

Molecular Toxicology: Chemical and Biological Mechanisms (PHRM 5900) – Fall 2024

Course Director: Trevor M. Penning, Professor of Systems Pharmacology and Translational Therapeutics; Director, Center of Excellence in Environmental Toxicology

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Course Goals: Exposures to foreign compounds (drugs, carcinogens, and pollutants) can disrupt normal cellular processes leading to toxicity. This course will focus on the molecular mechanisms by which environmental exposures lead to end-organ injury and to diseases of environmental etiology (neurodegenerative and lung diseases, and reproduction and endocrine disruption). Students will learn the difficulties in modeling response to low-dose chronic exposures, how these exposures are influenced by metabolism and disposition, and how reactive intermediates alter the function of biomolecules. Mechanisms responsible for cellular damage, aberrant repair, and end-organ injury will be discussed. In addition, students will discuss the relationship between genetics and epigenetics and environmental exposures. Students will learn about modern predictive toxicology to classify toxicants, predict individual susceptibility and response to environmental triggers, and how to develop and validate biomarkers for diseases of environmental etiology. Students are expected to write a term paper on risk assessment on an environmental exposure using available TOXNET information. This course is required for those pursuing the Certificate Program in Environmental Health Sciences.

Format: 60-minute lectures; three times per week on Monday/Wednesday/Friday

Course Materials: Casarett & Doulls: Toxicology: The Basic Science of Poisons (7th – 9th Ed) and relevant literature.

Pre-requisites: Undergraduate course work in biochemistry and chemistry essential. Exceptions allowed based on past course work. Please consult with the Course Director.

Students: All 1st and 2nd year BGS students with required prerequisites; Residents in Environmental and Occupational Health, and Professional Master's Students (e.g. MPH and MTR).

Accommodations for Students with Disabilities: The University of Pennsylvania provides reasonable Accommodations to students with disabilities who have self-identified and received approval from the Office of Student Disabilities Services (SDS). If SDS has approved your request for accommodations, please make an appointment to meet with me as soon as possible in order to discuss the arrangements for your accommodations. If you have not yet contacted Student Disabilities Services, and would like to request accommodations or have questions, you can make an appointment by calling (215) 573-9235. The office is located in the Weingarten Learning Resources Center at Stouffer Commons, 3702 Spruce Street, Suite 300. Please visit the SDS website at <http://www.vpul.upenn.edu/lrc/sds/index.php>. SDS services are free and confidential.

Molecular Toxicology Course Schedule- IMPORTANT PLEASE READ

Course Times: Mondays, Wednesdays, and Fridays: **1:45PM - 2:45PM**; a few classes are **1:45PM - 3:45PM** as highlighted in gray on the schedule. Please read the schedule carefully; in-person classes will be held in Richards Pavilion B205. Other classes utilize a pre-recording or are live online.

Location: **Richards Pavilion B205**
 Live Online
 Pre-recorded

2024 Fall Schedule

Week	Date	Location	Topic	Lecturer
GENERAL PRINCIPLES				
1	F, Aug 30	Richards Pavilion B205	Introduction /Orientation	Trevor Penning, PhD
2	M, Sep 2	Labor Day – No Class		
	W, Sep 4	Richards Pavilion B205	Regulatory Policy and EPA	Richard Pepino, MS
	F, Sep 6	Richards Pavilion B205	General Principles: Dose Response & Exposures	Trevor Penning, PhD
3	M, Sep 9	Richards Pavilion B205	Metabolism Phase I	Trevor Penning, PhD
	W, Sep 11	Richards Pavilion B205	Metabolism Phase II	Trevor Penning, PhD
	F, Sep 13	Richards Pavilion B205	Chemical Carcinogenesis by Genotoxic Agents	Trevor Penning, PhD
4	M, Sep 16	Richards Pavilion B205	Chemical Carcinogenesis by Non-Genotoxic	Trevor Penning, PhD
	W, Sep 18	Richards Pavilion B205	Heavy Metal Toxicity	Jay Schneider, PhD
	F, Sep 20 1:45pm-3:45pm	Richards Pavilion B205	Risk Assessment Assignment Problem Set: Metabolism	Trevor Penning, PhD
5	M, Sep 23	Richards Pavilion B205	DNA Adducts and their Repair	Catia Marques, PhD
	W, Sep 25	Richards Pavilion B205	Mutagenesis/Mutational Signatures	Jeffrey Field, PhD

