic studies, and medicine. Open to physician assistant practice majors only. *Prerequisite:* PCPA 543.

549 Topics in Medicine III (6) Basic instruction in normal/abnormal states of organ systems in the study of human disease. The third of three courses that includes instruction in pathophysiology, pharmacology, diagnostic studies, and medicine. Open to physician assistant practice majors only. *Prerequisite:* PCPA 546.

561 Clinical Assignment I (3.5, FaSpSm) One discrete consecutive five-day-a-week intensive field placement under a program-approved supervising preceptor in a program-approved clinical setting. Requires departmental approval. Graded CR/NC.

562 Clinical Assignment II (3.5, FaSpSm) One discrete consecutive five-day-a-week intensive field placement under a program-approved supervising preceptor in a program-approved clinical setting. Requires departmental approval. Graded CR/NC.

563 Clinical Assignment III (3.5, FaSpSm) One discrete consecutive five-day-a-week intensive field placement under a program-approved supervising preceptor in a program-approved clinical setting. Requires departmental approval. Graded CR/NC.

564ab Clinical Assignment IV (a: 3.5; b: 0, FaSpSm) One discrete consecutive five-day-a-week intensive field placement under a program-approved supervising preceptor in a program-approved clinical setting. Requires departmental approval. Graded CR/NC.

565ab Clinical Assignment V (a: 3.5; b: 0, FaSpSm) One discrete consecutive five-day-a-week intensive field placement under a program-approved supervising preceptor in a program-approved clinical setting. Requires departmental approval. Graded CR/NC.

566 Clinical Assignment VI (3.5, FaSpSm) One discrete consecutive five-day-a-week intensive field placement under a program-approved supervising preceptor in a program-approved clinical setting. Requires departmental approval. Graded CR/NC.

567 Clinical Assignment VII (3.5, FaSpSm) One discrete consecutive five-day-a-week intensive field placement under a program-approved supervising preceptor in a program-approved clinical setting. Requires departmental approval. Graded CR/NC.

568 Clinical Assignment VIII (3.5, FaSpSm) One discrete consecutive five-day-a-week intensive field placement under a program-approved supervising preceptor in a program-approved clinical setting. Requires departmental approval. Graded CR/NC.

583 Advanced Topics in PA Studies: Education (4) Seminar format: students explore educational theories and methods used by PAs in a variety of settings, including clinical practice, classroom and community. Open to physician assistant practice majors only. Requires departmental approval.

586 Advanced Topics in PA Studies: Research (4) Seminar format: students receive an integrated experience in research methods including methodology, data collection, analysis and evaluation. Open to physician assistant practice majors only. Requires departmental approval.

589 Advanced Topics in PA Studies: Medical Care Organization (4) Seminar format: students will explore current topics in medical care organization and physician assistant practice including administration, financing, changing organizational settings, and workforce issues. Open to physician assistant practice majors only. Requires departmental approval.

Department of Molecular Microbiology and Immunology

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(Neurology)

Faculty
Gunther Dennert, *Interim Chair and Professor*

Berle and Lucy Adams Chair in Cancer Research:
Jeffrey Weber

Richard Angus Grant, Sr., Chair in Neurology:
Leslie P. Weiner

Distinguished Professor: M. M.C. Lai
(Neurology)

Professors: G. Dennert; D. A. Horwitz
(Medicine); C.O. Jacob (Medicine); D.B. Kohn
(Pediatrics); M. Lieber (Pathology, Biochemistry
and Molecular Biology); M. McMillan
(Neurology); J.-H. Ou; P. K. Pattengale
(Pathology); S. A. Stohlman (Neurology);
K. Weinberg (Pediatrics); Leslie P. Weiner
(Neurology)

Associate Professors: E. Bogenmann (Pediatrics);
G. Coetzee (Urology); L. Comai; R. Duncan
(Pharmacy); H. K.W. Fong (Ophthalmology);
Y.K.T. Fung (Pediatrics); C. Hill (Radiation
Oncology); A. Jong (Pediatrics); J. R. Landolph
(Pathology, Toxicology); G. Matioli; A. Schönthal;
S. Walker (Pediatrics); J. Weber (Medicine)

Assistant Professor: E. Zandi

Professor of Research: M.D. Trousdale
(Ophthalmology)

Associate Professor of Research: G.M. Shackelford
(Pediatrics)

Emeritus Professors: F. Aladjem; I. Gordon;
M. Lieb; R. Parkman (Pediatrics)

The Department of Molecular Microbiology and Immunology is located on the Health Sciences campus in the Elaine Stevely Hoffman Medical Research Center, McKibben Hall, and the Norris Cancer Hospital and Research Institute. Faculty guidance and specialized facilities are available for advanced research in animal virology, eucaryotic cell biology and cellular differentiation, molecular and cellular immunology, microbial and molecular genetics, control of gene expression, control of protein synthesis, and chemical and viral carcinogenesis.

Graduate Programs

Admissions

An applicant to the graduate programs in molecular microbiology and immunology must have a bachelor's degree from an accredited college or university with a major in science — usually biology, chemistry or physics. The applicant must have demonstrated strength in science or mathematics. Undergraduate course work should have included at least one year of biology, chemistry through organic chemistry, mathematics through calculus, physics and physical chemistry. Deficiencies may be made up early in the predoctoral program.

The department encourages applicants to contact its office prior to making formal application. Each applicant must pass satisfactorily the general and advanced (biochemistry, cell and molecular biology or biology, chemistry or physics) portions of the Graduate Record Examinations, and must also arrange for three letters of recommendation to be written. In addition, the applicant must provide a one-page statement of career objectives, including the general area of research interest. This statement is intended to facilitate selection of those students who will most benefit from the department's graduate program. A personal interview is strongly recommended but not required.

Applicants who have attended graduate school at another university may be admitted to advanced standing upon recommendation of the department.

Training Grants and Fellowships

Incoming domestic students are supported by a departmental training grant or by a research grant to a specific faculty mentor during their first year; subsequently, students are supported by research grants awarded to individual faculty members. Foreign students are supported by research assistantships.

Master of Science

The primary objectives of this program are to provide the necessary theoretical preparation for microbiological and immunological careers and to expose students to microbiological and immunological research activities culminating with the master of science degree. Goals of the program are to train students in preparation for (1) microbiological and immunological positions in industry and

academia, (2) teaching positions at the community college level and (3) further doctoral study.

Admission requirements are the same as for the doctor of philosophy degree. The prerequisite for applicants to the graduate program in molecular microbiology and immunology is a bachelor's degree with an undergraduate major in one of the natural sciences. A minimum GPA of 3.0 in the natural sciences (including mathematics) is normally required. Applicants must satisfactorily pass the general and advanced (biology, chemistry or molecular biology) portions of the Graduate Record Examinations. In addition, the department requires at least three letters of recommendation from faculty members who can evaluate the applicant's potential for graduate work and independent research. Demonstrated proficiency in the English language is required. Special circumstances may provide consideration for conditional admission. Students admitted for studies leading to the Ph.D. may request a change in degree objective to the M.S. with the permission of the faculty.

Course Requirements

A total of 34 units is required. Students may pursue a thesis option which requires completion of MICB 594abz (2-2-0) plus 30 units of approved course work, no more than 8 of which can be MICB 590 Directed Research. Students pursuing a non-thesis option must complete 34 units of approved course work. Students must choose one of these options by the end of the first year of study.

Fourteen or more course units must be taken in the Department of Molecular Microbiology and Immunology; 8 units may be pursued outside the department and, upon approval, a maximum of 8 units of directed research in molecular microbiology and immunology may be applied to the degree. No more than 4 units of course work taken outside of USC can be applied toward the M.S. degree requirements. Students considering such an action should submit a petition to the department and document a rigorous academic standard for the course (reading materials, tests and other performance criteria, lecture content, etc.). The graduate advisory committee will review the petition and inform the student of its decision.

Doctor of Philosophy

The Department of Molecular Microbiology and Immunology offers a Ph.D. degree program geared toward training students for future independent research careers in an academic or industrial setting. The program introduces students to research early in their first year through rotations in laboratories. Subsequent required course work in basic

and advanced topics and an intensive research experience are designed to foster independent and critical thinking.

Students normally select a faculty research advisor for their dissertation by the end of their first year.

Course Requirements A minimum of 60 units of graduate study is required for the Ph.D. degree; at least 30 of these must be taken at USC. Because the background of applicants varies widely, the department's Graduate Committee consults with each student to design an individualized schedule of prescribed courses. In the course of their program, all students are expected to become familiar with the principles of microbiology and general biochemistry and to study advanced biochemistry, microbial physiology and genetics, immunology, virology, molecular biology, and chemical and viral oncology.

Screening Procedure Before completing more than six courses (24 units) in regular graduate status, each student is required to pass a written screening examination administered at the end of the first year of graduate study. This examination consists of questions submitted by all faculty and is intended to expose any areas of weakness in the student's abilities. After passing the screening examination, the student is expected to select an area of research and obtain the consent of a member of the department to serve as research advisor.

Guidance Committee The department's Graduate Committee serves as the advisory committee for all first- and second-year graduate students. To replace the Graduate Committee, a five-member guidance committee is appointed for each student after the departmental screening examination is passed. The guidance committee is responsible for counseling the student, preparing the student for the qualifying examination, administering the examination, and recommending advancement of the student to candidacy for the Ph.D. degree. The student may recommend a chair for this committee, who must be a departmental faculty member but not the student's Ph.D. advisor. Appointment of the chair is subject to approval of the student's research advisor, the department chair and the Graduate Advisory Committee. Other committee members must include three faculty from within the department and one faculty member from another Ph.D. granting department. Members of the committee must be approved by the department chair and the full training committee faculty and are officially appointed by the dean of graduate studies.

Qualifying Examination Students in the Ph.D. program must pass both the written and oral portions of the qualifying examination administered by their guidance committee during the second year of graduate study. The examination consists of a research proposition which must be presented in written form and defended orally. The written proposition is an independent research proposal, outside of the student's immediate area of thesis research and supported by documentary references. The Graduate Advisory Committee and the guidance committee will instruct the student in how to prepare the proposition in appropriate subdisciplines of microbiology. The final draft of the written proposition must be submitted to the department faculty at least two weeks in advance of the oral examination.

The oral examination is open, and all members of the department faculty may participate in questioning the student. The examination will include exploration of the student's written proposition but need not be restricted to it; faculty may also question the student on relevant areas of science covered in course work or in current scientific literature. All portions of the oral examination must be completed at the same time.

Final evaluation of the examination is by vote of the guidance committee alone. If there is more than one dissenting vote from the guidance committee, the student is judged to have failed the examination. At the discretion of the committee, the student may be allowed to repeat the examination once within a period of one year from the date of the original examination but not before six months.

Annual Research Appraisal (ARA) Beginning in the second year, each graduate student presents a progress report to his or her research committee. For students not yet appointed to candidacy, their major advisor, one faculty member from within the department and one faculty member from outside the department comprise the committee. Students appointed to candidacy meet with their dissertation committee. Prior to the meeting, the student prepares a short written document describing significant experiments, problems and projected studies. This document is distributed to committee members and is included in the student's file. The ARA meeting is intended to be a working session between the student and his or her committee; experimental results and problems are discussed within this context. In addition the student presents a research plan for the next year of work.

A satisfactory ARA is required of every student for each year in residence.

A final ARA is required before the student is permitted to write the dissertation. The student collects and organizes all experimental data to be written into the dissertation as the final ARA document. This will be considered a preliminary draft of the dissertation. At the conclusion of the final ARA meeting, the dissertation committee will either recommend further experiments or approve the document and give permission for writing the dissertation.

Advancement to Candidacy When the student has successfully passed the qualifying examination, the guidance committee recommends the student's advancement to candidacy for the Ph.D. degree. Admission is by action of the dean of graduate studies. At this time the guidance committee also approves the student's dissertation topic.

Dissertation Committee After advancement to candidacy and approval of the dissertation topic, and with the unanimous recommendation of the committee to the dean of graduate studies, the guidance committee may be

reduced to a three-member dissertation committee. Members of the dissertation committee should include the student's research advisor as chair, another faculty member from the department and one faculty member from outside the department; additional members may be appointed. This committee is responsible for counseling the student during preparation of the dissertation, and conducting the final oral examination during the dissertation defense.

Dissertation and Oral Defense The student's research is reported in a dissertation written under the guidance of the research advisor. The dissertation must demonstrate the student's capacity for independent research, scholarly achievement and technical mastery of a special field. When the final draft of the dissertation is ready, the student will take the final oral examination, which is open to the university community. This examination is a defense of the major research conclusions of the dissertation.

All doctoral candidates must be registered in 794 Doctoral Dissertation each semester (excluding summer sessions) from the time of their advancement to candidacy until their dissertation is approved for final typing. Under exceptional circumstances students may be excused from registration for a semester by petitioning the Graduate School for a leave of absence. The granting of a leave does not alter the student's responsibility to meet the time schedule for completion of all degree requirements.

Time Requirements It is the policy of the department to encourage the student to complete the degree program for the Ph.D. as rapidly as possible. Ph.D. degrees are currently taking an average of four-and-a-half to five years. The university requires that the student complete the degree within six or eight years of the date on which USC graduate work commenced, depending upon whether the student was admitted with a prior applicable master's degree. Extensions may be granted for compelling reasons, but in no case may the time be extended for more than two years.

Courses of Instruction

MOLECULAR MICROBIOLOGY AND IMMUNOLOGY (MICB)

The terms indicated are *expected* but are not *guaranteed*. For the courses offered during any given term, consult the *Schedule of Classes*.

462 Physiology for the Health Professions (4, Sp) (Enroll in PHBI 462)

500L Introductory Medical Microbiology (4, Irregular) A survey of microorganisms which cause human infectious diseases including mechanisms of pathogenesis, principles of antibiotic usage, pertinent microbial genetics; lectures, laboratories and demonstrations. *Prerequisite:* one year general biology, one semester biochemistry.

501 Introduction to Immunology (1, Irregular) Basic introduction into molecular, cellular, and clinical immunology for second year medical students and graduate students in Microbiology. (Duplicates credit in BISC 450L.)

502 Molecular and Cellular Immunology (2, max 8, Irregular) Specific topics to be scheduled on a yearly and rotating basis. *Prerequisite:* MICB 501.

503 Current Topics in Immunology (1, max 8, FaSp) Discussion forum on the diverse areas of research which constitute modern immunology. *Prerequisite:* MICB 501.

531 Cell Biology (4) (Enroll in INTD 531)

541 Immunochemistry (2, max 6, Irregular) Chemistry of antigens and antibodies; antigen-antibody reaction; biological consequences of antigen and antibody reactions.

542 Animal Virology (2, max 6, Irregular) Virus structure and chemistry; virus-cell interactions; aspects of virus genetics; molecular biology; pathogenesis, immunology, and evolution of viral infections.

549 Student Seminar Series (1, max 8, FaSp) Microbiology students will present research seminars describing their thesis progress.

550 Microbial Pathogenesis (2, Irregular) Critical discussion of recent developments in pathogenesis of select microbial, viral and parasitic agents with particular emphasis on molecular factors and their synergistic (antagonistic) actions.

551 Prokaryotic Molecular Genetics (4, Fa) Macromolecular processes and their regulation in prokaryotes; DNA replication, transcription, and post-transcriptional events in general and as related to operons, phage biology, and eucaryotic organelles.

560 Recent Advances in Microbiology (1, max 6, Irregular) Intensive examination of selected topics in microbiology. Student presentations and critiques. Required for all graduate students.

561 Molecular Genetics (4, Sp) (Enroll in INTD 561)

562 Systems and Integrative Physiology (4) (Enroll in PHBI 562)

570 Microbiology Research Seminar (1, max 10, FaSpSm) Critical discussion of current research topics. Students present published and unpublished research results for discussion and critique. *Prerequisite:* current enrollment in Microbiology Ph.D. program.

571 Biochemistry (4, Fa) (Enroll in INTD 571)

590 Directed Research (1-12, FaSpSm)

Research leading to the master's degree. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

594abz Master's Thesis (2-2-0, FaSpSm)

Credit on acceptance of thesis. Graded IP/CR/NC.

