Molecular Toxicology: Chemical and Biological Mechanisms
GGPS-PHRM 590

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

Email: penning@upenn.edu
www.med.upenn.edu/ceet

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 a required for those pursuing the Certificate Program in Environmental Health Sciences.

Lecture Course: 60 minute lectures meets twice per week.
Course Unit: 1 credit unit
Proposed Days: Mon and Weds (some Friday classes may be necessary)
Semester: Spring
Course Materials: Casarett & Doulls: Toxicology: The Basic Science of Poisons (7th or 8th 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 1st and 2nd 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: Mon and Weds: 2:00- 3:00 P.M. (some Fridays may be necessary)
Location: 10-146 Smilow Center for Translational Research, unless noted otherwise **

2019 Spring Schedule

Week	Date	Topic	Lecturer
		General Principles	
1	M, Jan 14	Introduction /Orientation/	Penning
	W, Jan 16	Regulatory Policy and EPA /	Pepino
	F, Jan 18	General Principles: Dose Response & Exposures	Penning
2	M, Jan 21	***No Class - Martin Luther King Day***	
	W, Jan 23	Metabolism-Phase I /	Penning
	F, Jan 25	Metabolism – Phase II	Penning
3	M, Jan 28	Reactive Oxygen Species	Ischiropoulos
	W, Jan 30	Chemical Carcinogenesis by Genotoxic Agents	Penning
	F, Feb 1	Chemical Carcinogenesis by Non- Genotoxic Agents	Penning
4	M, Feb 4	Heavy Metal Toxicity	Liu
	W, Feb 6	Mutagenesis / Mutational Signatures	Field
	M, Feb 11	DNA Adducts and their Repair /	Penning
5	W, Feb 13	Mitochondrial Dysfunction	Blair
		Gene-Environment Interactions	
6	**M, Feb 18 2-4**	Toxicogenetics – Toxicology and DNA Variation Toxicogenomics- Toxicology and RNA Expression	Burczynski
	W. Feb 20	Transcriptome-Analysis-Technologies and Experimental Design	Tobias
	F, Feb 22	Epigenetics /	Simmons
7	M, Feb 25	Folate and Methylation	Whitehead
	W, Feb 27	**Risk Assessment Assignment**	Penning
	F, Mar 1	**Midterm (2:00 – 5:00 PM)**	
8	M, Mar 4	Spring Break	
	W, Mar 8	Spring Break	
		Exposure Science	
9	M, Mar 11	Protein-Biomarkers-Proteomics	Mesaros
	W, Mar 13	Exposure and Response Biomarkers	Mesaros
10	M, Mar 18	Biosensors	Johnson
		Organ-Based Toxicology	
		Lung and Airway-Disease	
	W, Mar 20 2:00 – 3:00 3:00 - 4:00	Inhalation Toxicology 1: Respiratory Physiology Inhalation Toxicology 2: Mechanisms of Lung Injury	Panettieri
	F, Mar 22	Toxic Responses of the Respiratory System	Christofidou-Solomidou
11	M. Mar 25	Lung Cancer	Vachani

	W. Mar 27	Mesothelioma	Moon
		Nervous System	
12	M, Apr 1	Mechanisms of Neurotoxicity –	Ischiropoulos
	W, Apr 3	Overview of the Nervous System and Neurotoxicants	Robinson
13	M, Apr 8	Inflammation and Neurodegenerative Disease	Jordan-Sciutto
		Reproductive & Endocrine Disruption	
	W, Apr 10	Mechanisms of Reproductive Disruption-Female	Gerton
	F, Apr 12	*In utero* Genetic Imprinting	Bartolomei
14	M, Apr 15	Mechanisms of Reproductive Disruption-Male	Parry
	W, Apr 17	Exposure Biology Informatics /	Wang
		Data Integration & Predictive Toxicology	
15	M, Apr 22	Data-Integration-Bioinformatics	Weljie
	W Apr 24	Predictive Toxicology and TOX 21st Century	Penning
	Th, Apr 25	**Risk Assessment Presentations – 9:00 am- 11:00 am**	Field, Howarth, Penning
	M, Apr 29	**Final Examination – 9:00 am -12:00 pm /**	

Evaluation:
Mid-Term: 30%
Final Exam: 40%
Risk Assessment Paper: 30%
Text: Cassarett & Doull's: Toxicology: The Basic Science of Poisons

Lecturers:	**Email Address**	
Marisa Bartolomei	BARTOLOM@PENNMEDICINE.UPENN.EDU	
Ted Burczynski	tedburczynski@gmail.com	
Melpo Christofidou-Solomidou	melpo@mail.med.upenn.edu	
Jeff Field	jfield@upenn.edu	
George Gerton	GERTON@PENNMEDICINE.UPENN.EDU	
Harry Ischiropoulos	ISCHIROP@PENNMEDICINE.UPENN.EDU	
Charlie Johnson	cjohnson@physics.UPENN.EDU	
Kelly Jordan-Sciutto	jordank@upenn.edu	
Jianghong Liu	jhliu@nursing.upenn.edu	
Clementina Mesaros	mesaros@pennmedicine.upenn.edu	
Edmund Moon	Edmund.Moon@uphs.upenn.edu	
Rey Panettieri	reynold.a.panettieri@rutgers.edu	
Sam Parry	parry@mail.med.upenn.edu	
Trevor Penning	penning@upenn.edu	
Richard Pepino	rpepino@sas.upenn.edu	
Michael Robinson	Robinson@pennmedicine.upenn.edu	
Becky Simmons	rsimmons@pennmedicine.upenn.edu	
Carsten Skarke	cskarke@pennmedicine.upenn.edu	
John Tobias	jtobias@pcbi.upenn.edu	

Paul Wang	wangpaul@pennmedicine.upenn.edu	
Aalim Weljie	aalim@pennmedicine.upenn.edu	
Steve Whitehead	aswhiteh@upenn.edu	