Environmental Health Sciences

Center for Occupational and Environmental Health (COEH)
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http://www.medicine.uci.edu/occupational/graduate.asp
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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 Ph.D. program offers tracks in Environmental Toxicology and in Exposure Sciences and Risk Assessment. 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, biochemical neurotoxicology, reproductive and developmental toxicology, chemical pathology, toxicokinetics, radiation toxicology, exposure sciences, 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. Risk Assessment combines knowledge obtained from toxicological and exposure studies to come to conclusions about the risks to human health. Research in the Exposure Sciences and Risk Assessment Track includes:

• new approaches to the evaluation of human exposures to environmental chemicals, including exposure modeling and biomonitoring;
• scientific principles involved in evaluating risks to human health from environmental exposures.

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 toxicology, especially inhalation/pulmonary toxicology, reproductive and developmental toxicology, biochemical toxicology, chemical pathology, neurotoxicology, exposure sciences, 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 program. Candidates are selected on the basis of a balanced evaluation of the following criteria: (1) prior scholastic performance, including a consideration of grade point average, course load, nature of courses taken, and college attended; (2) recommendations by professors and others; (3) scores on the Graduate Record Examination; the Subject Test in either Biology or Chemistry is strongly recommended; (4) an interview by the Admissions Committee, when feasible; and (5) experience in undergraduate research. The applicant must have received a bachelor’s degree in a biological, public health, or physical science, in a premedical curriculum, or have an acceptable equivalent. Applicants with a bachelor’s degree in engineering may qualify for admission into the program if they have had sufficient training in biology, chemistry, and physical sciences.

Undergraduate preparation of applicants should include six quarter units in general biology, zoology, bacteriology, or anatomy; 12 quarter units in mathematics, including calculus through vector analysis and differential equations; 12 quarter units of chemistry, including four quarter units of organic chemistry; 12 quarter units of physics; and four quarter units in molecular biology or biochemistry. 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 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.

The graduate core curriculum for the Ph.D. degree includes TOX 206A-TOX 206B, TOX 264, TOX 298A-TOX 298B-TOX 298C, and EPIDEM 200. The core curriculum for the Ph.D. degree track in Environmental Toxicology further includes one of STATS 201, PUBHLTH 207, or EPIDEM 204; TOX 201 and TOX 207, and 16 units from an approved elective pool. This pool includes TOX 202, TOX 204, TOX 212, TOX 220, PHYSIO 206A-PHYSIO 206B, ANATOMY 203A-ANATOMY 203B, MOL BIO 203, MOL BIO 204, DEV BIO 231B, PUBHLTH 276. The core curriculum for the track in Exposure Sciences and Risk Assessment further includes STATS 201, STATS 202, STATS 203, TOX 275, PUBHLTH 283, and eight units from an approved elective pool. This pool includes TOX 269, TOX 270, EPIDEM 205, PUBHLTH 265, PUBHLTH 276. Ph.D. students must also fulfill comprehensive examination, qualifying examination, teaching, and research dissertation requirements. 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.

Requirements for the M.S. degree may be satisfied in one of two ways. Under Plan I, students complete the core program (including TOX 206A-TOX 206B, TOX 264, TOX 298A-TOX 298B-TOX 298C; one of STATS 201, PUBHLTH 207, or EPIDEM 204; and EPIDEM 200) and eight units from the approved elective pool with an average grade of B or better, and, under the direction of a faculty advisor, prepare a thesis that is acceptable to the thesis committee. Under Plan II, students complete the core program (including TOX 206A-TOX 206B, TOX 264, TOX 298A-TOX 298B-TOX 298C, TOX 299A-299B-299C; one of STATS 201, PUBHLTH 207, or EPIDEM 204; EPIDEM 200, and eight units from the approved elective pool) with an average grade of B or better, prepare a scholarly paper based on individual study in an area of
toxicology under the supervision of a faculty member, and pass the written comprehensive examination.