Week	Date	Location	Topic	Lecturer
	<i>For viewing outside of scheduled class session</i>	Pre-recorded	Folate and Methylation	Steve Whitehead, PhD
	F, Sep 27	Richards Pavilion B205	Mitochondrial Dysfunction	Ian Blair, PhD
GENE-ENVIRONMENT INTERACTIONS				
6	M, Sep 30 1:45pm-3:45pm	Richards Pavilion B205	Toxicogenetics – Toxicology and DNA Variation Toxicogenomics – Toxicology and RNA Expression	Ted Burczynski, PhD
	W, Oct 2 1:45pm-3:45pm	Live Online	Transcriptome-Analysis-Technologies and Experimental Design Problem Set: Chemical Carcinogenesis	John Tobias, PhD Jeffrey Field, PhD
	F, Oct 4	Richards Pavilion B205	Reactive Oxygen Species	Vladimir Muzykantov, MD, PhD
7	M, Oct 7 1:45pm-3:45pm	Richards Pavilion B205	Midterm	
EXPOSURE SCIENCE				
	W, Oct 9	Richards Pavilion B205	Protein-Biomarkers-Proteomics	Clementina Mesaros, PhD
	F, Oct 11	Richards Pavilion B205	Exposure and Response Biomarkers	Clementina Mesaros, PhD
8	M, Oct 14	Richards Pavilion B205	Biosensors	Charlie Johnson, PhD
ORGAN-BASED TOXICOLOGY				
LUNG AND AIRWAY-DISEASE				
	W, Oct 16	Richards Pavilion B205	Inhalation Toxicology 1: Respiratory Physiology	Krithika Lingappan, MD, PhD, MS
	F, Oct 18	Richards Pavilion B205	Toxic Responses of the Respiratory System	Jessica Rice, DO, MHS
9	M, Oct 21	Richards Pavilion B205	Lung Cancer	Anil Vachani, MD, MSCE
	W, Oct 23	Richards Pavilion B205	Inhalation Toxicology 2: Mechanisms of Lung Injury	Sharon McGrath-Morrow, MBA, MD

Week	Date	Location	Topic	Lecturer
	F, Oct 25	Richards Pavilion B205	Mesothelioma	Trevor Penning, PhD
NERVOUS SYSTEM				
10	M, Oct 28	Pre-recorded	Overview of the Nervous System and Neurotoxicants	Michael Robinson, PhD
	W, Oct 30	Richards Pavilion B205	Mechanisms of Neurotoxicity	Aimin Chen, MD, PhD
	F, Nov 1	Richards Pavilion B205	Sleep Disturbance and Neurodegenerative Disease	Sigrid Veasey, MD
REPRODUCTIVE & ENDOCRINE DISRUPTION				
11	M, Nov 4	Richards Pavilion B205	Environmental Reproductive Epidemiology	Sunni Mumford, PhD
	W, Nov 6	Richards Pavilion B205	In utero Genetic Imprinting	Marisa Bartolomei, PhD
	F, Nov 8	Pre-recorded	Mechanisms of Reproductive Disruption-Male	George Gerton, PhD
12	M, Nov 11	Richards Pavilion B205	Epigenetics	Thea Golden, PharmD, PhD
DATA INTEGRATION & PREDICTIVE TOXICOLOGY				
	W, Nov 13	Richards Pavilion B205	Predictive Toxicology and TOX 21st Century	Joseph Romano, PhD
	F, Nov 15	Richards Pavilion B205	Exposure Biology Informatics	Joseph Romano, PhD
	M, Nov 18	Richards Pavilion B205	Data-Integration-Bioinformatics	Aalim Weljie, PhD
13	W, Nov 20 1:45pm-3:45pm	Richards Pavilion B205	Risk Assessment Presentations	
	M, Nov 25	Richards Pavilion B207	Final Examination	

Evaluation:

Mid-Term: 30%

Final Exam: 40%

Risk Assessment Paper: 30%

Text: Casarett & Doulls: Toxicology: The Basic Science of Poisons (7th – 9th Ed)

Questions on individual lectures can be sent by email to:

Lecturers:	Email Address
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