Overview

The Division of Occupational and Environmental Medicine in the Department of Medicine provides graduate training in environmental health sciences and offers the M.S. and Ph.D. degrees in Environmental Health Sciences. The Environmental Health Sciences program is also an official graduate program of the Program in Public Health. The Ph.D. program offers tracks in Environmental Toxicology and in Exposure Sciences and Environmental Epidemiology. The program in Environmental Health Sciences provides students with the knowledge and skills necessary and appropriate to teach and/or conduct basic and applied research programs in inhalation/pulmonary toxicology, neurotoxicology, reproductive and developmental toxicology, chemical pathology, toxicokinetics, radiation toxicology, exposure sciences, environmental epidemiology, and risk assessment.

Environmental Toxicology involves the scientific study of the entry, distribution, biotransformation, and mechanism of the action of chemical agents that are harmful to the body. The graduate program interprets environmental toxicology as the study of the effects and mechanisms of action of hazardous chemicals in food, air, water, and soil in the home, the workplace, and the community. It considers experimentally and theoretically such diverse research problems as:

- new scientific approaches to toxicological evaluation of environmental chemicals such as air and water pollutants, food additives, industrial wastes, and agricultural adjuvants at the molecular, cellular, and organism levels
- mechanisms of action in chemical toxicity
- the molecular pathology of tissue injury in acute and chronic toxicity

Exposure Sciences involves the study of human exposures to environmental contaminants in different media such as air, water, and food and via multiple routes including inhalation, ingestion, and dermal absorption. Environmental Epidemiology examines the effects of exposure to environmental pollutants and other factors on health outcomes. Research in the Exposure Sciences and Environmental Epidemiology Track includes:

- new approaches to the evaluation of human exposures to environmental chemicals, including exposure modeling and biomonitoring
- modeling individual level exposures to environmental pollutants and examining associations of these exposures with health and disease outcomes
- exposure to physical and psychosocial work environment hazards and health outcomes

Students entering the program have varied backgrounds, including chemistry, biology, and physiology. The curriculum is based on a foundation of basic and health sciences with applications of scientific principles to environmental exposures and their potential health effects. Formal course work is enriched by a strong commitment to student-professor interaction throughout the program. An important and integral part of the learning process is an early and intensive involvement of the student in ongoing original research projects in environmental health sciences, especially inhalation/pulmonary toxicology, reproductive and developmental toxicology, biochemical toxicology, chemical pathology, neurotoxicology, exposure sciences, environmental epidemiology, and risk assessment.

In addition to meeting the general admission requirements set by the Graduate Division, applicants must be admitted by an Admissions Committee composed of faculty members of the graduate program. Candidates will be selected on the basis of a balanced evaluation of the following criteria, with no one factor having more influence: (1) prior scholastic performance, including a consideration of grades, course load, nature of courses taken, and college attended; (2) recommendations by professors and others; (3) scores for the general Graduate Record Examination test (GRE); (4) an interview by members of the Admissions Committee and other faculty members, when feasible; and (5) experience in undergraduate and/or post-baccalaureate research.

Undergraduate preparation of applicants should include one year of biology (one quarter of molecular biology or biochemistry is strongly recommended) one year of mathematics (calculus and/or statistics), and one year of chemistry. Outstanding applicants who lack one or two of these prerequisites may be given an opportunity to take the required course(s) either before admission or during the first year in the graduate program; in such circumstances, none of these required undergraduate courses may be used to satisfy the program elective or core course requirements. Upper-division or graduate science courses may be considered as substitutes for the above prerequisites by the Admissions Committee.

Doctor of Philosophy in Environmental Health Sciences

All courses must be passed with an average grade of B or better.

Program-wide Core Curriculum

A. Select one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>PUBHLTH 206A</td>
<td>Principles of Epidemiology</td>
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</table>
B. Select two of the following:

- EHS 202  Principles of Environmental Toxicology
- EHS 206A  Target Organ Toxicology I
- EHS 206B  Target Organ Toxicology II

C. Complete the following:

- EHS 264  Introduction to Environmental Health Science
- EHS 298  Seminar in Environmental Health Sciences
- EHS 299  Research Problems

Select one track and complete track-specific requirements:

1. Environmental Toxicology Track

D. Select one of the following:

- PUBHLTH 207A  Probability and Statistics in Public Health
- or EPIDEM 204A  Biostatistics I: Introduction to Statistical Methods

E. Select one of the following (the one not taken to fulfill program-wide core course requirement):

- EHS 202  Principles of Environmental Toxicology
- EHS 206A  Target Organ Toxicology I
- EHS 206B  Target Organ Toxicology II

F. Complete:

- EHS 201  Case Studies in Environmental Toxicology

G. Complete 16 units from the approved elective pool.

2. Exposure Sciences and Environmental Epidemiology Track:

H. Complete:

- PUBHLTH 283  Geographic Information Systems for Public Health
- PUBHLTH 207A-207B  Probability and Statistics in Public Health and Analysis of Public Health Data Using Statistical Software
- EPIDEM 205  Environmental Epidemiology

I. Select one of the following:

- PUBHLTH 279  Special Topics in Environmental & Occupational Health (Human Exposure Modeling, course # pending)
- EHS 275  Environmental Modeling and Risk Management

J. Complete 8 units from the approved elective pool.

Approved elective pool for both tracks:

- EHS 203  Psychosocial Occupational Epidemiology
- EHS 204  Neurotoxicology
- EHS 212  Inhalation Toxicology
- EHS 220  Industrial Toxicology
- EHS 269  Air Pollution, Climate, and Health
- EHS 270  Human Exposure to Environmental Contaminants
- EHS 294  Occupational Health Psychology
- EPIDEM 244  Toxic Chemicals in Environment
- ANATOMY 203A  Human Microscopic Anatomy
- ANATOMY 203B  Human Microscopic Anatomy
- DEV BIO 231B  Cell Biology
- MOL BIO 203  Nucleic Acid Structure and Function
- MOL BIO 204  Protein Structure and Function
- PHYSIO 206A  Introduction to Medical Physiology
- PHYSIO 206B  Introduction to Medical Physiology
- PUBHLTH 265  Advanced Environmental Health Science

K. Fulfill the following:

- Comprehensive Exam
- Qualifying Exam
Teaching Requirement

Research Dissertation

1. All graduate students in the program will be required to take EHS 298 every academic quarter they are enrolled in the graduate program.
2. Enroll during research rotations and dissertation research.
3. Track-specific core courses for one track may be taken as electives for other track.

