

CURRICULUM IN TOXICOLOGY (GRAD)

Contact Information

Curriculum in Toxicology

Visit Program Website (<http://www.med.unc.edu/toxicology>)

Ilona Jaspers, Director

The Curriculum in Toxicology administers a degree program leading to the award of the Ph.D. in toxicology. The curriculum is an interdisciplinary program, and its faculty is drawn from various administrative units of the schools of medicine, pharmacy, and public health. The training faculty also includes scientists at government laboratories on campus or in the Research Triangle Park (e.g., EPA, NIEHS). The research interests of the faculty include most areas of toxicology, with particular emphasis on understanding the links between the environment and health risks, the mode of action of toxicants and disease pathogenesis, and how emerging knowledge could be translated into prevention strategies, new therapeutic interventions, and an improved scientific basis for risk assessment.

The main areas of research concentration are molecular carcinogenesis, mechanistic toxicology, neurotoxicology, cardiopulmonary toxicology, hepatic toxicology, computational toxicology, developmental toxicology, immunotoxicology, drug and xenobiotic metabolism, and ethanol toxicology. Multidisciplinary efforts are directed at environmental toxicology, systems biology, animal models of human diseases, translational research, and biomarkers. The faculty generally does not conduct research in the areas of aquatic toxicology, forensic toxicology, the ecological aspects of toxicology, or studies in invertebrate systems. The research activities of the Curriculum in Toxicology are conducted in the laboratory facilities assigned to each faculty member by a participating administrative unit.

Applications

Students with interest in the Ph.D. degree in toxicology must apply for Graduate School admission through the Biological and Biomedical Sciences Program. Applications are considered from students who have received or expect to receive a B.S./B.A. or an M.S. degree in a scientific discipline. A desirable background for predoctoral studies in toxicology includes courses in biological sciences (including histology and animal physiology), in chemistry (including analytical and organic), and in mathematics through calculus, although all of these are not absolutely essential. A strong course in general biochemistry accelerates the student's progress. Applicants are evaluated on the basis of undergraduate (and graduate) academic performance, Graduate Record Examination (GRE) scores, and letters of recommendation. Students are accepted on the basis of their achievement and potential. Prior research experience is strongly considered in the assessment of qualifications for admission.

Financial Aid

The curriculum seeks to fund predoctoral students each year. All applicants are considered for financial aid awards.

Doctor of Philosophy

The selection of graduate courses for the Ph.D. degree is influenced by the student's prior academic background. The academic courses that are considered appropriate for graduate training in toxicology include biochemistry, biostatistics, pathology, pharmacology, toxicology, and two elective courses in the specific areas of the doctoral research. In addition, each predoctoral student is expected to participate in other training activities (i.e., student-centered seminars and scientific meetings) while developing the doctoral dissertation project. Attendance and participation in the Curriculum in Toxicology seminar series is required during the entire training period.

A major requirement for the Ph.D. degree is a doctoral dissertation based on the development of the student's research project. Written and oral examinations are required in the fields of general toxicology and the student's research concentration.

Professional Science Master's

The professional science master's in toxicology is associated with the Professional Science Master's Program. For more information about the program, see the Professional Science Master's Program (<http://catalog.unc.edu/graduate/schools-departments/professional-science-masters-programs>).

Code	Title	Hours
PATH 713	Molecular and Cellular Pathophysiological Basis of Disease: Mechanisms of Disease	3
PATH 714L	Molecular and Cellular Pathophysiological Basis of Disease: Laboratory I	2
PATH 715	Molecular and Cellular Pathophysiological Basis of Disease: Systemic Pathology	3
TOXC 442	Biochemical Toxicology	3
TOXC 707	Advanced Toxicology	3
TOXC 722	Toxicology Seminar III	3
BIOS 600	Principles of Statistical Inference	3
GRAD 710	Professional Communication: Writing	1.5
GRAD 711	Professional Communication: Presenting	1.5
GRAD 712	Leadership in the Workplace	1.5
GRAD 713	Applied Project Management: Frameworks, Principles and Techniques	1.5
GRAD 714	Introduction to Financial Accounting	1.5
GRAD 715	Building Your Leadership Practice	0.5
GRAD 721	Research Ethics	1
GRAD 725	Build Your Professional Brand: Develop Job Search Skills and Materials to Make Employers Notice You	3
GRAD 989	Professional Science Master's Internship/ Practicum	3
Elective Courses		7.5
Total Hours		42.5