601 Molecular Biology of Gene Regulation (2, max 8, FaSp) (Enroll in BIOC 601)**790 Research (1-12, FaSpSm)**

Research leading to the doctorate. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

794abcdz Doctoral Dissertation (2-2-2-0, FaSpSm) Credit on acceptance of dissertation. Graded IP/CR/NC.

Department of Pathology

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Faculty

Clive R. Taylor, *Professor and Chair*

Harold E. Lee Chair in Cancer Research:
Michael F. Press

Kenneth T. Norris, Jr. Chair in Medicine: Edward D. Crandall

Rita and Edward Polusky Chair in Basic Cancer Research: Michael Lieber

Gavin S. Herbert Professorship in Vision Research: David R. Hinton

Professors: V. Askanas (*Neurology*); S.B. Chandor; P.T. Chandrasoma*; C.-M. Chuong; R.J. Cote (*Urology*); E. Crandall (*Medicine*); L. Dubeau; W.K. Engel (*Neurology*); A.L. Epstein; P.S. Gill (*Medicine*); F.H. Gilles (*Neurological Surgery, Neurology*); E.D. Gomperts (*Pediatrics*); S. Govindarajan; D. Hinton (*Neurological Surgery, Ophthalmology*); F.M. Hofman (*Ophthalmology, Neurological Surgery*); R.W. Jelliffe (*Medicine*); M.N. Koss; M.R. Lieber (*Biochemistry and Molecular Biology, Molecular Microbiology and Immunology*); T.M. Mack (*Preventive Medicine*); C.A. Miller (*Neurology*); B.N. Nathwani; P.K. Pattengale (*Molecular Microbiology and Immunology*); M.F. Press; F.P. Quismorio, Jr. (*Medicine*); N.A. Rao (*Ophthalmology*); S. Rasheed; C. Patrick Reynolds (*Pediatrics*); P. Roy-Burman (*Biochemistry and Molecular Biology*)*; A. Sevanian (*Molecular Pharmacology and Toxicology*); R.P. Sherwin; D.K. Shibata; I. Shulman; M.R. Stallcup (*Biochemistry and Molecular Biology*); T.J. Triche (*Pediatrics*); H. Tsukamoto

Associate Professors: T.D. Coates (*Pediatrics*); B.H. Gross (*Psychiatry and Behavioral Sciences, Medicine*); J.P. Handlers (*Dentistry*); T.A. Khwaja; A. Kovacs (*Pediatrics*); B.W. Kovacs (*Obstetrics and Gynecology*); J.R. Landolph (*Molecular Microbiology and Immunology, Molecular Pharmacology and Toxicology*); H. Liebman (*Medicine*); S.E. Martin; P.R. Meyer; S.B. Turkel (*Psychiatry and Behavioral Sciences, Pediatrics*)

Assistant Professors: T.C. Chen (*Neurological Surgery*); M. Russell (*Emergency Medicine*)

Adjunct Professor: W.M. Blackmore (*Physiology and Biophysics*)

Clinical Professors: A.M. Abrams (*Dentistry*); M.D. Appleman; K.D. Bauer; C.A. Bell; J.N. Carberry; J. De La Torre-Bueno; K.A. Frankel; S.B. Gilbert; B. Gottlieb (*Medicine*); D.N. Halikis; D.S. Harrington; D.V. Hoang; R.E. Horowitz; D. Kon; O.T. Kuzma (*Medicine*); C.E. Marshall; D.H. Mills; J.M. Mirra; D.L. Moyer; W.N. Parnassus; C. Rogers; A.A. Roscher; L. Sathyavagiswaran (*Medicine*); K. Sheibani; R. Siegler; M. Sommer; S.V. Sostrin; P. Thornton

Clinical Associate Professors: M.I. Abbott; J.S. Allan; H.M. Bauer; S.W. Binder; W.F. Burgos; M. H. Cheng; M.M. Cosgrove; J.T. Gmelich; C.I. Goldsmith; C.J. Hanna; R.M. Hathout; A.M. Hernandez; P.C. Hsieh; L.G. McCarthy; J.M. McDonnell; O.S. Miller; H. Muensch; C.C. Osborn; H.Y. Pak; G.C. Ponto; R.M. Protzel; J.K. Ribe; M.E. Rose; K. Saeger; S.F. Selser; R.M. Silton; C.P. Treling; T.R. Wells

Clinical Assistant Professors: A.R. Abrams; I.S. Arulanantham; B. Bodey; X. Bu; E. Carpenter; J.A. Chan; O. Chinwah; P. Colman; S.S. Erlich (*Neurology*); P.L. Fitzgibbons; B.D. Florentine; M.D. Haimowitz; A. Hieshima; R. Karjoo; D.L. Krasne; B.J. Le Berthon; K. Makarewicz; J. Nachazel; E. Ojo-Amaize; J.A. Pachiarz; M. Pietruszka; B. Platz; B.J. Poletti;

A. Rechdouni; S.K. Reddy; D.R. Rogers; S. Sadeghi; S. Sahgal; L. Scheinin; R.K. Schmidt; W.M. Schultheis; T.A. Sherwood; S.D. Stewart; J.A. Taddie; D.D. Tschirhart, Jr.; R.R. Turner; E.A. Wagar; C. Williams; P. Yetur; M.L.B. Yip

Clinical Instructors: P. Javaherbin; B. Kaplan; A.J. Panchal; G.N. Pontrelli; C. Tom

Assistant Clinical Instructor: J. Toh

Professors of Clinical: R.K. Brynes; H.N. Canawati; .K.-M. Chan; J. Ciciarelli (*Urology*); D.B. Endres; J.C. Felix (*Obstetrics and Gynecology*); T.S. Greaves; A.L. Hiti; C.B. Inderlied (*Molecular Microbiology and Immunology*); Y. Iwaki (*Urology*); G.C. Kanel; A.J. Keyser; L.A. Khawli; W.S. Matthews; J.M. Nelson; P.W. Nichols; S. Saxena; A.E. Sherrod

Professors of Research: J. Groffen (*Pediatrics*); E. Heisterkamp (*Pediatrics*)

Associate Professors of Clinical: D.W. Anderson; N.J. Barr; D.B. Casebolt; C. Cobb; D.L. Commins; A.N. Fedenko; R.D. MacPhee; W.Y. Naritoku; Z. Pavlova (*Pediatrics*); D.E. Schofield (*Pediatrics*); S.R. Shi; H. Shimada; G.D. Zeger

Assistant Professors of Clinical: B. Adler; C.A. Amezcua; R. Atkinson (*Neurology*); M. Burnett (*Neurology*); W. Cozen (*Preventive Medicine*); R. Datar; I. Gonzales-Gomez; D. Hawes; S. He; L.K. Kelly; N. Klipfel; Y. Ma; H. Montforte-Munoz; G. Pinsky; A.S.S. Raza; V. Richters; R. Soni; M.S. Vadmal (*Medicine*); C.-Y. Wu; J. Zheng

Visiting Clinical Professors: A.M. Gown; G.A. Panglis

Professors of Research: J. Groffen (*Pediatrics*); E. Heisterkamp (*Pediatrics*)

Associate Professors of Research: M. Alauddin (*Radiology*); C.C. Bergmann (*Neurology*); N. Berndt (*Pediatrics*); R. Widelitz

Assistant Professors of Research: J.L. Badger (*Pediatrics*); P. Hu; T. Jiang; V. Kaartinen; N.W. Marten; R. Masood; R.A. Moats (*Radiology*); K.A. Nash; C.K. Sung; L. Wu

Research Associate Professor: S.M. Brennan

Research Assistant Professors: K. Rich; M. Sibug Saber; T. Howard

Visiting Research Professor: T. Oki

Visiting Research Assistant Professor: T. Shichinohe

Resident Clinical Instructors: L. Cai; S. Cernosek; V. Chan; M. Charara; L.-S. Chen; D. Karunasiri; Y.C. Lin; L. Lin-Chang; C.-A. Lum; F. Luo; R. McMasters; M. Moatamed; W. Naing; M. Osby; J. Pan; S. Pullarkat; J. Rice; S. Sasu; M. Shah; R. Simenthal-Pizarro; F. Suthar; R. Tadros; A. Tafazzoli; H. Tan; S. Turla; D. Varshney; Y. Wang; W. Xing; T. Yang; M. Yong

Visiting Assistant Professor: P. Malik

Emeritus Professors: F.S. Buck; J.W. Parker; A. Richters; D. Tatter; R. Terry; N.E. Warner; E.T. Wong

Emeritus Associate Professors: A.D. Cramer; R.M. Nakamura; C.B. Walberg

Emeritus Assistant Professor: A.-L. Wittman

Emeritus Clinical Professors: H.S. Aijjian; R. Aller; W.K. Bullock; M. Greenblatt; G.G. Hadley; W.H. Kern; J.A. Kern; E.B. Reilly; H.J. Sacks; D.S. Shillam; R.J. Schroeder; S.C. Sommers; P.R. Thompson

Emeritus Clinical Associate Professors: W.C. Smith; J.K. Waken

Emeritus Clinical Assistant Professors: R.L. McClure; L. Weiss

Emeritus Professors of Clinical: M. Biddle (*Molecular Microbiology and Immunology*); J.F.P. Dixon; T.T. Noguchi (*Emergency Medicine*)

Emeritus Associate Professor of Clinical: W.P. Lewis

Emeritus Assistant Professor of Clinical: R.B. Hopper

Emeritus Professor of Research: T.L. Lincoln

*Recipient of university-wide or school teaching award.

The Department of Pathology provides training for both medical and graduate students. Medical students are trained in general, systemic and cellular pathology, providing them with an understanding and visualization of the basic processes underlying symptoms and clinical courses, as well as the ability to evaluate laboratory findings. This department also contributes to the instruction of residents at the LAC+USC Healthcare Network, providing these residents with an intense program in clinical and anatomical pathology, as well as the REACH Residency Program, which sponsors one year of research dedicated to basic clinical or nontranslational research.

The Department of Pathology has both a Master of Science and a Ph.D. program. The two-year M.S. program provides training in the latest technologies and concepts of biomedical research and provides the graduate with enhanced opportunities for positions in biotechnology companies, teaching colleges and various health department/governmental positions. The Ph.D. program provides the student with training to be an independent scientist. Faculty members provide a cutting-edge scientific environment in the fields of cancer research, neurodegenerative disorders, AIDS and other disease processes.

With more than 96 full-time faculty and more than 34 residents-in-training, the USC Department of Pathology is one of the largest pathology departments in the United States. The department is particularly strong in areas of hematopathology, immunocytochemistry, immunopathology, neuropathology, and AIDS-related research. The department maintains ongoing research interests in hematopathology and neuropathology and has begun to expand its base in radioimmunomaging and immunotherapy, utilizing monoclonal antibodies. It also has ongoing research projects in the new areas of molecular and genetic pathology.

The department provides diagnostic laboratory services for the LAC+USC Medical Center, the Norris Cancer Hospital, the Doheny Eye Hospital, USC University Hospital and the USC Clinical Reference Laboratories. Approximately 40 of the department's full-time faculty members work in service laboratories throughout the LAC+USC Medical Center, where they are supported by 34 residents and fellows and a technical and clerical staff numbering in excess of 500. The Norris Cancer Hospital and Research Institute houses three full-time pathologists, two fellows and approximately 25 clerical and support staff.

Graduate Programs

Admissions

Applicants to the graduate program in pathology must have a bachelor's degree from an accredited college or university with an undergraduate major in one of the natural sciences; a minimum cumulative GPA of 3.0 for undergraduate work is required. Applicants must submit undergraduate transcripts and letters of recommendation from two undergraduate teachers with their application. All applicants must take the general portion of the Graduate Record Examinations. Foreign applicants whose first language is not English must submit the result of their Test of English as a Foreign Language (TOEFL). Personal interviews by members of the department's Graduate Committee are required whenever practical.

Original application materials, except letters of recommendation, should be sent to the Office of Admission, University of Southern California. To expedite consideration of the application, applicants should also send photocopies of the application, transcripts, and GRE scores to the department's Graduate Committee. Letters of recommendation should be addressed directly to the secretary, Graduate Committee.

Applications are considered for admission to both the fall and spring semesters.

Internships and Residency Programs

The Department of Pathology offers four internships and 30 residency positions in its fully approved five-year training program in anatomic and clinical pathology at the LAC+USC Medical Center. Training is offered in autopsy and surgical pathology, neuropathology, cytology, microbiology, hematopathology, immunohematology, clinical chemistry, toxicology, immunopathology, radioisotopes, cytogenetics, instrumentation, management, computer techniques, electron microscopy, and other specialty areas. One year of basic or clinical research is required for completion of the residency program.

Research Residency Program

The REACH research residency program is a comprehensive five year program which includes one year of sponsored research in the third year. In addition to the anatomic and clinical pathology courses described above, REACH residents will be required to perform experiments, analyze data, present their work at scientific meetings and write at least one manuscript of publication quality. This program is designed for residents interested in academic career goals and in cutting edge biomedical research.

Fellowship Program

A limited number of fellowships are offered in immunopathology, hematopathology, surgical pathology, oncology, neuropathology, and pediatric pathology. Postdoctoral positions in viral and chemical carcinogenesis, slow viral diseases, immunopathology, environmental toxicology and related fields are also available.

Master of Science in Experimental and Molecular Pathology

The Department of Pathology offers a program for the master of science degree with a major in experimental and molecular pathology. The primary objectives of this program are to provide the necessary theoretical and practical training in experimental pathology that culminates with the master of science degree. Goals of the program are to train students in preparation for senior research staff or senior technician positions in academic or industrial institutes, further M.D. or Ph.D. study, consultantships requiring multidisciplinary backgrounds or advanced teaching positions in community colleges.

Admissions Admission requirements are similar to those of the doctor of philosophy degree. The prerequisite for applicants to this program in pathology is a bachelor's degree with an undergraduate major in one of the natural sciences. A minimum GPA of 3.0 in the natural sciences (including mathematics) is usually required. Applicants must achieve a competitive score on the general portions of the Graduate Record Examinations (GRE). In addition, the department requires at least three letters of recommendation from faculty members who can evaluate the applicant's potential for graduate work. Demonstrated proficiency in the English language is required. Special circumstances may provide consideration for conditional admission.

Course Requirements At least 34 units of graduate study are required. The required courses include INTD 531 (4 units), INTD 550 (6 units), INTD 551 (6 units), INTD 561 (4 units) or BIOC 510 (2 units), INTD 571 (4 units), PATH 552ab (5 units) and PATH 570ab (2 units). Fourteen or more course units must be taken in the Department of Pathology, 8 units may be pursued outside the department, and a maximum of 8 units of directed research in pathology may be applied to the degree. No more than 4 units of course work taken outside of USC should be applied toward the M.S. degree requirements. Students considering such an action should submit a petition to the pathology graduate committee and document a rigorous academic standard for the course (reading materials, texts and other performance criteria, lecture content, etc.). The pathology graduate committee reviews the petition and informs the student of its decision.

Master's Examinations/Master's Thesis

The Master of Science has the option of either a thesis or non-thesis course of study. Each student's program will be tailored to suit individual needs and background. Students who have extensive laboratory experience and require training mainly in the knowledge of pathology may opt for the non-thesis course of study. Students also have an opportunity to register for directed research (PATH 590). There may be circumstances under which some students will be allowed to register for up to 8 units of research without writing a master's thesis. For the thesis option, the student must take PATH 594ab Master's Thesis. For the non-thesis option, the student must take GRSC 810 Studies for Master's Examination the semester they plan to graduate.

Doctor of Philosophy in Pathobiology

The department's graduate program in pathobiology prepares individuals for careers in research and teaching and leads to conferment of the Ph.D. degree. The program seeks to develop scientists who have a sound understanding of disease and are capable of creating experimental approaches to investigate its mechanisms. The program can be varied to fit individual requirements and goals. Areas of research include cancer, neurodegenerative diseases, molecular biology, virology and developmental biology.