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: *Chief, Division of Occupational and Environmental Medicine*; Environmental medicine and clinical toxicology; epidemiology; clinical effects of heavy metals, pesticides, and hazardous waste

Scott M. Bartell: Probabilistic models and statistical methods for exposure assessment, environmental epidemiology, and risk/decision analysis

Stephen C. Bondy: Neurotoxicology; biochemical changes in membranes resulting from toxic exposures

Vincent J. Caiozzo: Structure and function of muscle with emphasis on exercise physiology; special interest in the role of environmental toxicants in modulating physiological responses in human muscle

Jefferson Y. Chan: Chemical pathology of tissue injury with focus on the oxidative stress response in cells exposed to toxic xenobiotics

Ralph J. Delfino: Air pollution health effects and air pollution exposure assessment; environmental epidemiology; gene-environment interactions

Derek Dunn-Rankin: Laser and optical diagnostics in practical systems, optical particle sizing; droplet formation and vaporization and application to human exposures

Rufus D. Edwards: Air pollution, particles, VOC, the developing world, greenhouse gases, European cities, Expolis, and environmental epidemiology

Chenyang (Sunny) Jiang: Application of molecular techniques to detect human pathogenic bacteria and viruses in aquatic environments; coastal water quality microbiology

Michael T. Kleinman: Uptake and distribution of inhaled toxic materials in the respiratory tract; effects of air pollutants on cardiopulmonary function

Virginia Kimonis: Genetics of neuromuscular diseases, inherited muscle disorders that occur in combination with diseases of bone

Ulrike Luderer: *Graduate Program Director*; Reproductive and developmental toxicology; roles of oxidative stress in ovarian toxicity, ovarian aging, and ovarian cancer

Charles Limoli: Mechanisms by which cells perpetuate genomic instability in response to radiation and environmental toxicants and the role of oxidative stress in these processes; how DNA damage and oxidative stress might drive the progression of normal multipotent cells in the CNS to brain tumor stem cell

Oladele Ogunseitan: *Chair, Department of Population Health and Disease Prevention*; Microbial diversity and ecology; environmental pollution; industrial ecology; health and development

Betty H. Olson: Environmental microbiology and water chemistry; public policy issues in environmental toxicology

Kathryn E. Osann: Cancer epidemiology; applied biostatistics

Robert F. Phalen: Biophysics, aerosol science, and inhalation toxicology; toxicity of mixtures of particles and gases, lung defenses, and particle deposition in airways

J. Leslie Redpath (*Emeritus*)

Ronald C. Shank (*Emeritus*)

Veronica Vieira: Geographic information systems, groundwater modeling, cluster detection methods, and persistent environmental contaminants

Jun Wu: Air pollution exposure assessment and air pollution epidemiology

**Courses**

**TOX 201. Principles of Toxicology. 4 Units.**

Problem solving to demonstrate principles of toxicology; quantitative dose-response relationship; toxicant-target (receptor) interaction emphasizing interspecies differences in Ah receptor and dioxins; complete in vivo metabolism of xenobiotics by mammalian systems; integration of organ responses to toxic agents.

Prerequisite: TOX 206 and MOL BIO 204 and PHYSIO 206A and PHYSIO 206B.

Restriction: Graduate students only.

**TOX 202. Environmental Toxicology. 4 Units.**

Analysis of real problems involving toxic chemicals and the human food, air, and water supplies, occupational exposures, and life styles. Formal problems will be considered by small groups of students and discussed by the class.

Prerequisite: TOX 201.

Restriction: Graduate students only.

**TOX 204. Neurotoxicology. 4 Units.**

The effects of various harmful chemicals upon nervous system function. Emphasis given to the molecular events underlying neurological damage and to the relation of such processes to basic mechanisms of neurobiology.

**TOX 206A. Target Organ Toxicology I. 6 Units.**

Analysis of responses occurring in 12 organ systems of humans exposed to environmental chemicals at toxic levels; distinctive cellular and tissue structure and physiological function; toxicological responses discussed in terms of phenomena, mechanisms of action, and methods of study.

Same as PUBHLTH 277A.
TOX 206B. Target Organ Toxicology II. 6 Units.
Analysis of responses occurring in 12 organ systems of humans exposed to environmental chemicals at toxic levels; distinctive cellular and tissue structure and physiological function; toxicological responses discussed in terms of phenomena, mechanisms of action, and methods of study.
Prerequisite: PUBHLTH 277A or TOX 206A.
Same as PUBHLTH 277B.