The normative time for advancement to candidacy is three years. The normative time for completion of the Ph.D. is five years, and the maximum time permitted is seven years.

Master of Science in Environmental Health Sciences

All courses must be passed with an average grade of B or better.

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<td>or EPIDEM 200A</td>
<td>Principles of Epidemiology</td>
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<td>EPIDEM 204A</td>
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<tr>
<td>EHS 299</td>
<td>Research Problems ²</td>
</tr>
<tr>
<td>EHS 290</td>
<td>Independent Study in Environmental Toxicology ³</td>
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</table>

Eight units from the approved elective pool.

D. Complete one of the following plans:

Plan I:
Under the direction of a faculty advisor, prepare a thesis that is acceptable to the thesis committee

Plan II:
1. Under the supervision of a faculty member, prepare a scholarly paper based on individual study in an area of toxicology
2. Pass the written comprehensive examination.

1. All graduate students in the program will be required to take EHS 298 every academic quarter they are enrolled in the graduate program.
2. Applies to Plan I.
3. Applies to Plan II.

Opportunities for individual training and independent research experience exist in inhalation and pulmonary toxicology, atmospheric chemistry and aerosol science, neurochemistry and neurotoxicology, reproductive and developmental toxicology, toxicology of naturally occurring compounds, exposure modeling, risk assessment, chemical pathology, environmental microbiology, and environmental chemistry. Research grants and contracts are available to support qualified doctoral students as research assistants.

Faculty

Dean B. Baker, M.D. University of California, San Diego, Professor Emeritus of Medicine; Environmental Health Sciences; Program in Public Health

Scott Bartell, Ph.D. University of California, Davis, Associate Professor of Program in Public Health; Environmental Health Sciences; Statistics

Bruce Blumberg, Ph.D. University of California, Los Angeles, Professor of Developmental and Cell Biology; Biomedical Engineering; Environmental Health Sciences; Pharmaceutical Sciences (gene regulation by nuclear hormone receptors in vertebrate development physiology, endocrine disruption)

Stephen C. Bondy, Ph.D. University of Birmingham, Professor of Medicine; Environmental Health Sciences; Program in Public Health

Vincent J. Caiozzo, Ph.D. University of California, Irvine, Adjunct Associate Professor of Orthopaedic Surgery; Environmental Health Sciences; Physiology and Biophysics

Jefferson Chan, Ph.D. University of California, San Francisco, Professor of Pathology and Laboratory Medicine; Environmental Health Sciences
Environmental Health Sciences

Bongkyoo Choi, Sc.D. University of Massachusetts, Assistant Professor of Medicine; Environmental Health Sciences; Program in Public Health

Derek Dunn-Rankin, Ph.D. University of California, Berkeley, Department Chair and Professor of Mechanical and Aerospace Engineering; Civil and Environmental Engineering; Environmental Health Sciences (combustion, optical particle sizing, particle aerodynamics, laser diagnostics and spectroscopy)

Rufus D. Edwards, Ph.D. Rutgers, The State University of New Jersey, Professor of Program in Public Health; Environmental Health Sciences; Epidemiology

C. Sunny Jiang, Ph.D. University of South Florida, Department Chair and Professor of Civil and Environmental Engineering; Ecology and Evolutionary Biology; Environmental Health Sciences (water pollution microbiology, environmental biotechnology, aquatic microbial ecology)

Virginia Kimonis, M.D. University of Southampton, Professor of Pediatrics; Environmental Health Sciences; Genetic Counseling; Pathology and Laboratory Medicine

Masashi Kitazawa, Ph.D. Iowa State University, Associate Professor of Medicine; Environmental Health Sciences

Charles E. Lambert, Ph.D. University of California, Irvine, Assistant Adjunct Professor of Environmental Health Sciences

Charles L. Limoli, Ph.D. University of California, San Diego, Professor of Radiation Oncology; Environmental Health Sciences

Ulrike Luderer, M.D., Ph.D. Northwestern University, Director of the Environmental Health Sciences Graduate Program and Professor of Medicine; Developmental and Cell Biology; Environmental Health Sciences; Program in Public Health

Oladele A. Ogunseitan, Ph.D. University of Tennessee, Department Chair and Professor of Program in Public Health; Environmental Health Sciences

Kathryn Osann, Ph.D. University of California, Berkeley, Adjunct Professor of Medicine; Environmental Health Sciences

Robert F. Phalen, Ph.D. University of Rochester, Professor of Medicine; Environmental Health Sciences

John L. Redpath, Ph.D. University of Newcastle, Professor Emeritus of Radiation Oncology; Environmental Health Sciences

Ronald C. Shank, Ph.D. Massachusetts Institute of Technology, Professor Emeritus of Medicine; Environmental Health Sciences

Veronica M. Vieira, D.Sc. Boston University, Professor of Program in Public Health; Environmental Health Sciences

Jun Wu, Ph.D. University of California, Los Angeles, Associate Professor of Program in Public Health; Environmental Health Sciences