Course Requirements A minimum of 60 units of graduate study is required for the Ph.D. degree. Each student's program will include required courses plus a number of elective courses offered within and outside the department; the student must make up any prerequisite deficiencies before taking a required or elective course for which that background is necessary. Required courses include INTD 531 (4 units), INTD 550 (6 units), INTD 551 (6 units), INTD 561 (4 units), INTD 571 (4 units) or prior equivalent, PATH 552ab (5 units), PATH 570abcd (4 units), PATH 794ab (4 units). The remaining 23 units will consist of 8 units from the courses listed below, or any other graduate level course of interest to the student, research credits (not to exceed 14 units), and up to four additional units of dissertation research: BIOC 542, BISC 467L, INTD 504, INTD 555, MICB 502, MICB 542, MICB 551, MPTX 500, PATH 575, PATH 580, PATH 581, PATH 599, PATH 630, PHBI 562, PM 510L. During years I and II, students are advised to rotate through at least two research laboratories. The student must maintain at least a 3.0 GPA for all course work, exclusive of research credits.

Screening Procedure The graduate committee members assess each newly admitted student's educational objectives and research interests, acquaints the student with the research activities of the department, and recommends a program of graduate courses and research. This committee must approve the student's program before the student may register for any course. The graduate committee evaluates the performance of each first-year student, and must approve the student's progress before the student may register for the second year. The committee's evaluation may include a written or oral screening examination.

Guidance Committee Not later than one month after being approved to register for the second year, each student must file for formation of a five-member guidance committee, one member of which must be from a department other than pathology. This committee guides the student in selecting a thesis advisor and advises the student during preparation for the qualifying examination and writing of a research proposal. This committee may also serve as a dissertation committee, for which the student may request changes in membership. The dissertation committee advises the student during dissertation research and evaluates the dissertation.

Qualifying Examination To be admitted to candidacy for the Ph.D. degree, each student is required to pass both the written and oral portions of a qualifying examination, usually taken no later than the fifth semester of graduate standing. The examination is designed to test the student's core knowledge in pathobiology and to determine fitness and competence to undertake independent research on a disease-related interest. The written portion of the examination is prepared by the department's Graduate Committee and is offered once or twice each year.

The oral examination is administered by the individual student's guidance committee and is based in part on a written proposal which the student must submit two weeks prior to the oral examination. The written proposal must consist of a proposal for an original research project.

Dissertation and Oral Defense The written dissertation is prepared in a format commonly used by major peer-reviewed scientific journals that publish similar experimental results. When the student has substantially completed the research and writing of the dissertation, the department requires that the student orally defend the dissertation's research conclusions. Although attendance at the oral defense is open to all members of the department and other interested

faculty, the examination is conducted and evaluated solely by the candidate's dissertation committee. The student may defend the dissertation at any time in the year mutually agreeable to the dissertation committee. It should be noted that the Master of Science degree is not automatically awarded to Ph.D. students who do not finish the Ph.D. program.

Postgraduate Program

Faculty of the Department of Pathology participate in postgraduate programs for continuing education which are sponsored by the Schools of Medicine and Pharmacy. Additional subspecialty courses in anatomic and clinical pathology are under development.

Courses of Instruction

PATHOLOGY (PATH)

The terms indicated are *expected* but are not *guaranteed*. For the courses offered during any given term, consult the *Schedule of Classes*.

462 Physiology for the Health Professions (4, Sp) (Enroll in PHBI 462)

500ab Basic and Applied Systemic Pathology (3-2, Irregular) Clinical, gross, and microscopic study of basic disease processes. Pathophysiology of major organ systems; etiology, pathogenesis and histopathology of important diseases; oral manifestations, clinical recognition.

531 Cell Biology (4) (Enroll in INTD 531)

552ab Methods in Experimental Pathology (a: 3, Fa; b: 2, Sp) Includes advanced techniques in: *a*: cell biology and protein chemistry; *b*: DNA analysis. The course is a practical approach to acquaint graduate students with current methodologies and applications used in biomedical research.

555 Biochemical and Molecular Bases of Disease (4, Sp) (Enroll in INTD 555)

560 Ultrastructural Pathology (4, Sp) Didactic presentation of pathological alterations in cells and tissues as seen with the electron microscope. Laboratory in techniques of electron microscopy. *Prerequisite*: INTD 550.

561 Molecular Genetics (4, Sp) (Enroll in INTD 561)

562 Systems and Integrative Physiology (4) (Enroll in PHBI 562)

565 Techniques in Tissue Culture (2, Fa) Methods used in tissue culture; their application to the study of diseased cells and tissues.

570abcd Seminar in Pathology (1-1-1-1, FaSp) Recent advances in the understanding of diseased cells and tissues are reported and discussed using standard seminars, as well as autopsy organ reviews.

571 Biochemistry (4, Fa) (Enroll in INTD 571)

575 Frontiers of Pathology (2, max 8 Sp) Weekly research lectures by leading investigators in the field of homeostatic response to injury such as cell death, inflammation, fibrosis and regeneration.

580 Cell Cycle Regulation (2, Sp) The course will focus on recent advances in cell cycle research and discuss its potential significance for human development and health care. *Prerequisite*: biochemistry and cell biology.

581 Essentials of Animal Experimentation (1, Fa) A course providing basic information on the issues and responsibilities of investigators using animals in biomedical research. *Recommended preparation*: graduate standing.

590 Directed Research (1-12, FaSpSm) Research leading to the master's degree. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

594abz Master's Thesis (2-2-0, FaSpSm) Credit on acceptance of thesis. Graded IP/CR/NC.

599 Special Topics (2-4, max 8, FaSp)

600 Immunopathology (2, Sp) Immune mechanisms responsible for pathologic alterations in cells and tissues are described in detail. *Prerequisite*: INTD 550; *corequisite*: INTD 551.

620 Neuropathology (2, max 8, Sp) Diseases of the nervous system with special emphasis on disease processes exclusive to that organ system. *Prerequisite*: INTD 550; *corequisite*: INTD 551.

625 Comparative Pathology (2, Fa) Unifying concept of diseases common to animals and man. Similarities and differences of diseases affecting certain organ systems of animals as compared to man. *Prerequisite*: INTD 550; *corequisite*: INTD 551.

630 Viral Oncology (2, Sp) Broad aspects of RNA and DNA viral oncology from epidemiology to molecular genetics. *Prerequisite*: INTD 550; *corequisite*: INTD 551.

711abc Surgical Pathology (2-2-2, FaSp) Gross and microscopic features of surgical material, principally of neoplastic disease in the mouth and jaws; correlation of clinical aspects with pathology.

790 Research (1-12, FaSpSm) Research leading to the doctorate. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

794abcdz Doctoral Dissertation (2-2-2-2-0, FaSpSm) Credit on acceptance of dissertation. Graded IP/CR/NC.

Department of Pediatrics Division of Medical Education

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Faculty

Division Head: M.A. Hitchcock

Professors: M.A. Hitchcock (*Education*);
J.G. Nyquist; B.P. Wood

Associate Professors: J. Gates (*Family Medicine*);
R.A. Girard; K.I. Hoffman (*Education*);
W. May

Assistant Professor: Zoi-Helen "Elza" Mylona

Instructor: D. Poole

Clinical Faculty: A.M. Alexander; J. Davis;
D.L. Fisher; K.A. Garman; S.A. Lemme
(*Family Medicine*); H.J. Powell; S.E. Radecki;
D. Souder; M. Sullivan

Visiting Professor: P.A. Lattore

Emeritus Professor: S. Abrahamson

Established in 1963 as one of the first medical education units in the United States, the division conducts educational programs for four different types of students: medical students; graduate students in education;

those teaching in medical and other health professional education settings; and physicians in the postgraduate study of medical education.

The division's primary mission is to enhance the quality of medical education by serving as a resource of educational expertise for planning, developing, and evaluating medical education programs and conducting educational research. Similar activities and programs are conducted with various government and private organizations outside the university.

Major research and training interests of the faculty include the instruction of lay persons to be used as standardized patients for teaching and evaluation, case-based learning, pre-med programs for minority students and interactive video systems.

Administratively, the division is an independent unit in the Department of Pediatrics in the Keck School of Medicine. The faculty hold appointments in the Department of Pediatrics. The division also employs 10 staff and research assistants. All activities of the division are conducted at the USC Health Sciences campus.

Fellowship Programs

Teaching and Learning

A Teaching and Learning Fellowship program is offered to healthcare professionals who are engaged in teaching. The primary goals of this fellowship are to provide participants with

multiple ways to teach and evaluate effectively. Through seminars, fellows will gain increased understanding of basic principles of teaching and learning and achieve the skills necessary to apply principles effectively.

Educational Leadership

An Educational Leadership Fellowship program is available for healthcare professionals with two primary goals: to prepare participants for understanding and serving in positions of leadership and enhance fellows' personal and professional effectiveness. Seminars will explore transformational change, team and community formation, group dynamics, organizational culture and resources.

Health Professions Teachers

From time to time, the division offers special workshops or seminars in various subject areas related to the improvement of instruction. Division staff members are available to plan these special programs on request.

Postgraduate Program

Individually tailored programs of study in medical education are available to visiting postdoctoral fellows who wish to gain an understanding of principles, problems and practices in medical education. These visiting fellows may spend from a few weeks to a year in residence, participating in ongoing projects, seminars, readings and independent study.

Department of Physiology and Biophysics

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Faculty

Richard N. Bergman, *Keck Chair in Medicine and Chair of Physiology and Biophysics*

USC Associates/Thomas H. Brem Chair in Medicine: Neil Kaplowitz (*Medicine/GI Liver/Patient Care*)

Professors: Michael Arbib (*Computer Science/Engineering*); Timothy M. Chan (*Molecular Pharmacology and Toxicology*); Robert A. Farley* (*Biochemistry*); Caleb Finch (*Gerontology and Neurobiology*); Michael Goran (*Preventive Medicine*); Cage S. Johnson (*Medicine/Hematology*); Alicia McDonough; Herbert J. Meiselman; Austin K. Mircheff; Dennis O'Leary (*Otolaryngology*)

Associate Professors: Marilyn Ader; Thomas Buchanan (*Medicine/Obstetrics and Gynecology*); Robert H. Chow; Casey Donovan (*Exercise*

Science); Timothy C. Fisher; Sarah Hamm-Alvarez (*Pharmaceutical Sciences*); Harvey R. Kaslow; Kwang Jin Kim (*Medicine, Biomedical Engineering*); R.M. Nakamura (*Obstetrics and Gynecology, Pathology*); Richard L. Lubman (*Medicine/Pulmonary Patient Care*); Jang-Hyun Youn

Assistant Professors: Jonathan K. Armstrong; Bjoern Neu; Joyce Richey; Alan S.L. Yu

Adjunct Professor: Dwight W. Warren III

*Recipient of university-wide or school teaching award.

The Department of Physiology and Biophysics is located on the Health Sciences campus, with laboratories and administrative offices in the Seeley Mudd Laboratory, the Doheny Eye Institute, the Parkview Medical Building and the Raulston Building. Faculty of the department are also located at the LAC+USC Medical Center and in research laboratories on the University Park campus.

The graduate program in physiology and biophysics is designed to prepare students for a career in research and teaching in physiology and related fields. Faculty of the department guide students toward becoming effective members of today's scientific community by providing an integrated knowledge of physiological systems at several levels of organization. The course of study required of each candidate is planned to meet his or her individual interests and needs.

Faculty guidance and specialized facilities are available for advanced research in the four broad areas of research represented in the department: endocrinology, reproduction and metabolism; neurophysiology; fluid and electrolyte physiology; and cellular and molecular physiology.

Graduate Programs

Admissions

Applicants should have a bachelor's degree in one of the natural sciences. Undergraduate course work in mathematics (including one and a half years of calculus), physics (one year), organic chemistry (aliphatic and aromatic), and biological sciences (one year) is required. Prospective students should also have completed at least two courses from among the following areas: physical chemistry, advanced physics, electronics, histology, physiology, cell biology, computer science, or biochemistry. Equivalent work will be considered on an individual basis.

Students interested in applying must complete a departmental preapplication available from the director of graduate studies. Graduate Record Examinations scores, complete undergraduate transcripts and three letters of recommendation are required before the application can be considered.

The preapplication procedure should be completed before May 1 for admission to the following fall semester. All applicants must also apply formally to the university. Final acceptance is contingent upon completion of the official admission procedure.

Master of Science

Admission requirements are the same as for the Doctor of Philosophy degree.

Course Requirements The master's degree in physiology and biophysics requires completion of 32 graduate level units with a minimum grade point average of 3.0. All students are required to take the following: PHBI 562, PHBI 608ab, PM 510, and two of the following: INTD 531, INTD 561 or INTD 571. Students enroll in additional graduate level classes with prior approval of their graduate student advisor. The Master of Science candidate has the option of either a thesis or non-thesis course of study; the thesis option is usually required if more than 6 research units make up a 32-unit course plan. The specific program followed by thesis-option students is tailored to suit individual needs and background in consultation with the academic director of the program and the student's guidance committee. There is no foreign language requirement.

Doctor of Philosophy

Course Requirements A total of 60 units of graduate study is required for the Ph.D. degree. All students are required to take PHBI 552, PHBI 562 and PHBI 608ab; INTD 531, INTD 561 and INTD 571; and PM 510L. A one-semester course in neuroscience is also required. The balance of the 60 unit requirement will be drawn from advanced physiology courses and seminars, courses from other departments, research and the dissertation. The specific program to be followed by each student is determined in consultation with the student's advisor, guidance committee and the department faculty. There is no foreign language requirement.

Screening Procedure An overall GPA of 3.0 or better and a minimum grade of B (3.0) in all courses given by the department and also in INTD 531 are the minimum requirements for continuation in the Ph.D. program. After completion of the first two semesters of study, the eligibility of each student for continuation in the program will be reviewed by a departmental graduate screening committee. At the discretion of the graduate committee, successful completion of a screening examination may be required for progression to the third semester of graduate study.

Guidance Committee The guidance committee consists of at least five members, three of whom must be from within the department and at least one of whom must be drawn from the faculty of another department. The chair of the committee will be the student's dissertation advisor.

Qualifying Examination The purpose of the qualifying examination is to give the student a formal opportunity to demonstrate to the faculty that he or she is qualified to conduct independent research. Passing this examination is formal recognition that the student has independently developed a research proposal that is significant and can be reasonably accomplished with available resources.

At least 60 days prior to its scheduled date, the student must petition the Graduate School for permission to take the qualifying examination; the examination must be completed by the end of the semester during which application is made. Students must complete this examination no later than the fifth semester of graduate work. If the student fails to take the examination by this time, the guidance committee will report a failure to pass the examination. The student then has one additional chance to take and pass the examination; this may not occur sooner than six months nor later than one year after the first examination. Applications to take the qualifying examination later than the fifth semester may be considered on an individual basis and must be approved by both the guidance committee chair and the department chair.

The qualifying examination consists of a written and an oral portion. For the written portion, the student must prepare a proposal for a research project. The proposal must be submitted to the members of the guidance committee not less than 10 days prior to the oral portion of the examination. For the oral defense, the student should prepare an oral presentation of the proposal of approximately 30 minutes duration and be prepared to answer questions regarding any topic related to the proposal.

Dissertation and Oral Defense Upon completion of the research project, and with the consent of the dissertation committee, the candidate prepares the written dissertation. After the dissertation has been read by the committee, the candidate must make an oral defense of the work.

Courses of Instruction

PHYSIOLOGY AND BIOPHYSICS (PHBI)

The terms indicated are *expected* but are not *guaranteed*. For the courses offered during any given term, consult the *Schedule of Classes*.

462 Physiology for the Health Professions (4)

Overview of how organ systems operate and interact to maintain homeostasis including responses to common challenges and disorders. *Prerequisite:* BISC 120L or BISC 220L or BISC 113L; CHEM 105abL or CHEM 115abL; *recommended preparation:* cell biology, physics.

463L Physiology Lab for the Health Professions (1, Sp)

Practical, hands-on and non-invasive illustrations of human organ systems including measurement of physiologic parameters, computer modeling. *Corequisite:* PHBI 462.