Professors

Louise M. Ball, Metabolism and Genotoxicity of Environmental Xenobiotics

Thomas W. Bouldin, Neuropathology, Ocular Pathology and Neurotoxicology

Kim R. Brouwer, Pharmacokinetics, Hepatic Transport, Hepatobiliary Disposition, Biliary Excretion, Hepatotoxicity

Bruce A. Cairns, Burn Trauma, Lung Injury following Inhalation Injury, T Cell Response after Burn Injury

Frank C. Church, Thrombosis and Hemostasis, Breast and Prostate Carcinogenesis, Macromolecular Structure-Function

William B. Coleman, Hepatocarcinogenesis, Tumor Suppressor Genes, Biology of Liver Stem Cells, Cancer Epigenetics

Channing J. Der, Ras Protein Superfamily, Signal Transduction and Oncogenesis

Mohanish P. Deshmukh, Molecular Mechanisms of Apoptosis in Neurons and Other Postmitotic Cells

Avram Gold, Structure-Reactivity Relationships in Metabolism and Mutagenicity of Polycyclic Aromatic Hydrocarbons

Milan J. Hazucha, Health Effects of Air Pollutants, Human Studies, Mechanisms of Response

David J. Holbrook Jr., Biochemical Toxicology, Xenobiotic Metabolism

Ilona Jaspers, Cellular Mechanisms of Air Pollutant Toxicity

David G. Kaufman, DNA Replication, Chemical Carcinogenesis

William K. Kaufmann, DNA Metabolism in Radiation and Chemical Carcinogenesis

Nobuyo N. Maeda, Animal Models of Hyperlipidemia, Atherosclerosis and Cardiomyopathy

Terry Magnuson, Mammalian Genetics, Genomics and Development

A. Leslie Morrow, Neurotoxicology and Excitotoxicity of Alcohol

Leena A. Nylander-French, Development of Methods to Monitor and Assess Dermal Exposure to Chemical Carcinogens and Contact Sensitizers

David B. Peden, Translational and Clinical Research in Environmental Lung Disease

Charles M. Perou, Characterization and Classification of Human Breast Tumors into Subtypes of Biological and Clinical Importance

Daniel Pomp, Genetic Architecture of Complex Traits, Gene-Environment Interactions, Polygenic Mouse Models, Obesity

Dale A. Ramsden, V(D)J Recombination and DNA Double Strand Break Repair

Aziz Sançar, DNA Repair and Cancer, Structure and Function of DNA Repair Enzymes, Connection between the Circadian Clock and DNA Excision Repair

Norman E. Sharpless, Tumor Suppressor Genes, Genetics of Cancer and Aging

Miroslav Styblo, Metabolism and Biological Effects of Essential and Toxic Metals and Metalloids

James A. Swenberg, Carcinogenesis, DNA and Protein Adducts, Cell Proliferation, Risk Assessment

Nancy E. Thomas, Molecular Carcinogenesis, Environmental Toxicology, Molecular Epidemiology, Research Translation, Biomarkers

Alexander Tropsha, Molecular Modeling, Computer-Assisted Drug Design, Molecular Dynamics of Proteins, Protein Folding

Cyrus Vaziri, Cell Cycle Responses to Environmental Genotoxins (Benzo[a]pyrene, UV Radiation), DNA Replication and Repair, Genome Stability

Paul B. Watkins, Mechanistic Toxicology, Hepatotoxicology, Research Translation, Biomarkers

Bernard E. Weissman, Chromatin Remodeling and Epigenetic Alterations in Human Cancer

Elizabeth M. Wilson, Environmental Androgens and Antiandrogens, Androgen Receptor Regulation of Prostate Cancer

Associate Professors

Rebecca Fry, Metal-Induced Disease, Prenatal Origins of Disease, Epigenetics

David Neil Hayes, Lung Carcinogenesis, Research Translation, Biomarkers, Computational Toxicology

Jeffrey M. Macdonald, Metabolomics and Fluxomics Using NMR Spectroscopy and Imaging, Tissue Engineering

Scott H. Randell, Identification of Airway Epithelial Stem Cells, Airway Innate Immunity, Pathophysiology of Lung Diseases

W. Kimryn Rathmell, Genetics of Renal Cell Carcinoma

Philip C. Smith, Toxicokinetics and Xenobiotic Metabolism, Peptide Analysis and Disposition

Assistant Professors

Michelle L. Hernandez, Severe Asthma, Development of Novel Therapies against Neutrophilic Airway Inflammation

