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).

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

Samir Kelada, Mouse Models of Diversity, Asthma, Ozone

Robert Maile, Innate and Adaptive Immune Regulation during Health and 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. Klebeiger, 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
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, 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 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.