524 Advanced Neurosciences I (4) (Enroll in NEUR 524)

525 Advanced Neurosciences II (4, Sp) (Enroll in NEUR 525)

531 Cell Biology (4) (Enroll in INTD 531)

550 Seminar in Physiology (2, max 4, FaSp) Selected topics in mammalian physiology. Graded CR/NC.

552abcd Advanced Physiological Methods (2-4 each, FaSp) Techniques used in advanced physiology; construction and use of physiological instruments; training in surgical techniques; introduction to the use of radioisotopes in physiological investigation. *Prerequisite:* PHBI 581, PHBI 582, PHBI 583.

556ab Recent Advances in Physiology (2-2, FaSp) Requirements include preparation of abstracts of papers appearing in current physiological literature.

560 The Microcirculation (3, Sp) Physiology of mammalian microcirculation in various organs including flow dynamics, transepithelial exchange, and control mechanisms. *Prerequisite:* PHBI 581, PHBI 582, PHBI 583.



561 Molecular Genetics (4, Sp) (Enroll in INTD 561)

562 Systems and Integrative Physiology (4, FaSp) Provide a graduate level overview of how organ systems operate and interact to maintain homeostasis, with examples of common challenges and disorders (e.g., how base balance is maintained by an interplay between renal and respiratory systems during high altitude and drug overdose.) *Prerequisite:* INTD 531 or equivalent.

571 Biochemistry (4, Fa) (Enroll in INTD 571)

581 Cellular and Molecular Mechanisms in Physiology (4, Fa) Membrane structure, biophysical principles of transport mechanisms, epithelial function, muscle physiology, hormone-receptor interactions, hormone regulation of ion transport and gene expression, membrane biogenesis.

582 Endocrinology, Reproduction, and Metabolism (4, Sp) Systemic approach to the study of the endocrine glands, reproductive physiology and regulation of metabolic processes. *Prerequisite:* PHBI 581 or departmental approval.

583 Cardiovascular, Respiratory, and Renal Physiology (4, Sp) Survey of cardiovascular, renal, and respiratory physiology. Suitable for physiology and medical science graduate students and biomedical engineers. *Prerequisite:* PHBI 581 or departmental approval.

590 Directed Research (1-12, FaSpSm) Research leading to the master's degree. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

594abz Master's Thesis (2-2-0, FaSpSm) Credit upon acceptance of thesis. Graded IP/CR/NC.

599 Special Topics (2-4, max 8, Sp)

608ab Advanced Cellular, Molecular and Systemic Physiology (a: 2 or 4, Fa; b: 2 or 4, Sp) Lectures and student presentations on advanced topics in molecular, cellular and systemic physiology.

610 Advanced Circulation (3, Sp) Combination lecture, student seminar; consideration of current research ideas in cardiovascular physiology. *Prerequisite:* PHBI 581, PHBI 582, PHBI 583.

618 Mathematical Modeling in Endocrinology and Metabolism (3, Fa) The application of mathematics to problems including hormone-receptor interactions, tracer kinetics, and regulation of hormones and substrates at the level of the whole organism. *Prerequisite:* Calculus III.

650 Mechanisms of Ion Transport in Animal Cells (2, alt Sp) A comprehensive examination of ion transport pathways, covering kinetic and structural analysis, physiological regulation, and theoretical treatments of ion pumps, channels, exchange pathways, and model compounds. *Prerequisite:* PHBI 581, BIOC 441.

790 Research (1-12, FaSpSm) Research leading to the doctorate. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

794abcdz Doctoral Dissertation (2-2-2-0-0, FaSpSm) Credit on acceptance of dissertation. Graded IP/CR/NC.

Department of Preventive Medicine

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Faculty

Ronald K. Ross, *Chair and Professor*

John M. Peters, *Vice Chair and Hastings
 Professor*

AFLAC Chair in Cancer Research:
 Leslie Bernstein, *Senior Associate Dean for
 Faculty Affairs and Professor*

*Catherine and Joseph Aresty Chair in Urologic
 Research:* Ronald K. Ross

Sidney R. Garfield Chair in Health Sciences:
 C. Anderson Johnson

Kenneth T. Norris, Jr. Chair in Epidemiology:
 Brian E. Henderson

Verna R. Richter Chair in Cancer Research:
 Duncan Thomas

Flora L. Thornton Chair in Preventive Medicine:
 Ronald K. Ross

Professors: S.P. Azen (*Biomedical Engineering,
 Ophthalmology, Occupational Science*);
 L. Bernstein; P. Clarke (*Communication*);
 J. Dwyer; F.D. Gilliland; H. Gong (*Medicine*);
 M. Goran (*Physiology and Biophysics*); R. Haile;
 B.E. Henderson; C.A. Johnson (*Psychology*);
 T.M. Mack (*Pathology*); B. Meyerowitz
 (*Psychology*); M.A. Pentz; J.M. Peters; M.C.
 Pike; B. Portnoy (*Pediatrics*); S. Preston-Martin;
 J. Richardson; R.K. Ross; S. Sussman; S.
 Tavare (*Mathematics*); D.C. Thomas; M.C. Yu;
 A. Wu

Associate Professors: G. Coetzee (*Urology,
 Microbiology*); W.J. Gauderman; H. Hodis
 (*Medicine*); N. Kuenzli; W. Mack;
 R.S. McConnell; K. Reynolds; H.N. Sather;
 T. Seeman (*Gerontology*); J. Sobell; A. Stacy;
 D. Stram; G. Ursin; T. Valente

Assistant Professors: L. Baezconde-Garbanati;
 K. Berhane; D. Conti; V. Cortessis; S. Ingles;
 K. Siegmund; M. Stern; J. Van Tornout
 (*Pediatrics*); J. Unger; R. Watanabe

Professors of Clinical: E.L. Avol; D. Deapen;
 R.K. Peters (*Family Medicine*)

Associate Professor of Clinical: A. Hricko

Assistant Professors of Clinical: W. Cozen;
 A. Hamilton; C. Koprowski; E. Nezami;
 P. Palmer

Clinical Associate Professors: J.T. Casagrande;
 W.S. Linn; J.N. Weitzel

Clinical Assistant Professors: C.B. Tang;
 H. Tang

Clinical Instructor: P.M. Rideout

Professors of Research: J.D. Buckley (*Pediatrics*);
 S. Groshen; A. Paganini Hill; M. Krailo;
 B. Langholz; F. Stanczyk (*Obstetrics and
 Gynecology*)

Associate Professors of Research: C.-P. Chou;
 C.W. Dent; R. Sposto

Assistant Professors of Research: T. Alonzo;
 M. Cockburn; M. Cruz; T. Cruz; P. Marjoram;
 L. Rohrbach; R. McKean-Cowdin;
 D. Spruijt-Metz; P. Sun; J. Van Tornout
 (*Pediatrics*); A. Xiang; J-M Yuan; T. Zhou

Adjunct Associate Professors: C.N. Bailey-Merz;
 M.R. Calderon; A. Forsythe; G. Marks;
 T. Maryon; S. Nessim; J. Niland;
 G. Wolde-Tzadik

Adjunct Assistant Professors: B. Dietsch;
 S. Donaldson; D. Ikle; J.A. Longmate;
 S.V. McKane; S. Montgomery

The Department of Preventive Medicine is responsible for training medical and graduate students in the areas of biostatistics, epidemiology, health behavior research, public health, and preventive medicine. Faculty from the department also perform research in the areas of biostatistics, epidemiology of acute and chronic diseases, and environmental health.

The undergraduate and graduate programs offered by the department are noteworthy for the extensive opportunities offered to the students for involvement in faculty research. It is not uncommon for students to begin working closely with faculty members on research projects as early as their first or second year of study.

Degree Programs

The Department of Preventive Medicine offers the following degree programs:

B.S. in Health Promotion and Disease
 Prevention Studies
 B.S. in Health Promotion and Disease
 Prevention/Master of Public Health
 Minor in Health Communication
 Minor in Public Health
 Minor in Nutrition and Health Promotion
 Minor in Substance Abuse Prevention
 M.S. in Applied Biostatistics/Epidemiology
 M.S. in Clinical and Biomedical Investigations
 M.S. in Molecular Epidemiology
 Master of Public Health
 Master of Public Health/Doctor of Medicine
 Master of Public Health (Health Promotion)/
 Ph.D. in Psychology (Clinical)
 Master of Public Health/Pharm.D.
 Master of Public Health/Doctor of Physical
 Therapy
 Ph.D. in Biostatistics
 Ph.D. in Epidemiology
 Ph.D. in Molecular Epidemiology
 Ph.D. in Preventive Medicine (Health
 Behavior Research)
 Ph.D. in Statistical Genetics and Genetic
 Epidemiology

Bachelor of Science in Health Promotion and Disease Prevention Studies

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 Email: nezami@usc.edu
 www.usc.edu/medicine/hp

The undergraduate program in Health Promotion and Disease Prevention Studies (HP) provides a well-rounded, yet professionally-focused, education leading to the Bachelor of Science degree. The program is concerned with the sociocultural, behavioral, psychological, and biological factors contributing to wellness and disease. It is an ideal major for students pursuing careers in medicine, public health, health promotion and disease prevention and prepares students for advanced study in medicine, pharmacy, dentistry, public health, epidemiology, health psychology, and health behavior research. Areas of study include: (1) substance abuse prevention and program planning, (2) nutrition and fitness, (3) health promotion of minority and underserved populations, and (4) general public health issues (e.g., HIV/AIDS, violence, health promotion in the workplace and behavioral medicine).

Program Requirements

The Bachelor of Science degree is awarded after students successfully complete 128 units, consisting of 66 units for the major and fulfillment of USC general education requirements including third semester equivalency in a foreign language.

General Education Requirements

The university's general education program provides a coherent, integrated introduction to the breadth of knowledge you will need to consider yourself (and to be considered by other people) a generally well-educated person. This program requires six courses plus writing and diversity requirements, which are described in detail on pages 183 through 187.

Requirements for the Major (66 units)

The program is divided into core and elective components. Students are required to complete 20 electives (at least 12 out of the 20 must be HP courses).

The following core component (46 units) is required of all students.

NON-HP COURSES (24 UNITS)		UNITS
BISC 120L	General Biology: Organismal Biology and Evolution, or	
BISC 121L	Advanced General Biology: Organismal Biology and Evolution	4
BISC 220L	General Biology: Cell Biology and Physiology, or	
BISC 221L	Advanced General Biology: Cell Biology and Physiology	4
CHEM 105aL	General Chemistry, or	
CHEM 115aL	Advanced General Chemistry	4

MATH 116	Mathematics for the Social Sciences, or	
MATH 125*	Calculus I	4
PPD 230	Introduction to Health Policy and Management	4
PSYC 100	Introduction to Psychology	4

*MATH 125 allows students who have placed out of MATH 116 to take a higher-level math class; it also satisfies the math requirement for premedical students.

HP COURSES (22 UNITS)

		UNITS
HP 200	Introduction to Health Promotion and Disease Prevention	4
HP 300	Theoretical Principles of Health Behavior	4
HP 320	Biological and Behavioral Basis of Disease	4
HP 340L	Health Behavior Statistical Methods	4
HP 350L	Health Behavior Research Methods	4
HP 480	Internship in Health Promotion and Disease Prevention, or	2-4
HP 490x	Directed Research	2-8

Advanced HP and Health Profession Preparatory Courses

A total of 20 units in electives is required of all students (at least 12 of the 20 must be HP courses).

ELECTIVES (20 UNITS)

		UNITS
BISC 212Lx	Human Anatomy	4
BISC 310Lx	Principles of Human Microbiology	4
BISC 320L	Molecular Biology	4
BISC 330L	Biochemistry	4
CHEM 105bL	General Chemistry, or	
CHEM 115bL	Advanced General Chemistry	4
CHEM 322abL	Organic Chemistry	4-4
EXSC 300L	Physiology of Exercise	4
EXSC 407aL	Advanced Exercise Physiology	4
HP 290	Introduction to Research Apprenticeship	2-8, max 8
HP 400	Culture, Lifestyle, and Health	4
HP 401	Cultural Competence: Promoting Health in Diverse Communities	4
HP 402	Maternal and Child Health	4
HP 403	Behavioral Medicine	4
HP 410	Issues in Prevention and Cessation of Drug Abuse	4
HP 411	Drug Intervention Program Design and Evaluation	4
HP 412	Health Promotion and Prevention Policy	4

HP 420	Gender and Minority Health Issues	4
HP 421	Violence as a Public Health Issue	4
HP 422	AIDS in Society	4
HP 430	Nutrition and Exercise Epidemiology (Prerequisite: EXSC 200L)	4
HP 431	Behavior and Education Strategies for Nutrition and Fitness	4
HP 432	Clinical Nutrition	4
HP 433	Advanced Topics in Nutrition	4
HP 441	Health Promotion in the Workplace	4
HP 442	Chronic Disease Epidemiology	4
HP 443	Health Communication Strategies and Evaluation	4
HP 450	Traditional Eastern Medicine and Modern Health	4
HP 460	Adolescent Health	4
PHYS 135abL	Physics for the Life Sciences, or	4-4
PHYS 151L	Fundamentals of Physics I: Mechanics and Thermodynamics, and	4
PHYS 152L	Fundamentals of Physics II: Electricity and Magnetism	4
PPD 330	Introduction to Health Care Systems	4
PSYC 336L	Developmental Psychology	4
PSYC 338	Adolescent Development	4
PSYC 355	Social Psychology	4
SOCI 350	Deviant Behavior	4
SOCI 475	Medical Sociology	4

Dual Degree in Health Promotion and Disease Prevention (B.S.) and Master of Public Health (M.P.H.)

This program is a dual accelerated degree program requiring at least 163 units for completion of both B.S. and M.P.H. degrees. The program allows superior students to complete all of their B.S. and M.P.H. requirements in five years.

Admission

Admission to this program for current USC students enrolled in the Health Promotion and Disease Prevention major may take place at the junior level. For transfer students, an application for this accelerated program should be filed with the department at the time of transfer. Students must demonstrate the minimum requirements for admission to this accelerated program: minimum 3.5 overall GPA; minimum GRE score of 1100; and outstanding scholarship and dedication to the field of public health as evidenced by a personal statement.

Curriculum Requirements

University requirements for the B.S. and the M.P.H. in Health Promotion (health promotion and disease prevention track) must be satisfied. Students will fulfill program requirements of both degrees by completing three 500-level courses (PM 525, PM 526 and PM 528) during their fourth year. Students must maintain a cumulative GPA of 3.0 in order to remain in this accelerated program.

In addition to required course work, all B.S./M.P.H. students conduct a directed research project (HP 490x) and participate in an internship rotation through an area of public practice (PM 593).

Additional information and sample curricula are available from the department.

Minor in Cultural Competence in Medicine

This minor is designed for students who plan to enter careers or professional programs in medicine after graduation and are interested in using cultural knowledge to provide more effective health care. The minor focuses on cultural differences in the understanding of health, disease, health care and risk factors unique to specific populations. The minor will provide a foundation for students who want to be able to function as effective health care providers in our increasingly diverse society. It complements major programs such as biological sciences, chemistry, exercise science and environmental studies.

REQUIRED COURSES (20 UNITS)		UNITS
HP 200	Introduction to Health Promotion and Disease Prevention	4
HP 400	Culture, Lifestyle and Health	4
HP 401	Cultural Competence: Promoting Health in Diverse Communities	4
HP 420	Gender and Minority Health Issues	4
one of the following:		
HP 402	Maternal and Child Health	4
HP 410	Issues in Prevention and Cessation of Drug Abuse	4
HP 421	Violence as a Public Health Issue	4
HP 422	AIDS in Society	4
HP 442	Chronic Disease Epidemiology	4
HP 443	Health Communication Strategies and Evaluation	4
HP 450	Traditional Eastern Medicine and Modern Health	4
HP 460	Adolescent Health	4
PSYC 462	Minority Mental Health	4

Minor in Health Communication

This minor is designed to appeal to students with a wide range of interests, including those with a general interest in promoting healthy lifestyle practices through communication. These students will be prepared to seek future job opportunities from various areas including the managed care industry, hospitals, wellness programs, broadcast and cable companies, private and governmental agencies as well as other organizations looking for experts with demonstrated knowledge in health-related fields.