Folami Ideraabdullah, Epigenetics, Mouse Models

Samir Kelada, Mouse Models of Diversity, Asthma, Ozone

Robert Maile, Innate and Adaptive Immune Regulation during Health and in Disease

Thomas J. Urban, Genetic and Genomic Studies of a Variety of Human Traits, Including Rare Adverse Drug Reactions such as Drug-Induced Liver Injury (DILI)

Research Professor

Kenneth H. Pearce, Jr., Non-Glycosylated Proprotein Convertase Ectodomain Protein for Apo Crystallization, Small Molecule Inhibitor Co-Crystals, and Fragment Screens

Faculty Affiliates from Other Research Institutions

LifeNet Health

Edward L. LeCluyse, Cellular/Molecular Mechanisms Regulating Liver Cytochrome P450 Enzymes Expression

National Institute of Environmental Health Sciences

Trevor Archer, Molecular Carcinogenesis, Chromatin Structure, Control of Gene Transcription, Epigenetics

Linda S. Birnbaum, Chemical Disposition of Xenobiotics, Mechanistic Toxicology, Dose-Response and Risk Assessment

Michael DeVito, Development of Models for Cumulative Risk to Endocrine Disruptors

Suzanne Fenton, Environmental Effects on Mammary Gland Development and Function

Michael B. Fessler, Induction and Regulation of Innate Immune Response, Toll-Like Receptor Signaling

G. Jean Harry, Developmental Neurotoxicology, Molecular Neuro/Immunotoxicology

Steven R. Kleeberger, Genetic Determinants of Environmental Lung Disease

Gregory S. Travlos, Hematology and Clinical Chemistry

Carmen J. Williams, Environmental Effects on Reproductive Biology and Early Mammalian Embryogenesis, Epigenetics, Endocrine Disruption

Humphrey Yao, Developmental Reproductive Biology

North Carolina Central University

Antonio Baines, Molecular Mechanisms of Disease and Drug Therapy

North Carolina State University

David C. Dorman, Experimental Neurotoxicology, Nasal Toxicology, Pharmacokinetics
Quintiles

Daniel Kemp, Impact of the Microbiome on Drug Discovery

U.S. Environmental Protection Agency

David DeMarini, Mutagenesis, Environmental Protection, Complex Mixtures, Biomarkers

Daniel L. Costa, Cardiopulmonary and Inhalation Toxicology, Health Effects of Air Pollutants

Kevin M. Crofton, Understanding the Consequences of Endocrine Disruption on Neurodevelopment

Robert B. Devlin, Pulmonary Toxicology, Molecular Biology

David Díaz-Sánchez, Translation Research, Environmental Impacts on Human Health, Immunology, Genetic Susceptibility, Epigenetics

Aimen K. Farraj, Comparative Cardiovascular Effects of Biodiesel and Petroleum Diesel Fuel Emissions

M. Ian Gilmour, Pulmonary Toxicology, Immunotoxicology

Mehdi A. Hazari, Neurophysiological Mechanisms Mediating

Cardiopulmonary Dysfunction due to Air Pollution Exposure

E. Sidney Hunter, Mechanisms of Developmental Toxicity, Oxidative Stress, Embryonic Stem Cells in Developmental Toxicity

Gary Klinefelter, Male Reproductive Toxicology

Urmila P. Kodavanti, Cardiovascular Diseases and Susceptibility, Air Pollutants, Cardiopulmonary Interactions, Molecular Mechanisms, Genetic and Environmental Factors

Robert Luebke, Modulation of Normal Immune Function by Environmental Agents, Alternative Methods for Screening/Testing Immunotoxicants

Michael C. Madden, Air Pollution Toxicology, Lung Oxidative Stress and Inflammation

Shaun D. McCullough, Epigenetic Mechanisms Underlying Susceptibility and Exposure Effects

Michael G. Narotsky, Developmental Toxicology, Pregnancy Maintenance and Parturition

Stephanie Padilla, Behavioral Toxicology and Neurotoxicology

John M. Rogers, Developmental Toxicology, Teratology, Developmental Biology, Embryology, Nutrition

James M. Samet, Inflammatory Responses to Pollutant Inhalation, Cytokines, Eicosanoids

Washington State University

Mary F. Paine, Drug Xenobiotic Metabolism, Pharmacokinetics, Drug Xenobiotic Interactions

Consultant

Ram (T.V.) Ramabhadran, Neurotoxicological Effects of Environmental Pollutants, Cellular Stress Pathways

TOXC

Advanced Undergraduate and Graduate-level Courses

TOXC 423. Developmental Toxicology and Teratology. 3 Credits.

