

**Molecular Toxicology: Chemical and Biological Mechanisms**  
**GGPS-PHRM 590**

**Course Director: Trevor M. Penning, Professor of Systems Pharmacology and Translational Therapeutics**

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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.

**Lecture Course:** 60 minute lectures meets twice per week on Monday's and Wednesday's and also some Friday's

**Course Unit:** 1 credit unit

**Proposed Days:** Mon and Weds (and some Friday's)

**Semester:** Spring

**Course Materials:** Casarett & Doulls: Toxicology: The Basic Science of Poisons (7<sup>th</sup> or 8<sup>th</sup> Edition) 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 1<sup>st</sup> and 2<sup>nd</sup> year BGS students with required prerequisites; residents in Environmental and Occupational Health, and professional masters students (MPH and MTR).

## Molecular Toxicology Course Schedule

**Mondays and Wednesdays: 2:00PM- 3:00 PM.** (NOTE: Some classes are 2p – 4p and also some Fridays as highlighted in yellow below) The Risk Assessment Presentations and Final Exam also occur during different timeframes as noted in yellow below.

**Location: 10-146 Smilow Center for Translational Research**

### 2020 Spring Schedule

Week	Date	Location	Topic	Lecturer
<b>General Principles</b>				
1	M, Jan 13	10-146 SCTR	Introduction /Orientation	Penning
	W, Jan 15	10-146 SCTR	Regulatory Policy and EPA	Pepino
	<b>F, Jan 17</b>	<b>10-146 SCTR</b>	<b>General Principles: Dose Response &amp; Exposures</b>	<b>Penning</b>
2	M, Jan 20		<i>No Class - Martin Luther King Day</i>	
	W, Jan 22	10-146 SCTR	Heavy Metal Toxicity	Howarth
	<b>F, Jan 24</b>	<b>10-146 SCTR</b>	<b>Reactive Oxygen Species</b>	<b>Ischiropoulos</b>
3	M, Jan 27	10-146 SCTR	Metabolism Phase I	Penning
	W, Jan 29	10-146 SCTR	Metabolism Phase II	Penning
	<b>F, Jan 31</b>	<b>10-146 SCTR</b>	<b>Chemical Carcinogenesis by Genotoxic Agents</b>	<b>Penning</b>
4	M, Feb 3	10-146 SCTR	Chemical Carcinogenesis by Non-Genotoxic	Penning
	W, Feb 5	10-146 SCTR	Mutagenesis / Mutational Signatures	Field
5	M, Feb 10	10-146 SCTR	DNA Adducts and their Repair	Penning
	W, Feb 12	10-146 SCTR	Mitochondrial Dysfunction	Blair
<b>Gene-Environment Interactions</b>				
6	M, Feb 17	10-146 SCTR	Epigenetics	Heller
	W, Feb 19	10-146 SCTR	Transcriptome-Analysis-Technologies and Experimental Design	Tobias
	<b>F, Feb 21</b>	<b>10-146 SCTR</b>	<b>Folate and Methylation</b>	<b>Whitehead</b>
7	<b>M, Feb 24</b> <b><u>2:00-4:00</u></b>	<b>10-146 SCTR</b>	<b>Toxicogenetics – Toxicology and DNA Variation</b> <b>Toxicogenomics- Toxicology and RNA Expression</b>	<b>Burczynski</b>
	W, Feb 26	10-146 SCTR	Risk Assessment Assignment	Penning
	<b>F, Feb 28</b>	<b>10-146 SCTR</b>	<b>Midterm (2:00 – 5:00 PM)</b>	
<b>Exposure Science</b>				
8	M, Mar 2	10-146 SCTR	Protein-Biomarkers-Proteomics	Mesaros
	W, Mar 4	10-146 SCTR	Exposure and Response Biomarkers	Mesaros
	<b>F, Mar 6</b>		<b>Biosensors</b>	<b>Johnson</b>
9	M, Mar 9		Spring Break	
	W, Mar 11		Spring Break	

Week	Date	Location	Topic	Lecturer
<b>Organ-Based Toxicology</b>				
<b>Lung and Airway-Disease</b>				
10	M, Mar 16	10-146 SCTR	Mesothelioma	Moon
	W, Mar 18	10-146 SCTR	Toxic Responses of the Respiratory System	Christofido Solomidou
11	M. Mar 23	10-146 SCTR	Lung Cancer	Vachani
	<b>W. Mar 25 2:00 –4:00</b>	<b>10-146 SCTR</b>	<b>Inhalation Toxicology 1: Respiratory Physiology Inhalation Toxicology 2: Mechanisms of Lung Injury</b>	<b>Joseph Jude (Rutgers)</b>
<b>Nervous System</b>				
12	M, Mar 30	10-146 SCTR	Mechanisms of Neurotoxicity	Ischiropoulos
	W, Apr 1	10-146 SCTR	Overview of the Nervous System and Neurotoxicants	Robinson
13	M, Apr 6	10-146 SCTR	Sleep Disturbance and Neurodegenerative Disease	Veasey
<b>Reproductive &amp; Endocrine Disruption</b>				
	W, Apr 8	10-146 SCTR	<i>In utero</i> Genetic Imprinting	Bartolomei
14	M, Apr 13	10-146 SCTR	Mechanisms of Reproductive Disruption-Male	Gerton
	W, Apr 15	10-146 SCTR	Environmental Reproductive Epidemiology	Burriss
<b>Data Integration &amp; Predictive Toxicology</b>				
15	M, Apr 20	10-146 SCTR	Data-Integration-Bioinformatics	Weljie
	W, Apr 22	10-146 SCTR	Exposure Biology Informatics	Jason Moore
	<b>F, Apr 24</b>	<b>10-146 SCTR</b>	<b>Predictive Toxicology and TOX 21<sup>st</sup> Century</b>	<b>Penning</b>
16	<b>M, Apr 27</b>	<b>10-146 SCTR</b>	<b>Risk Assessment Presentations – 9:00 am- 11:00 am</b>	<b>Field, Howarth, Pepino, Penning</b>
	<b>W, Apr 29</b>	<b>10-146 SCTR</b>	<b>Final Examination – 9:00am - 12:00pm</b>	

Evaluation:

Mid-Term: 30%

Final Exam: 40%

Risk Assessment Paper: 30%

Text: Cassarett & Doull's: Toxicology: The Basic Science of Poisons

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