REQUIRED COURSES (20 UNITS)		UNITS
COMM 302	Persuasion	4
COMM 385	Survey of Organizational Communication	4
HP 200	Introduction to Health Promotion and Disease Prevention	4
HP 443	Health Communication Strategies and Evaluation	4
one of the following:		
COMM 304	Interpersonal Communication	4
COMM 308	Communication and Conflict	4
COMM 315	Health Communication	4
COMM 324	Intercultural Communication	4
COMM 375	Business and Professional Communication	4
COMM 402	Public Communication Campaigns	4
COMM 480	Nonverbal Communication	4
COMM 486	Human and Technological Systems in Organizations (Recommended preparation: COMM 385)	4
HP 400	Culture, Lifestyle, and Health	4
HP 401	Cultural Competence: Promoting Health in Diverse Communities	4
HP 402	Maternal and Child Health	4
HP 403	Behavioral Medicine	4
HP 412	Health Promotion and Prevention Policy	4
HP 420	Gender and Minority Health Issues	4
HP 421	Violence as a Public Health Issue	4
HP 422	AIDS in Society	4
HP 430	Nutrition and Exercise Epidemiology	4
HP 442	Chronic Disease Epidemiology	4

Minor in Public Health

This minor is designed for students interested in a broad array of health issues. The focus of the minor is on reducing disability and mortality from avoidable injuries and chronic disease, educating the community about healthy lifestyles, assuring access to health care and measuring changes using various indicators over time. This minor offers students an opportunity to acquire insight for meeting the challenges of the changing environment of the health care system. It complements a number of majors including psychology, sociology, American studies and ethnicity, biological sciences, economics, environmental studies, exercise science, gender studies, international relations, philosophy, religion, gerontology, education and political science.

REQUIRED COURSES (*20-24 UNITS)		UNITS
HP 200	Introduction to Health Promotion and Disease Prevention	4
PPD 330	Introduction to Health Care Systems	4
three of the following:		
HP 400	Culture, Lifestyle and Health	4
HP 401	Cultural Competence: Promoting Health in Diverse Communities	4
HP 402	Maternal and Child Health	4
HP 403	Behavioral Medicine	4
HP 410	Issues in Prevention and Cessation of Drug Abuse (recommended preparation: HP 300)	4
HP 412	Health Promotion and Prevention Policy	4
HP 420	Gender and Minority Health Issues	4
HP 421	Violence as a Public Health Issue	4
HP 422	AIDS in Society	4
HP 430	Nutrition and Exercise Epidemiology	4
HP 441	Health Promotion in the Workplace	4
HP 442	Chronic Disease Epidemiology (recommended preparation: HP 320)	4
HP 443	Health Communication Strategies and Evaluation	4
HP 460	Adolescent Health (prerequisite: HP 200, PSYC 100)	4

*Prerequisite required.

Minor in Nutrition and Health Promotion

This minor is designed to appeal to students interested in nutrition, especially in preparation for graduate study in health-related fields (e.g., medicine, public health) or to enter health-related fields of employment. The focus of the minor is on assessing, planning and evaluating dietary intake of individuals or groups under various conditions of health and disease based upon principles of nutrition and behavioral science. Students in this minor will study factors associated with dietary habits so that effective interventions at individual and group levels can be developed. It complements a number of majors including psychology, gerontology, biological sciences, chemistry, exercise science and environmental studies.

REQUIRED COURSES (20 UNITS)		UNITS
HP 230	Nutrition and Health	4
HP 430	Nutrition and Exercise Epidemiology (Prerequisite: EXSC 200L)	4
HP 431	Behavior and Education Strategies for Nutrition and Fitness	4
two of the following:		
HP 400	Culture, Lifestyle, and Health	4
HP 401	Cultural Competence: Promoting Health in Diverse Communities	4
HP 402	Maternal and Child Health	4
HP 403	Behavioral Medicine	4
HP 412	Health Promotion and Prevention Policy	4
HP 420	Gender and Minority Health Issues	4
HP 432	Clinical Nutrition	4
HP 433	Advanced Topics in Nutrition	4
HP 443	Health Communication Strategies and Evaluation	4
HP 460	Adolescent Health	4
HP 480	Internship in Health Promotion and Disease Prevention	2-4, max 4
HP 490x	Directed Research	2-8, max 8

Minor in Substance Abuse Prevention

This minor offers students an opportunity to gain an overall understanding of substance abuse as a major modifiable risk factor for illness. It allows students to learn theories of behavior change, to understand the issues in prevention and cessation of drug abuse, and to develop, implement, and evaluate intervention strategies. It complements a number of majors including psychology, sociology, American studies and ethnicity, biological science, gerontology and education.

REQUIRED COURSES (24 UNITS)		UNITS
HP 200	Introduction to Health Promotion and Disease Prevention	4
HP 300	Theoretical Principles of Health Behavior (Prerequisite: PSYC 100; recommended preparation: HP 200)	4
HP 410	Issues in Prevention and Cessation of Drug Abuse (Recommended preparation: HP 300)	4
HP 411	Drug Intervention Program Design and Evaluation (Recommended preparation: HP 410)	4
one of the following:		
HP 400	Culture, Lifestyle, and Health	4
HP 401	Cultural Competence: Promoting Health in Diverse Communities	4
HP 402	Maternal and Child Health	4
HP 403	Behavioral Medicine	4
HP 412	Health Promotion and Prevention Policy	4
HP 421	Violence as a Public Health Issue	4
HP 443	Health Communication Strategies and Evaluation	4

Graduate Programs-Admissions

Master of Science in Applied Biostatistics/Epidemiology

The department encourages applicants with undergraduate degrees in allied health, pharmacology, public health, medicine, biological and clinical sciences or other related fields. Undergraduate preparation should have included applied statistics, college algebra, an introductory course in calculus and basic computer programming. Applicants should also meet the minimum requirements for admission to the Graduate School. Demonstrated proficiency in the English language is essential. With approval of the Graduate School, applicants not meeting these requirements may be conditionally admitted contingent upon maintaining a GPA of 3.5 for the first 12 units of graduate study.

Master of Science in Biostatistics

The department encourages applicants with undergraduate degrees in mathematics, statistics or biostatistics, computer science or other related fields. Undergraduate preparation should have included differential and integral calculus, introduction to mathematical statistics, and basic computer programming.

Applicants should also meet the minimum requirements for admission to the Graduate School. Demonstrated proficiency in the English language is essential. With approval of the Graduate School, applicants not meeting these requirements may be conditionally admitted contingent upon maintaining a GPA of 3.5 for the first 12 units of graduate study.

Master of Science in Clinical and Biomedical Investigations

The program will consider applicants who satisfy all requirements for admission to the Graduate School. MCAT scores may be substituted for the GRE. Applicants not meeting Graduate School requirements for regular standing may, with approval of the Graduate School, be conditionally admitted. Regular standing is contingent upon maintaining a GPA of 3.0 in the first 12 units of graduate studies. All graduate students must maintain a GPA of 3.0 throughout their graduate studies.

Master of Science, Molecular Epidemiology

Students with a bachelor's degree in quantitative biological sciences will be eligible for admission. In addition, the B.A. students must have completed at least one year of general biology, one semester of biochemistry and one semester of statistics to be admitted into the Graduate School. Under unusual circumstances, conditional acceptance will be offered to students who do not meet these requirements — allowing them to complete the missing undergraduate courses prior to their full admission into the Graduate School. An introductory biochemistry class is also available in the School of Pharmacy which may satisfy the biochemistry prerequisite. A joint departmental admission committee will review all applicants.

Master of Public Health

The M.P.H. program has four tracks: Health Promotion, Biostatistics/Epidemiology, Health Communication and Nutrition. The curriculum includes a set of core courses for each track and electives. The program also includes an internship placement that integrates academic and practical experiences and prepares individuals to work in governmental and non-governmental organizations in health-related fields.

The department encourages applicants from the USC undergraduate program in health promotion and disease prevention and throughout the campus, as well as health professionals seeking advanced degrees, medical students who are interested in pursuing an M.P.H. along with their medical degree, nurses who desire a more public health focus, pharmacists and dentists. Applicants should meet the minimum requirements for admission to the Graduate School. Demonstrated

proficiency in the English language is essential. With approval of the Graduate School, applicants not meeting these requirements may be conditionally admitted contingent upon maintaining a grade point average of 3.0 (A = 4.0) in PM 501, PM 510L and PM 512 (12 units).

Doctor of Philosophy in Biostatistics

The department encourages applicants with undergraduate degrees in mathematics, statistics or biostatistics, or other related fields. Undergraduate preparation should have included differential and integral calculus, introduction to mathematical statistics and basic computer programming. Applicants should also meet the minimum requirements for admission to the Graduate School. Demonstrated proficiency in the English language is essential. With approval of the Graduate School, applicants not meeting these requirements may be conditionally admitted contingent upon maintaining a GPA of 3.0 for the first 12 units of graduate study.

Doctor of Philosophy in Epidemiology

The department encourages applicants who have undergraduate degrees in allied health, public health, biological sciences or other related fields. Applicants not meeting these requirements may, with approval of the Graduate School, be conditionally admitted contingent upon maintaining a GPA of 3.5 in the first 12 units of graduate studies. Applicants should also meet the minimum requirements for admission to the Graduate School. An MCAT score of 30 may be substituted for the GRE requirement.

Doctor of Philosophy in Molecular Epidemiology

The department encourages applicants who have undergraduate or master's degrees in quantitative biological sciences or other related fields. Undergraduate preparation should include at least one year of general biology, one semester of biochemistry and molecular biology, and one semester of applied statistics. The Ph.D. program is designed to train students for future independent research careers in an academic, government or private sector setting. The objective of the Ph.D. program is to produce a molecular epidemiologist with in-depth laboratory, statistical and analytic skills in both epidemiology and the molecular biosciences. To meet this objective, the program introduces students to molecular/laboratory science and research early in their training.

The program will consider applicants who satisfy all requirements for admission to the Graduate School and demonstrate proficiency in the English language. MCAT scores may be substituted for the GRE. Applicants not meeting Graduate School requirements for regular standing may, with approval of the

Graduate School, be conditionally admitted. Regular standing is contingent upon maintaining a GPA of 3.0 in the first 12 units of graduate credit.

A student in one of the division's master's programs in biostatistics, epidemiology or molecular epidemiology may be considered for either the Ph.D. in biostatistics, epidemiology or molecular epidemiology prior to completing the M.S. degree, providing he or she has met the requirements for admission to the Ph.D. program, obtained approval of the department's Admission Committee, demonstrated research and writing ability, and passed the doctoral-level screening examination. For further information contact: Mary Trujillo, Program Coordinator, Keck School of Medicine, Department of Preventive Medicine, Division of Biostatistics, Center for Health Professions 218, 1540 Alcazar Street, Los Angeles, CA 90089-9010, (323) 442-1810, FAX: (323) 442-2993.

Doctor of Philosophy in Preventive Medicine (Health Behavior Research)

Applicants must have a bachelor's degree from an accredited institution; students entering with an advanced degree may be eligible to transfer course credit. Applicants should also meet the minimum requirements for admission to the Graduate School.

Applicants must supply a completed application to the Graduate School, including transcripts from all institutions previously attended, a curriculum vitae (if available), a statement of interest, and three letters of recommendation. For further information contact: Director for Graduate Studies, USC Institute for Health Promotion and Disease Prevention Research, 1000 S. Fremont Avenue, Alhambra, CA 91803, (323) 442-2605, (626) 457-4012, FAX: (323) 442-2601.

Doctor of Philosophy in Statistical Genetics and Genetic Epidemiology

This program is designed to train students for future independent research careers in an academic, government or private sector setting. The department encourages applicants who have undergraduate or master's degrees in mathematics, statistics or biostatistics; statistical genetics or quantitative biological sciences; or other related fields. The program will consider applicants who satisfy all requirements for admission to the Graduate School and demonstrate proficiency in the English language.

Master of Science in Applied Biostatistics/Epidemiology

Course Requirements

General requirements include at least 37 units of required courses as follows: 24 units of core courses and at least 9 units of elective

courses. In addition, each student must register for four units of 594ab Thesis and write a master's thesis.

CORE COURSES (24 UNITS)		UNITS
PM 510L	Principles of Biostatistics	4
PM 511aL	Data Analysis	4
PM 512	Principles of Epidemiology	4
PM 517a	Research Methods in Epidemiology	3
PM 518a	Statistical Methods for Epidemiological Studies	3
PM 523	Design of Clinical Studies	3
PM 527	Epidemiology of Infectious Disease	3
ELECTIVES (AT LEAST 9 UNITS)		UNITS
PM 511bL	Data Analysis	4
PM 515	Behavioral Epidemiology	3
PM 516ab	Statistical Problem Solving	1-1
PM 517b	Research Methods in Epidemiology	3
PM 529	Environmental Health	3
PM 530	Biological Basis of Disease	4
PM 533	Genetic and Molecular Epidemiology	3
PM 590	Directed Research	1-12
PM 611	Advanced Topics in Epidemiology	3
THESIS (4 UNITS)		
PM 594ab	Thesis	2-2

Electives will be determined by the student's needs and interests and will be approved by the student's advisor. When appropriate, courses not listed above may be chosen with approval of the student's advisor. Sufficient familiarity in computer languages to operate major software packages for data management and analysis is required.

Thesis Requirement

A master's thesis is required of all students. This thesis consists of a research project approved by the faculty and chosen from problems encountered within the department, in other departments of the Keck School of Medicine or university or elsewhere in the community.

Master of Science in Biostatistics

Course Requirements

General requirements include at least 37 units of required courses as follows: 26 units of core courses and at least 7 units of elective courses. Each student must also register for four units of 594ab Thesis and write a master's thesis.

CORE COURSES (26 UNITS)		UNITS
PM 510L	Principles of Biostatistics	4
PM 511abL	Data Analysis	4-4
PM 512	Principles of Epidemiology	4
PM 513	Experimental Designs	3
PM 518a	Statistical Methods for Epidemiological Studies	3
PM 522a	Introduction to the Theory of Biostatistics	4
ELECTIVES (AT LEAST 7 UNITS)		UNITS
PM 516ab	Statistical Problem Solving	1-1
PM 518b	Statistical Methods for Epidemiological Studies	3
PM 520	Advanced Statistical Computing	3
PM 522b	Introduction to the Theory of Biostatistics	4
PM 523	Design of Clinical Studies	3
PM 534	Statistical Genetics	3
PM 544L	Multivariate Analysis	3
PM 552	Survival Methods in Clinical Trials	3
PM 590	Directed Research	1-12
PM 603	Factor Analysis	4
PM 604	Health Behavior Research Methods (or MATH 506, MATH 542, MATH 543, MATH 545L, MATH 547, MATH 548, MATH 549, MATH 550, MATH 551L)	4
THESIS (4 UNITS)		
PM 594ab	Thesis	2-2

The student's choice of elective courses will be directed by needs and interests and must be approved by the student's graduate advisor. When appropriate, elective courses not listed above may be substituted with approval of the advisor. Sufficient familiarity in computer languages to operate major software packages for data management and analysis is required.

Thesis Requirement

A master's thesis is required of all students. This thesis consists of a research project approved by the faculty and chosen from problems encountered within the department, in other departments of the Keck School of Medicine or university or elsewhere in the community.

Master of Science in Clinical and Biomedical Investigations

The Master of Science in Clinical and Biomedical Investigations is a joint effort to train medical students and fellows or other health professionals in clinical research methods to translate clinical, biomedical and technological discoveries into advances in population-based, clinical or basic science

research. The program draws upon the well-established educational and research resources at the Keck School of Medicine, the Independent Health Professions and the USC School of Pharmacy, and complements the strengths of its research mentors. The M.S. in Clinical and Biomedical Investigations is specifically tailored to medical students who have completed their second year of medical school, as well as MDs doing their fellowships at USC.

The Departments of Preventive Medicine, Cell and Neurobiology, Family Medicine and the General Clinical Research Center jointly administer the program. The program oversight committee consists of faculty members representing these departments.

The M.S. in Clinical and Biomedical Investigations is designed to train students for future independent research careers in academic, government or private sector settings. The program gives students a solid background in the methodological aspects of research and in statistical thinking as applied to molecular epidemiology, as well as a solid grounding in biostatistical, epidemiological methods.