TOX 207. Experimental Design and Interpretation of Toxicology Studies. 2 Units.
Introduction to methods of structuring toxicology experiments and analyzing data including experimental design, data distributions, sample sizes, hypothesis testing, linear regression, analysis of variance, multiple comparison testing, and non-parametric tests.
Restriction: Graduate students only.

TOX 212. Inhalation Toxicology. 4 Units.
The principles and practice of laboratory inhalation toxicology. Topics include aerosols, gases, respiratory tract structure and function, lung defenses, aerosol deposition exposure techniques, characterization of exposure atmospheres, experimental designs, animal models, and regulations and guidelines.
Restriction: Graduate students only.

TOX 220. Industrial Toxicology. 4 Units.
Analysis of responsibilities toxicologists have in industry, including product safety generating material safety, data sheets, animal testing, ecotoxicological testing, risk/hazard communication, and assisting industrial hygienists and occupational physicians; emphasis on interdisciplinary nature of industrial toxicology and communication skills.
Prerequisite: (PUBHLTH 277A or TOX 206A) and (PUBHLTH 277B or TOX 206B).
Same as PUBHLTH 278.

TOX 264. Introduction to Environmental Health Science. 4 Units.
Convergence of agents (chemical, physical, biological or psychosocial) in environment can emerge as diseases influenced by social, political, and economic factors allowing them to become rooted in society. How these agents from various spheres come together and impact human health.
Same as EPIDEM 264, PUBHLTH 264.
Restriction: Graduate students only.

TOX 269. Air Pollution, Climate, and Health. 4 Units.
Emission of air pollutants into the atmosphere, physical and meteorological processes that affect transport, and influence on global warming. Concepts of how and where people are most exposed, and how exposures and health effects differ in developed and developing regions.
Same as EPIDEM 269, PUBHLTH 269.

TOX 270. Human Exposure to Environmental Contaminants. 4 Units.
Introduces founders of conceptual thought that environmental contaminants can impact health. Theory and principles of exposure assessment, the continuum from emissions of a containment into the environment to evidence of health effects in a population.
Same as EPIDEM 270, PUBHLTH 270.

TOX 275. Environmental Modeling and Risk Management. 4 Units.
Surveys the general principles, basic mathematical methods, and practices of environmental modeling and human health risk assessment. Topics include advection-dispersion models, risk management, and risk perception. Students conduct an original risk assessment as a final group project.
Prerequisite: MATH 2A and STATS 7.
Same as PUBHLTH 275.
Restriction: Graduate students only.
Concurrent with PUBHLTH 175.

TOX 290. Independent Study in Environmental Toxicology. 4 Units.
With consent from a faculty member who will supervise the program, a student may receive credit for individual study in some area of toxicology, culminating in the completion of a scholarly paper on the subject.
Repeatability: May be repeated for credit unlimited times.

TOX 297. Advanced Topics in Occupational Toxicology. 2 Units.
Discussions with clinical and research faculty in environmental toxicology and occupational medicine on current toxicology problems in the workplace and critical review of current publications in the field.
Repeatability: May be repeated for credit unlimited times.

TOX 298A. Seminar in Toxicology. 2 Units.
Presentation and discussion of current research problems and issues by students, postdoctoral fellows, faculty, and guests, covering the broad research and policy areas of environmental toxicology.
Repeatability: May be repeated for credit unlimited times.
Restriction: Graduate students only.

TOX 298B. Seminar in Toxicology. 2 Units.
Presentation and discussion of current research problems and issues by students, postdoctoral fellows, faculty, and guests, covering the broad research and policy areas of environmental toxicology.
Prerequisite: TOX 298A.
Repeatability: May be repeated for credit unlimited times.
Restriction: Graduate students only.

TOX 298C. Seminar in Toxicology. 2 Units.
Presentation and discussion of current research problems and issues by students, postdoctoral fellows, faculty, and guests, covering the broad research and policy areas of environmental toxicology.
Prerequisite: TOX 298B.
Repeatability: May be repeated for credit unlimited times.
Restriction: Graduate students only.

TOX 299. Research Problems. 1-12 Units.
Research work for the M.S. thesis or Ph.D dissertation.
Repeatability: May be repeated for credit unlimited times.