Emphasizes topics of current research interest relative to the genesis of environmentally caused and genetically based birth defects. One two-hour session per week (evening).

Grading status: Letter grade

Same as: CBIO 423.

TOXC 442. Biochemical Toxicology. 3 Credits.

Required preparation, one course in biochemistry. Biochemical actions of toxicants and assessment of cellular damage by biochemical measurements. Three lecture hours per week.

Requisites: Prerequisite, CHEM 430; permission of the instructor for students lacking the prerequisites.

Grading status: Letter grade

Same as: ENVR 442, BIOC 442.

Graduate-level Courses

TOXC 701. Current Topics in Toxicology. 1 Credit.

In this course, we will read, discuss and present primary research articles, from various research groups, in order to interpret the true meaning of recent scientific findings in the field of toxicology. A general understanding of Biology, Chemistry and Human Health is required.

Grading status: Letter grade.

TOXC 702. Principles of Pharmacology and Physiology. 3 Credits.

Introduces students to the major areas of pharmacology and physiology and serves as a basis for more advanced courses. Three lecture hours a week.

Requisites: Prerequisite, CHEM 430; permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade

Same as: PHCO 702.

TOXC 707. Advanced Toxicology. 3 Credits.

Cellular and physiological basis of toxicity of environmental chemicals, with emphasis on inhalation toxicology, developmental toxicology, and immunotoxicology, radiation toxicology, renal toxicology, and neurotoxicology. Three lecture hours per week.

Requisites: Prerequisite, PHCO 702; permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade

Same as: ENVR 707, PHCO 707.

TOXC 721. Toxicology Seminar II. 1 Credit.

Student-conducted presentations and discussions of recent advances in toxicology; emphasis on critical evaluation of published investigations and on organization and oral delivery of presentations. One hour per week.

Grading status: Letter grade.

TOXC 722. Toxicology Seminar III. 1 Credit.

Presentations by outside invited speakers, local faculty, advanced graduate students, and postdoctoral trainees. Topics will cover all areas of research in toxicology. One hour per week.

Grading status: Letter grade

Same as: ENVR 722.

TOXC 735. Regulatory Toxicology-Interacting with regulatory agencies & approval for drug, device, and chemical. 3 Credits.

Regulatory agency fundamentals, regulatory process for drug, medical device, cosmetic and agrochemical products. Industry, regulatory agency representatives and consultants will be invited to speak directly about their regulatory policies, challenges, and expectations. Students will develop and present a regulatory submission package as part of a group project.

Grading status: Letter grade

Same as: GRAD 735.

TOXC 760. Toxicokinetics. 3 Credits.

A quantitative examination of the time course of absorption, distribution, metabolism, excretion, and biologic effects of agents of toxicologic interest. Three lecture hours per week.

Grading status: Letter grade.

TOXC 792. Seminar in Carcinogenesis. 2 Credits.

Permission of the instructor. Survey of classical and current literature on selected critical issues in carcinogenesis. Students discuss experimental methods and observations as well as theories and generalizations. Two seminar hours a week.

Grading status: Letter grade

Same as: PATH 792.

TOXC 821. Scientific Writing. 1 Credit.

Doctoral candidacy in toxicology required. Workshops on scientific writing with special emphasis on fellowship applications and the doctoral research proposal. Students work on several written assignments and are expected complete a draft of their proposals by the end of the semester.

Grading status: Letter grade.

TOXC 901. Research in Toxicology. 3 Credits.

May be repeated. Students register in this course as they formulate their doctoral research projects.

Repeat rules: May be repeated for credit.

Grading status: Letter grade.

TOXC 992. Master's (Non-Thesis). 3 Credits.

Students acquire practical experience through an internship program at a non-academic institution where knowledge in toxicology is applied toward its mission. They subsequently prepare a capstone monograph (thesis substitute) that reports on their individualized experience, a requirement for the MPS in Toxicology.

Requisites: Prerequisites, TOXC 442 and TOXC 707.

Repeat rules: May be repeated for credit.

Grading status: Letter grade.

TOXC 993. Master's Research and Thesis. 3 Credits.

May be repeated. Hours and credits to be arranged.

Repeat rules: May be repeated for credit.

TOXC 994. Doctoral Research and Dissertation. 3 Credits.

May be repeated. Hours and credits to be arranged.

Repeat rules: May be repeated for credit.