General Requirements

Graduation requires the completion of 29 units, of which a maximum of 15 units are research track core courses taken in the first year (including summer sessions), with the remaining being directed to: 590 Directed Research (1-10 units) in an approved graduate-degree granting department for which research is being conducted and 594ab Thesis (2-2 units) in the same approved department taken in the second year. The equivalent of one year of full-time effort must be devoted to research leading to a master's thesis.

Because the background and interests of applicants vary widely, one to two members of the program oversight committee will consult with each student prior to the first year to design a schedule of recommended courses. The direction of research will also be facilitated by mandatory attendance in the Recent Advances Journal Club workshop. At the end of the first year, the student must submit a final program plan to the full oversight committee. At the end of the first year, the student must submit a final program to the full oversight committee. This will summarize the courses taken, the proposed thesis title and the names and credentials of the thesis committee. One of the members of the thesis committee will be the student's research advisor and will serve as the committee chair. At least one member of the thesis committee must be from outside the student's department.

Certificate Program

Students who do not wish to pursue an M.S. degree may earn a University Certificate in Clinical and Biomedical Investigations. The certificate program requires 12 credits and a minimum of six months of practical experience working on a research project approved by the oversight committee.

Recommended Core Courses for each Research Track

PATIENT-ORIENTED TRANSLATIONAL RESEARCH		UNITS
MPTX 517	Structure and Management of Clinical Trials	4
PM 510L	Principles of Biostatistics	4
PM 512	Principles of Epidemiology	4
PM 523	Design of Clinical Studies	3
PM 570	Statistical Methods in Human Genetics, or	
BIOC 543	Human Molecular Genetics	4
		19

COMMUNITY-BASED INTERVENTION TRIALS		UNITS
PM 510L	Principles of Biostatistics	4
PM 512	Principles of Epidemiology	4
PM 526	Communications in Public Health	4
PM 528	Program Design and Evaluation	4
		16

DESIGN, CONDUCT AND ANALYSIS OF CLINICAL STUDIES		UNITS
PM 510L	Principles of Biostatistics	4
PM 511a	Data Analysis	4
PM 523	Design of Clinical Studies	3
PM 538	Introduction to Biomedical Informatics	3
PM 570	Statistical Methods in Human Genetics	4
		18

EPIDEMIOLOGY AND DISEASE ETIOLOGY		UNITS
PM 510L	Principles of Biostatistics	4
PM 512	Principles of Epidemiology	4
PM 517a	Research Methods in Epidemiology	3
PM 518a	Statistical Methods for Epidemiological Studies I	3
PM 527	Epidemiology of Infectious Disease, or	
PM 529	Environmental and Occupational Health: An Epidemiological Approach, or	
PM 533	Genetic and Molecular Epidemiology	3
		17

HEALTH OUTCOMES RESEARCH		UNITS
PM 511a	Data Analysis	4
PMEP 538	Pharmaceutical Economics	4
PMEP 539	Economic Assessment of Medical Care	4
PMEP 540ab	Seminar in Pharmaceutical Economics and Policy	2-2
		16

MOLECULAR BIOLOGY		UNITS
INTD 531	Cell Biology	4
INTD 561	Molecular Genetics	4
INTD 571	Biochemistry	4
BIOC 543	Human Molecular Genetics, or	
INTD 504	Molecular Biology of Cancer, or	
INTD 555	Biochemical and Molecular Bases of Disease, or	
MICB 551	Prokaryotic Molecular Genetics	4
		16

CELL BIOLOGY		UNITS
INTD 531	Cell Biology	4
INTD 571	Biochemistry	4
PATH 552a	Methods in Experimental Pathology	3
INTD 504	Molecular Biology of Cancer, or	
INTD 555	Biochemical and Molecular Bases of Disease	4
		15

ALTERNATIVE OPTIONS TRACK (MINIMUM 15 UNITS)

Courses are determined by mentor and student, based on research interests, with approval from the Oversight Committee.

Seminars/Workshops

Participation is required in a Recent Advances Journal Club to learn how to read papers critically and develop the speaking skills necessary to explain a research paper. Faculty members in the program rotate as course directors in order to emphasize new topics. Students are expected to attend the three-day workshop on NIH Proposal Development offered by Thomas Ogden, Ph.D., and a workshop on the principles of scientific manuscript preparation.

Master of Science in Molecular Epidemiology

Course Requirements

The M.S. program requires 37 graduate-level units with a minimum grade point average of 3.0 including epidemiology core courses, 14 units; molecular biology core courses, 12 units; at least 3 elective units; laboratory research plus thesis, 8 units. Students must also complete a master's thesis.

Prerequisite: PM 510 Principles of Biostatistics

EPIDEMIOLOGY CORE COURSES (14 UNITS)		UNITS
PM 511aL	Data Analysis	4
PM 512	Principles of Epidemiology	4
PM 518a	Statistical Methods for Epidemiological Studies	3
PM 533	Genetic and Molecular Epidemiology	3

MOLECULAR BIOLOGY CORE COURSES (12 UNITS)		UNITS
BIOC 543	Human Molecular Genetics	4
INTD 504	Molecular Biology of Cancer, or	
INTD 555	Biochemical and Molecular Basis of Disease	4
INTD 571	Biochemistry	4

ELECTIVES (AT LEAST 3 UNITS)		UNITS
PM 517a	Research Methods in Epidemiology	3
PM 523	Design of Clinical Studies	3
INTD 561	Molecular Genetics/Biology	4

LABORATORY RESEARCH + THESIS (8 UNITS)		UNITS
DPT 590abcd	Directed Research	1-1-1-1
DPT 594ab	Thesis	2-2

(1) DPT refers to the department offering the laboratory/directed research experience and thesis supervision. DPT is one of the following departments (but not restricted to): PM, BIOC, PATH.

(2) Laboratories should expose students to: statistical and epidemiological methods, molecular techniques, human genetics, population-based studies.

Master of Public Health

Course Requirements

The master's degree program in public health (M.P.H.) requires a minimum of 42-46 semester units of required and elective graduate study.

CORE REQUIREMENTS		UNITS
PM 501	Foundations in Health Education Behavior	4
PM 508	Health Service Delivery in the U.S.	4
PM 510L	Principles of Biostatistics	4
PM 512	Principles of Epidemiology	4
PM 529	Environmental and Occupational Health: An Epidemiological Approach	3

In addition, at least another 23 to 27 units including the practicum must be completed in a selected track of either health promotion, biostatistics/epidemiology, nutrition or health communication.

Track 1: Health Promotion and Disease Prevention

REQUIRED COURSES (12 UNITS)		UNITS
PM 525	Culture and Health: An International Perspective	4
PM 526	Communications in Public Health	4
PM 528	Program Design and Evaluation	4

At least 4 units from:

HP 410, HP 412, HP 420, HP 421, HP 422, HP 430, HP 450; PM 505, PM 514, PM 530, PM 601, PM 602, PM 604 (4 unit courses)

At least 3 units from:

PM 513, PM 517a, PM 517b, PM 527, PM 537 (3 unit courses); PM 511aL, PM 511bL, PM 519, PM 535, PM 536, PM 539, PM 561 (4 unit courses)

And, 8 units of a practicum (PM 593) ending in a final report.

Track 2: Biostatistics/Epidemiology

REQUIRED COURSES (AT LEAST 10 UNITS)		UNITS
PM 511aL	Data Analysis	4
Select two courses from the following:		
PM 527*	Epidemiology of Infectious Disease	3
PM 536*	Program Evaluation and Research	4
PM 537*	Chronic Disease Epidemiology	3

At least 6 units from:

PM 511bL, PM 536* (4 unit courses); PM 513, PM 517a, PM 517b, PM 518a, PM 523*, PM 527*, PM 537* (3 unit courses)

At least 3 units from:

PM 505, PM 514, PM 519, PM 525, PM 526, PM 528, PM 530, PM 535, PM 539, PM 561, PM 602; HP 410, HP 412, HP 420, HP 421, HP 422, HP 430, HP 450 (4 unit courses)

* May not receive credit for both track core and track elective category.

And, 8 units of a practicum (PM 593) ending in a final report.

Track 3: Nutrition

PREREQUISITE COURSE (4 UNITS)		UNITS
PM 530**	Biological Basis of Disease	
REQUIRED COURSES (12 UNITS)		UNITS
PM 519	Introduction to Human Nutrition	4
PM 528	Program Planning and Evaluation	4
PM 535	Nutrition in Public Health	4

At least 4 units from:

PM 539, PM 540, PM 541, PM 561 (4 unit courses)

At least 3 units from:

HP 410, HP 412, HP 420, HP 421, HP 422, HP 450 (4 unit courses); PM 513, PM 517a, PM 527, PM 537 (3 unit courses); PM 505, PM 511aL, PM 511bL, PM 514, PM 525, PM 526, PM 536, PM 602 (4 unit courses)

**May waive if student demonstrates sufficient preparation. Units not required for degree.

And, 8 units of a practicum (PM 593) ending in a final report.

Track 4: Health Communication

REQUIRED COURSES (8 UNITS)		UNITS
COMM 581	Media and the Social Services: Design and Evaluation of Campaigns, or	
PM 526	Communications in Public Health	4
PM 536	Program Evaluation and Research	4

At least 8 units from:

COMM 510, COMM 520, COMM 528, COMM 530, COMM 575, COMM 582, COMM 583, COMM 587 (4 unit courses)

At least 3 units from:

PM 513, PM 517ab, PM 527, PM 537 (3 unit courses); PM 505, PM 511ab, PM 514, PM 519, PM 525, PM 528, PM 530, PM 535, PM 539, PM 561, PM 602 (4 unit courses); HP 410, HP 412, HP 420, HP 421, HP 422, HP 430, HP 450 (4 unit courses).

And, 8 units of a practicum (PM 539) ending in a final report.

The elective courses will be directed by the student's needs and interests and must be approved by the student's graduate advisor. Sufficient familiarity in computer languages to operate major software packages for data management and analysis is required.

Practicum Requirement

A practicum, PM 593, is required of all students as part of the culminating experience to the master's program. It is provided by an internship rotation through an area of public health practice in a county, state, federal or community-based agency. The practicum offers students the opportunity to observe as well as participate in applying their newly acquired skills and tools. All students are expected to participate in at least one internship and attend a corresponding seminar. A final report and presentation describing the project and evaluating the outcomes completes the course requirement.

Criteria

Students entering the program with clinical training (e.g., M.D., R.N., R.D., O.T., P.T., D.D.S., clinical psychology, social work, veterinary medicine or R.Ph.) may apply for a waiver to complete 4 units of practicum (instead of 8 units) ending in a final report and presentation.

Doctor of Philosophy in Psychology (Clinical)/Master of Public Health (Health Promotion)

The Ph.D./M.P.H. dual degree combines knowledge of clinical psychology research and practice with an understanding of health from a population perspective. The student enrolls primarily in the clinical psychology doctoral program and may apply to the M.P.H. program during the first year. During the second and subsequent years, course work is taken in both programs. The dissertation is undertaken through the Department of Psychology.

Pharm.D./Master of Public Health

The School of Pharmacy and the Master of Public Health program, in recognition of the rapidly changing health care environment and in response to the growing demand for pharmacists who are knowledgeable in both pharmacy and population-based health care issues, have developed a dual degree program. The joint Pharm.D./M.P.H. degree will enable graduates to be more responsive to today's health care needs and will provide training for pharmacists who seek to be agents of change within the profession and to assume leadership roles in the pharmacy field and in public health at the local, state and national levels.

The Pharm.D./M.P.H. program spans five years (four years of pharmacy school courses and one year of public health courses). Students begin the core M.P.H. courses following the successful completion of the first year of pharmacy school. The last three years of the program are devoted to the clinical rotations of the School of Pharmacy and to the completion of the elective courses and practicum (field experience) of the M.P.H. program.

At the conclusion of the joint degree program, students will have completed 46 units in the Master of Public Health program and four years of courses in the School of Pharmacy.

All students in the Pharm.D./M.P.H. program must meet course requirements, grade point average requirements and program residency requirements of both programs. Students must have a cumulative GPA of 3.0 in the Pharm.D. curriculum and a 3.0 in the M.P.H. curriculum to meet graduation requirements.

The Pharm.D. and the M.P.H. degrees are awarded simultaneously upon completion of the School of Pharmacy and the Master of Public Health requirements.

Application and Admissions Requirements

Students may apply to the dual Pharm.D./M.P.H. degree program in two ways. First, they may apply at the time they submit their Pharm.D. application by concurrently submitting applications to both programs. Students who elect this approach must identify themselves on both applications as potential dual degree students. Students admitted to both programs will be offered admission to the Pharm.D. and will be offered admission to the dual degree program contingent on passing all courses in their first year of the Pharm.D. with a minimum 3.0 G.P.A. Students who are accepted only by one program may choose to attend that program but will not be eligible for the dual degree. Second, students can apply to the dual degree by submitting an application to the M.P.H. program during their first year of enrollment in the Pharm.D. prior to the M.P.H. published application deadline. Students who elect this approach must apply through the School of Pharmacy. Students admitted to the M.P.H. program using this approach will be offered admission to the dual degree contingent on passing all courses in their first year of the Pharm.D. with a minimum 3.0 G.P.A. Students accepted to the dual degree program must maintain a minimum 3.0 G.P.A. in Public Health and Pharm.D. courses.

M.D./Master of Public Health

The joint M.D./M.P.H. program at the Keck School of Medicine is designed for individuals who envision a medical career that combines public health and medical disciplines. For further information about the joint program, refer to page 651.

Doctor of Physical Therapy/Master of Public Health

The Post Professional Doctor of Physical Therapy (D.P.T.) and the Master of Public Health (M.P.H.) dual degree program offers the opportunity for physical therapy clinicians to

pursue a doctoral-level education in combination with an integrated approach to health care. The program spans four years. Students begin the first one to two years completing M.P.H. core and elective course work in the Department of Preventive Medicine. The remaining two years are devoted to program requirements in physical therapy. At the conclusion of the program, students will have completed 68 units of course work, including a public health practicum.

Doctor of Philosophy in Biostatistics

The department offers a degree program leading to the Ph.D. in biostatistics. The program is designed to produce biostatisticians who will have in-depth knowledge of statistical theory and methodology and the ability to apply this knowledge creatively to statistical problems in the biological and health sciences.

Course Requirements

A minimum of 60 units of graduate study is required for the Ph.D. degree; a maximum of 19 of these units may be from research and dissertation. In preparation for the screening examination, all students must take the required and elective courses for the M.S. in Biostatistics (33 units). In preparation for the qualifying examination, all students are required to take PM 610 (at least two semesters). The student is also required to take at least six units from the following sequence: PM 543L, PM 544L, PM 550 or PM 552.

Screening Procedure

A student failing the screening examination will either terminate or will terminate with the M.S. degree upon completion of an acceptable thesis.

Guidance Committee

A formal guidance committee consisting of five faculty members — four from within the department (one of whom is designated as chair), and one from an outside department offering the Ph.D. degree — will recommend courses in preparation for the qualifying examination.

Qualifying Examination

The qualifying examination will test the student's integration of knowledge in biostatistics, mathematical statistics and the health sciences. An oral examination will ascertain the student's competence in orally communicating this knowledge. Students must pass the written portions and the oral portions in order to pass the qualifying examination.

Dissertation and Oral Defense

Upon passing the qualifying examination the Ph.D. candidate and his or her chair will recommend a three-member dissertation committee. The dissertation should be completed within two years and should be oriented

toward a theoretical-methodological application to a problem area in the biological or health sciences. The oral defense is based on a rough draft or final version of the dissertation. The defense is administered by the dissertation committee, with other faculty invited to attend.

Doctor of Philosophy in Epidemiology

The department offers a degree leading to the Ph.D. in epidemiology. This program may be an extension of the applied biostatistics and epidemiology M.S. program and is especially aimed at persons with a strong background in medicine: in particular, students enrolled in the M.D. program of the Keck School of Medicine who wish to interrupt their M.D. studies after two years to complete a Ph.D. degree. This program is designed to produce an epidemiologist with in-depth statistical skills. The program requires a solid core of courses in methodological aspects of statistics and in statistical thinking as applied to medicine, as well as a solid grounding in epidemiological methods and in certain medical disciplines.

Course Requirements

A minimum of 60 course units with a maximum of 20 units of research and dissertation; passing of screening and qualifying examinations; and completion of dissertation and final oral are required. In preparation for the screening examination the student must take the required core course and elective 33 units of master's level applied biostatistics and epidemiology courses. A student failing the screening examination will either terminate or terminate with the M.S. degree upon satisfactory completion of a master's thesis. In preparation for the qualifying examination, the student is required to join an on-going research project under the direction of the chair of the guidance committee and directly participate in the conduct of that project. Credit will be given as PM 790 (4 units, two semesters). In addition, it is recommended that the student take PM 610 (at least two semesters) and PM 611. Electives may be selected with the approval of the chair of the guidance committee from courses in the biological sciences or from the medical school. For students in the M.D./Ph.D. program in epidemiology, satisfactory completion of the first two years of the M.D. program will be considered to provide 20 units toward the Ph.D. degree.

Guidance Committee

A formal guidance committee, consisting of five faculty members, with at least three from the Department of Preventive Medicine (one designated as chair) and one from a department offering a Ph.D. outside of the Department of Preventive Medicine, will recommend courses in preparation for the qualifying examination.

Qualifying Examination

The written portion of the qualifying examination will test the student's integration of knowledge in biostatistics and medicine. In general, the qualifying examination will present plans for implementation and completion of three components: an independent and complete data analysis arising from ongoing epidemiological study, a "review" paper on an area of epidemiological research, and a grant application for a new epidemiological study.

Dissertation

Upon passing the qualifying examination, the Ph.D. candidate and his or her chair will recommend a three-member dissertation committee. The dissertation should be completed within two years and should be oriented toward a methodological application to a problem area in the biological or health sciences.

The Oral Defense

This examination is based on a draft or final version of the dissertation and will be administered by the dissertation committee with other faculty invited to attend.

Language and Other Requirements

Proficiency in the English language is essential.

Doctor of Philosophy in Molecular Epidemiology

The Doctor of Philosophy in molecular epidemiology combines molecular and population-based research. The objective of the Ph.D. program is to produce a molecular epidemiologist with in-depth laboratory, statistical and analytical skills in both epidemiology and the molecular biosciences. Applicants who have undergraduate or master's degrees in quantitative biological sciences or other related fields and graduate students in the PIBBS program at USC are encouraged to apply. The program is jointly administered by the Departments of Preventive Medicine and Biochemistry and Molecular Biology.

Course Requirements

Students must complete a minimum of 60 units, with a maximum of 20 units of research and dissertation; pass screening and qualifying examinations; complete the dissertation and the dissertation defense examination. In addition the student is required to join a research project under the direction of one or both of the chairs of the guidance committee and directly participate in the conduct of that project. Credit will be given by the department (DPT) conducting the research project DPT 790 Research (4 units, 2 semesters). In addition, at least two semesters of PM 610 is recommended.

Prerequisites: PM 510 Principles of Biostatistics or the equivalent. INTD 571 Biochemistry or the equivalent.

Biochemistry and Molecular Biology Core Courses (16 units): BIOC 543, INTD 531, INTD 561, INTD 504 or INTD 555.

Preventive Medicine Core Courses (17 units): PM 522aL, PM 512, PM 517a, PM 518a, PM 533.

Suggested Electives (at least 7 units) from: BIOC 602, MICB 551, PHBI 581, PM 511bL, PM 517b, PM 523, PM 527, PM 529 and PM 534.

Preparation for Screening Examination

The screening examination will be taken after two years in the program. Prior to the screening examination a mentor who will serve on the guidance committee must be identified. The screening examination will consist of a written component and an oral component. The written component will be drawn from the core courses. A student failing the screening examination may be given a second opportunity to retake either one or both portions. Students failing the examination for the second time will terminate with the M.S. degree upon satisfactory completion of 37 units and an acceptable master's thesis.

Annual Research Appraisal (ARA)

Beginning in the second year, each student must register for PM 610 (1 unit) and present an annual progress report to the program oversight committee. Once a dissertation topic has been selected, the annual progress report is presented to the student's guidance committee. Once the student has passed the qualifying examination and is appointed to candidacy, the annual progress report is presented to the student's dissertation committee. The student will meet annually with the dissertation committee, until he or she graduates from the program. The oral portion of the screening examination as well as the qualifying examination and the defense examination will count as ARAs.

Guidance Committee

A formal guidance committee will be formed, consisting of five faculty members: two from the Department of Preventive Medicine (one member designated as co-chair); two from the basic science departments (one designated as co-chair with an appointment in biochemistry and molecular biology) and one from an outside department offering a Ph.D. degree (neither preventive medicine or biochemistry and molecular biology). The guidance committee will recommend courses in preparation for the qualifying examination based on the student's research and dissertation topic.

Qualifying Examination

The dissertation topic should be both population-based and functional-based; the molecular/epidemiological nature of the dissertation topic must be agreed on by the guidance committee co-chairs.

Dissertation and Oral Defense

Upon passing the qualifying examination, the Ph.D. candidate and his or her chair will recommend a dissertation committee (typically all five members of the guidance committee). However, the university requires only three members; a three-member dissertation committee must consist of the co-chairs and the outside member. The dissertation should be completed within two years of the qualifying examination. The oral defense examination is based on the final version of the dissertation and will be administered by the dissertation committee and other invited faculty and students. The defense examination should contain a summary of the review article, the completed research and data analyses and the finalized grant proposal.

Doctor of Philosophy in Preventive Medicine (Health Behavior Research)

The Department of Preventive Medicine, Division of Health Behavior Research, offers a degree program in preventive medicine (health behavior), leading to attainment of the Ph.D. The program is designed to train exceptional researchers and scholars in the multidisciplinary field of health behavior research. Students receive a thorough grounding in academic and research experience, encompassing theoretical and methodological training in such allied fields as communication, psychology, preventive medicine, biostatistics, public health and epidemiology. Students receive research experience by participating in projects conducted through the USC Institute for Health Promotion and Disease Prevention Research (IPR). The doctoral program is full-time: students are expected to enroll for fall, spring and summer semesters.

Assistantships

Financial and educational support is provided to qualified doctoral students in health behavior research. Graduate (research and/or teaching) assistantships are half-time (20 hours per week) and provide tuition remission as well as a monthly stipend.

Computer Language Requirement

Sufficient familiarity in computer languages to operate major software packages for data management and analysis is required.

Course Requirements

The doctoral program in health behavior research is structured as a four to five year course of study for students entering with a bachelor's degree. Time requirements are subject to review and approval by the

division's Graduate Program Committee and the Graduate School.

A total of 60 units of graduate study is required for the Ph.D. in health behavior research. Students are required to complete nine core courses: PM 500, PM 511aL, PM 515, PM 530, PM 601, PM 602, PM 604 and PM 756 (total of 37 units). Other requirements include: two elective PM courses, one not offered by health behavior faculty (minimum of 7 units); and a minimum of 4 units each in PM 590, PM 690abcdz, PM 790 and PM 794abcdz.

For students entering with a bachelor's degree, one of the directed research projects will be equivalent in scope to a master's thesis. All research experiences/projects must be completed before registering for 794abcdz Doctoral Dissertation.

Screening Procedure

The progress of each student is reviewed at the end of every academic year. At the end of the second year of study, students who have not made satisfactory progress are advised that they will be dropped from the program unless their progress improves during their second year.

Guidance Committee

Each student's guidance committee consists of five members, including: no more than three health behavior faculty members; one other member from the Department of Preventive Medicine; and one member from a doctorate-granting program outside the Department of Preventive Medicine, representing the student's minor field.

Qualifying Examination

Following course work and prior to beginning the dissertation, students must demonstrate written and oral mastery of the general field of health behavior research as well as of their chosen area of specialization. The qualifying process includes a written examination on theory and literature relevant to a selected content area. The examination is administered by the student's guidance committee.

In addition to the qualifying examination, each student is expected to produce the following as evidence of qualification to conduct dissertation research: an academic dossier consisting of a summary of the student's academic record, teaching and research experience, and professional presentations and publications; at least one original empirical research paper of publishable quality, produced in connection with one of the student's courses or research experiences or developed independently; a dissertation proposal; and an oral defense of all the preceding materials.

Doctor of Philosophy in Statistical Genetics and Genetic Epidemiology

The program gives students a solid background in the methodological aspects of biostatistics and statistical genetics as well as solid grounding in molecular/laboratory science. The objective of the Ph.D. program is to produce a statistical geneticist or genetic epidemiologist with in-depth statistical and analytic skills in biostatistics, computational methods and the molecular biosciences. The program combines biostatistics, epidemiology, statistical and molecular genetics and computational methods in order to develop new and cutting-edge statistical methodology appropriate for human genomic studies.

Course Requirements

Graduation requires the completion of a minimum of 60 units, with a maximum of 20 units of research and dissertation, passing of screening and qualifying examinations, completion of the dissertation and the dissertation defense examination. Because the background of applicants varies widely, the program oversight committee consults with each student to design an individualized schedule of recommended courses. Electives may be selected (with the approval of the chair) from courses in preventive medicine, biological sciences, mathematics, and computational biology. For students in the M.D./Ph.D. program in statistical genetics and genetic epidemiology, satisfactory completion of the first two years of the M.D. program will be considered to provide 20 units toward the Ph.D. degree. After passing the screening examination, each student should register for at least two semesters of PM 610. Prior to passing the qualifying exam, each student must present an annual progress report (the Annual Research Appraisal, ARA) to the program oversight committee.

CORE COURSES (25-26 UNITS)

PM 511abL	Data Analysis	4-4
PM 518a	Statistical Methods for Epidemiological Studies I	3
PM 534	Statistical Genetics	4
PM 522a	Introduction to Theory of Biostatistics (E), or	4
MATH 541a	Introduction to Mathematical Statistics (S)	3
PM 533	Genetic and Molecular Epidemiology	3
PM 570	Statistical Methods in Human Genetics	4

RECOMMENDED ELECTIVE COURSES

BISC 478	Computational Genome Analysis (S, E)	4
BISC 505	Genomics and Molecular Genetics (S, E)	4
BIOC 543	Human Molecular Genetics (S, E)	4
BIOC 602	Current Topics in Human Molecular Genetics (E)	2
INTD 504	Molecular Biology of Cancer (E)	4
INTD 531	Cell Biology (E)	4
INTD 555	Biochemical and Molecular Bases of Disease (E)	4
INTD 561	Molecular Genetics (E)	4
INTD 571	Biochemistry (E)	4
MATH 505a	Applied Probability (S)	3
MATH 541ab	Introduction to Mathematical Statistics (S)	3-3
MATH 577ab	Computational Molecular Biology Laboratory (S)	2-2
MATH 578	DNA and Protein Sequence Analysis (S)	3
PM 510L	Principles of Biostatistics (S, E)	4
PM 512	Principles of Epidemiology (S, E)	4
PM 517ab	Research Methods in Epidemiology (E)	3-3
PM 520L	Advanced Statistical Computing (S)	3
PM 538	Introduction to Biomedical Informatics (S, E)	3
PM 544L	Multivariate Analysis (S)	3
PM 610	Seminar in Biostatistics/Epidemiology (S, E)	1, max 4
PM 611	Advanced Topics in Epidemiology (S, E)	3

(S) Statistical genetics track

(E) Genetic epidemiology track

Screening Procedure

The screening examination will be taken after two years in the program. Prior to the screening examination, a mentor who will serve on the guidance committee must be identified. The screening examination will consist of a written and oral component. The written component is a two-day examination that tests the student's knowledge of both theory and applications, drawn from the core courses. The oral portion comprises a one-hour presentation of a research plan that encompasses the student's own ideas and will constitute the annual research appraisal. A student failing the screening examination may be given a second opportunity to retake either one or both portions of the screening examination. Students failing the examination for the second time will terminate with the M.S. in Applied Biostatistics and Epidemiology upon satisfactory completion of 37 units (33 course units and 4 units of PM 594ab) and an acceptable master's thesis.

Guidance Committee

A formal guidance committee will be formed, consisting of five faculty members; at least one member from the Department of Preventive Medicine designated as chair, and one from an outside department offering a Ph.D. degree. The guidance committee will recommend courses in preparation for the qualifying examination based on the student's research and dissertation topic.

Qualifying Examination

Prior to the qualifying examination, a written draft of the dissertation proposal must be submitted to the Guidance Committee. The dissertation topic should be both population-based and functionally-based. The dissertation for the statistical genetics track will typically consist of (a) a "review" paper on current statistical genetic methods, (b) a proposal for a new methodological approach, (c) evaluation of the new methodological approach from a theoretical and/or computational perspective, and (d) application to real data arising from genetic research. Typically, the dissertation proposal should contain a near-completed draft of (a) and (b) and preliminary results from (c) and (d).

The dissertation for the genetic epidemiology track will typically consist of: (a) a "review" paper on an area of genetic epidemiological research, (b) an independent and complete data analysis arising from an ongoing genetic epidemiological study and (c) a grant application for a new genetic epidemiological study. The review paper (a) typically will provide the rationale and context for the data analysis (b). Typically, the dissertation proposal should contain a nearly completed draft of (a), preliminary results from (b) and preliminary plans for (c).

Dissertation and Oral Defense

Upon passing the qualifying examination, the Ph.D. candidate and his or her chair will recommend a dissertation committee (typically all five members of the guidance committee; however, the university requires only three members. (A three-member dissertation committee must consist of the chair and the outside members). The dissertation should be completed within two years of the qualifying examination. The oral defense examination is based on the final version of the dissertation and will be administered by the dissertation committee and other invited faculty and students.

Courses of Instruction

HEALTH PROMOTION AND DISEASE PREVENTION STUDIES (HP)

The terms indicated are *expected* but are not *guaranteed*. For the courses offered during any given term, consult the *Schedule of Classes*.

200 Introduction to Health Promotion and Disease Prevention (4, FaSp) Introduction to strategies for promoting health and wellness. Includes self monitoring of health risk behavior, goal setting, and behavior changes.

230 Nutrition and Health (4, FaSp) Nutrition as it relates to health promotion across the lifespan and disease prevention. Discussion of nutrients, factors affecting food choices, food safety and global nutrition issues.

290 Introduction to Research Apprenticeship (2-8, max 8, FaSpSm) Individual research apprenticeship in health related fields under supervision of a departmental faculty member. Graded CR/NC. Departmental approval.

300 Theoretical Principles of Health Behavior (4, Fa) Overview and analysis of predictors and consequences of health-related behaviors; theoretical viewpoints and strategies for behavior change. *Recommended preparation:* HP 200. *Prerequisite:* PSYC 100.

320 Biological and Behavioral Basis of Disease (4, Fa) Examination of the major systems of the human body; disease processes and behavioral risk factors. *Prerequisite:* BISC 120L or BISC 121L.

340L Health Behavior Statistical Methods (4, FaSp) Intermediate statistics for health behavior studies; topics include descriptive statistics, hypothesis testing, correlation and regression, and use of computer software in data analysis.

350L Health Behavior Research Methods (4, Sp) Introduction to the design, conduct and evaluation of health behavior research studies; quantitative and qualitative approaches to research and analysis. *Recommended preparation:* HP 340L.

400m Culture, Lifestyle, and Health (4, Fa) Comparison of national and international differences in health status as influenced by cultural practices and lifestyles within geographic, economic and political environments.

401 Cultural Competence: Promoting Health in Diverse Communities (4, Sp) Systematic development of specific professional skills for providing effective, culturally sensitive health services to diverse populations. *Prerequisite:* HP 200; *recommended preparation:* ANTH 101.

402 Maternal and Child Health (4, Sp) Health issues of women of childbearing age from pre-pregnancy through the postpartum period, and of children from their development in utero through early adolescence. *Prerequisite:* HP 200; *recommended preparation:* PSYC 100.

403 Behavioral Medicine (4, Sp) Examines behavioral risk factors for illness, health enhancing and health compromising behaviors, stress/coping in promoting health and preventing illness, and behavioral management of chronic illness. *Prerequisite:* HP 200, PSYC 100.

410 Issues in Prevention and Cessation of Drug Abuse (4, Sp) Examination of factors related to drug abuse behaviors; overview and assessment of drug abuse prevention and cessation programs; relapse prevention programs. *Recommended preparation:* HP 300.

411 Drug Intervention Program Design and Evaluation (4, Sp) Strategies for drug abuse prevention and intervention; introduction to techniques and research methods used in designing, conducting, and evaluating drug abuse prevention programs. *Recommended preparation:* HP 410.

412 Health Promotion and Prevention Policy (4, Sp) Overview of health promotion and drug prevention policy at local, state, and federal levels; methods for evaluating policy effectiveness and cost effectiveness.

420m Gender and Minority Health Issues (4, Fa) Examines the nature and roots of health disparities among women, men, and different ethnic and age groups; methods for reducing such disparities; strategies for prevention services.

421 Violence as a Public Health Issue (4, Fa) Patterns and prevalence of violence; psychosocial, environmental, and biological influences on violent behavior; youth gangs; drugs and violence; family violence; and prevention and intervention strategies.

422 AIDS in Society (4, Sp) Provides a broad examination of issues in HIV/AIDS, including behavioral, social, biological, clinical and ethical dimensions of the pandemic in the U.S. and elsewhere.

430 Nutrition and Exercise Epidemiology (4, Fa) Principles of nutritional assessment and dietary needs of special population groups; meal planning and exercise prescriptions during the lifecycle and for groups with chronic diseases. *Prerequisite:* HP 230.

431 Behavior and Education Strategies for Nutrition and Fitness (4, Sp) Examination of dietary intake and exercise behaviors as they relate to health and illness; methods for measuring diet and exercise. *Recommended preparation:* HP 430.

432 Clinical Nutrition (4, Sp) Metabolism of carbohydrates, fats and protein; introduction to vitamins, minerals and dietary modifications in various pathological conditions. *Prerequisite:* BISC 306Lx, CHEM 322aL.

433 Advanced Topics in Nutrition (4, Sp) In-depth discussion of vitamins and minerals and their role in human nutrition; introduction to the role of vitamins and minerals in selected pathological conditions. *Prerequisite:* HP 432.

441 Health Promotion in the Workplace (4, Fa) Covers phases of worksite health promotion; research, design, implementation and evaluation; concerns regarding escalating medical costs and the role of health promotion in offering solutions.

442 Chronic Disease Epidemiology (4, Sp) Overview of causative factors and demographic distributions of the major chronic diseases in the western world; epidemiologic concepts and research designs. *Recommended preparation:* HP 320.

443 Health Communication Strategies and Evaluation (4, Fa) Examination of how communication affects health behavior; role of doctor-patient contacts, social groups, community health campaigns, images in media, and advanced communication technologies.

450 Traditional Eastern Medicine and Modern Health (4, Fa) Overview of traditional Eastern approaches toward health and disease; relevance to modern health issues, emphasizing a comparison between traditional Chinese and modern Western medicine. *Recommended preparation:* fundamentals of medicine.

460 Adolescent Health (4, Fa) Survey of the development of healthy and the prevention of health-risk behaviors during adolescence. Prevention and promotion techniques will be explored emphasizing cultural differences. *Prerequisite:* HP 200, PSYC 100.

480 Internship in Health Promotion and Disease Prevention (2-4, max 4, FaSpSm) Field placement in a community agency such as a county health services agency, a not for profit voluntary agency or a health care setting. Open to majors only. Graded CR/NC. *Prerequisite:* completion of concurrent registration in required core courses.

490x Directed Research (2-8, max 8, FaSpSm) Individual research and readings. Not available for graduate credit. Open to HP majors only. *Corequisite:* HP 340L; *recommended preparation:* HP 350L.

PREVENTIVE MEDICINE (PM)

500 Foundations of Health Behavior (4, Fa) Overview of behavioral theory and research in disease prevention and health promotion and in adaptation of chronic disease, including an introduction to measures of outcomes. *Prerequisite:* admission to Ph.D. in Preventive Medicine or departmental approval.

501 Foundations in Health Education Behavior (4, Fa) Overview and application of behavioral theories to the field of health education and promotion. Examines the determinants of health behavior and strategies for change at the individual, group and community level.

505 Training and Curriculum Design in Public Health (4, Fa) Curriculum writing and training skills applied to public health needs and settings. Covers adult learning theories, assessment of learning needs, curriculum design, training design, conduct and evaluation. *Recommended preparation:* PM 500.

508 Health Service Delivery in the U.S. (4, Fa) Historical development of the American health care system; determinants of health care utilization; role of health care providers; health policy; public health services; and health care finance.

510L Principles of Biostatistics (4) Concepts of biostatistics; appropriate uses and common misuses of health statistics; practice in the application of statistical procedures; introduction to statistical software including EXCEL, SPSS, nQuery. Laboratory.

511abL Data Analysis (4-4, a: Fa, b: Sp) a: Major parametric and nonparametric statistical tools used in biomedical research, computer packages including SAS. Includes laboratory. Lecture, 3 hours; laboratory, 1 hour. *Prerequisite:* PM 510L. **b:** Exploratory data analysis, detection of outliers, robust methods, fitting data with linear and nonlinear regression models, computer packages including BMDP. Includes laboratory. Lecture, 3 hours; laboratory, 1 hour. *Prerequisite:* PM 511aL.

512 Principles of Epidemiology (4, Fa) Terminology/uses of epidemiology and demography; sources/uses of population data; types of epidemiologic studies; risk assessment; common sources of bias in population studies; principles of screening. *Recommended preparation:* algebra.

513 Experimental Designs (3, Sp) Statistical methods for analysis of various experimental designs. Parametric analysis of variance (ANOVA), repeated measures methods, crossover designs, non-parametric ANOVA. *Prerequisite:* PM 510L.

514 An International Perspective on Sexually Transmitted Diseases (4, Sm) Design and management of STD prevention and control programs in international settings; overview of major STDs and regional differences; strategic planning and evaluation of STD programs. *Recommended preparation:* PM 500.

515 Behavioral Epidemiology (3, 2 years, Sp) Basic understanding of behavioral risk factors in chronic disease and premature mortality; epidemiological research methods for studying behavioral risk factors. *Recommended preparation:* PM 512.

516ab Statistical Problem Solving (1-1, FaSpSm) An overview of the tools used by statisticians for solving statistical problems. *Prerequisite:* PM 510L.

517ab Research Methods in Epidemiology (a: 3, Fa, b: 3, Sp) a: Study design, ascertainment of study objects, questionnaire development, various methodological issues in data analysis and interpretation including bias, measurement error, confounding and effect modification. *Prerequisite:* PM 511aL, PM 518a. **b:** Overview of epidemiologic research in cancer. Selected cancer sites will be covered to highlight study design and conduct, exposure assessment, data analysis and interpretation. *Prerequisite:* PM 517a.

518ab Statistical Methods for Epidemiological Studies I, II (3-3) a: Principles and methods used in epidemiology for comparing disease frequencies between groups. Restricted to the analysis of binary outcome variables. *Prerequisite:* PM 512. **b:** Statistical methods for binary outcomes by introducing techniques for cross classified risks and rates and regression models for individual data. *Prerequisite:* PM 518a.

519 Introduction to Human Nutrition (4, Sp) Dietary role of carbohydrates, proteins, lipids, vitamins, and minerals in metabolism; nutritional assessment; nutritional deficiencies. Focus on the role of nutrition in the prevention and treatment of chronic disease. (Duplicates credit in former PHNU 527.) *Recommended preparation:* PM 530.

520L Advanced Statistical Computing (3, FaSm) Techniques for the solution of statistical problems through intensive computing; iterative techniques, randomization tests, the bootstrap, Monte Carlo methods.

521ab Seminar in Nutrition (2-2, FaSp) (Duplicates credit in former PHNU 520ab.)

522ab Introduction to the Theory of Biostatistics (4, Fa; 4, Sp) a: Density distribution and hazard functions; normal, chi-square, student's t and F distributions; and sampling procedures for single factor and multiple factor designs, distributions. *Prerequisite:* undergraduate differential and integral calculus. **b:** Theory of estimation and testing, determining structure in data, and sampling methods. *Prerequisite:* PM 522a.

523 Design of Clinical Studies (3) Design, conduct, and interpretation of results of clinical trials; emphasis on principles affecting structure, size, duration of a trial, and the impact of ethical and practical considerations. *Prerequisite:* PM 511abL, PM 513.

524abc Practicum in Health Behavior (2-2-2, FaSpSm) Practical experience in a variety of field settings to gain a certain type of skill such as curriculum development, media production, and patient education. **a:** Practicum in prevention; **b:** practicum in compliance; **c:** practicum in health behavior topics. *Recommended preparation:* PM 500.

525 Culture and Health: An International Perspective (4, Fa) International variations in health status with a focus on the impact of socioeconomic status, politics, environment, education and gender in etiology of illness, access to health care, progression of disease, and recovery.

526 Communications in Public Health

(4, Sp) Application of communication theories and methods to community health problems. Includes background assessment, program design, evaluation, social marketing, media advocacy, review of major health campaigns. *Recommended preparation:* PM 500.

527 Epidemiology of Infectious Disease

(3, FaSp) Survey of natural history of infectious disease, methods of disease control and outbreak investigation. *Prerequisite:* PM 512.

528 Program Design and Evaluation (4, Sp)

Core concepts, methods and values of public health program planning and evaluation, including community needs assessment, writing objectives, designing health promotion programs, process and outcome evaluation. *Recommended preparation:* PM 500.

529 Environmental and Occupational Health: An Epidemiological Approach

(3, Sp) An overview of environmental health, identifying issues in assessing effects of exposure on health and potential interventions for reducing adverse health risks. *Prerequisite:* PM 510L, PM 512.

530 Biological Basis of Disease (4, 2 years, Sp)

With a physiological overview, differentiates genetic and environmental disease; emphasis on the relationships between lifestyle, behavior, and health. *Prerequisite:* admission to Ph.D. in Preventive Medicine, Health Behavior Research or basic biology.

533 Genetic and Molecular Epidemiology

(3, Fa) Genetic principles; design and analysis of family studies; introduction to likelihood estimation; segregation and linkage analysis; biomarkers of exposure, susceptibility, and disease; laboratory methods; susceptibility genes; association and linkage disequilibrium. *Prerequisite:* PM 510L, PM 511a, PM 512, PM 518a.

534 Statistical Genetics (4, Sp) Familial aggregation, segregation analysis, linkage analysis, association, regressive models, gene-environment interactions, genetic heterogeneity and linkage disequilibrium. *Prerequisite:* PM 518a, PM 522a.

535 Nutrition in Public Health (4, Fa) Principles related to developing effective programs and services to improve the health and nutrition within a community. Attaining and maintaining nutritional health related to biology, lifestyle choices, environments, and health care delivery systems. (Duplicates credit in former PHNU 523.) *Recommended preparation:* PM 530.

536 Program Evaluation and Research

(4, Fa) Overview of concepts, tools, data collection, analysis methods and designs used to evaluate health promotion programs. Examples from substance abuse prevention, family planning and reproductive health programs.

537 Chronic Disease Epidemiology (3, Sp)

Overview of causative factors and demographic distribution of major chronic diseases in the western world. Epidemiologic concepts, methods and research design as applied to chronic disease prevention will be emphasized. *Prerequisite:* PM 512; *recommended preparation:* PM 527.

538 Introduction to Biomedical Informatics

(3, Fa) Overview of current topics, enabling technologies, research initiatives, and practical considerations in biomedical informatics.

539 Nutrient-Drug Interactions (4, Fa)

Examines the various ways foods, and the nutrients contained in them, interact with medications used to treat chronic health conditions. *Prerequisite:* PM 519; *recommended preparation:* PM 530.

540 Maternal and Child Health and Nutrition (4, Sp)

Public health issues and appropriate interventions relating to maternal and child health and nutrition. (Duplicates credit in former PHNU 540.) *Recommended preparation:* PM 530.

541 Obesity, Metabolism and Health

(4, Fa) Overview of the epidemiology of obesity, related health conditions and mechanisms related to energy balance, food intake and genetics. Discussion of prevention and treatment strategies. *Recommended preparation:* PM 530.

542 Social Network Analysis (4, Sp)

Theory, methods and procedures of network analysis with emphasis on applications to public health programs.

543L Nonparametric Statistics (3) (Enroll in MATH 543L)

544L Multivariate Analysis (3, 2 years, Sp)

Exploratory and inferential techniques for multivariate data, Hotelling's T², multivariate analysis of variance, classification analysis, principle components, cluster analysis, factor analysis. Involves computer use. *Prerequisite:* PM 510L, PM 522a.

545L Introduction to Time Series (3) (Enroll in MATH 545L)

550 Sample Surveys (3) (Enroll in MATH 550)

552 Statistical Methods in Clinical Trials

(3, 2 years, Sp) Stochastic failure process; parametric models for survival data; sample size estimation procedures for clinical trials; multivariate regression models for binary outcome and censored survival data; computer programs; multiple failure modes and competing risks. *Prerequisite:* PM 518a, MATH 408.

561 Behavioral Theories in Nutrition and Fitness (4, Fa)

Overview of behavior theory as it pertains to nutrition and fitness; the use of theoretical models to develop dietary and physical activity intervention models. (Duplicates credit in former PHNU 561.) *Recommended preparation:* PM 501.

570 Statistical Methods in Human Genetics

(4, Sp) An introductory course in the statistical methods used in the analysis of human genetic data. *Prerequisite:* PM 533.

571 Applied Logistic Regression (3, Sm)

An introduction to the logistic regression model, emphasizing practical data analysis techniques. *Prerequisite:* PM 510L; PM 512; and PM 511aL or PM 518a.

590 Directed Research (1-12, FaSpSm)

Research leading to the master's degree. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

592abz Directed Field Research in Health Behavior (1-12, Sm)

Research leading to the advanced degree. Graded CR/NC.

593 Public Health Practicum (4 or 8, FaSpSm)

Field placement in a community agency, such as a county health department or community-based organization. Open to MPH candidates only. Graded CR/NC. *Recommended preparation:* completion of all course work.

594abz Master's Thesis (2-2-0, FaSpSm)

Credit on acceptance of thesis. Graded IP/CR/NC.

599 Special Topics (2-4, max 8, Irregular)

Special topics relevant to the study of selected issues and areas of health behavior research or other aspects of preventive medicine.

601 Basic Theory and Strategies in Prevention (4, 2 years, Fa)

Psychosocial basis of health-hazardous lifestyle behaviors and preventive strategies. *Recommended preparation:* PM 500, PM 515.

602 Basic Theory and Strategies for Compliance/Adaptation (4, 2 years, Fa) Behavioral and psychosocial demands of acute and chronic diseases. Comparison of theoretical models of compliance and adaptation with intervention methods to improve compliance and adaptation. *Recommended preparation:* PM 500, PM 515.

603 Factor Analysis (4, 2 years, Fa) Exploratory and confirmatory factor analytic approaches to health behavior research—conceptual, practical and mathematical. *Prerequisite:* at least two graduate level statistics courses.

604 Health Behavior Research Methods (4, Sp) Health research/evaluation philosophies, approaches, and development of skills for development and critique of health behavior research projects/studies. *Recommended preparation:* PM 511.

610 Seminar in Biostatistics and Epidemiology (1, max 4, FaSp) Special topics of current interest to provide background for research in biostatistics and epidemiology. Based largely on student dissertation research. Graded CR/NC. *Prerequisite:* Ph.D. level or departmental approval.

611 Advanced Topics in Epidemiology (3, Irregular) Review of current epidemiologic research contained in recent medical literature; emphasis on critique of studies and interpretation of findings.

690abcdz Directed Research in Health Behavior (2-2-2-2-0, FaSpSm) Independent research at an advanced level on a problem in the field of Health Behavior. Graded CR/NC. *Recommended preparation:* PM 604.

756 Research Seminar in Health Behavior (1, max 6, FaSp) Short seminar presentations and discussions on issues accompanying the development of the field of health behavior and implementation of research in this field. Graded CR/NC.

790 Research (1-12, FaSpSm) Research applicable to the doctorate. Maximum units which may be applied to the degree to be determined by the department. Graded CR/NC.

794abcdz Doctoral Dissertation (2-2-2-2-0, FaSpSm) Credit on acceptance of dissertation. Graded IP/CR/NC.