SYLLABUS

PHLT 203-1: Principles of Toxicology

Fall 2024

Tuesdays and Thursdays, 12:30pm to 1:45pm

Location: Lattimore Room 431

Course Instructor:
Matthew Rand, PhD
Email: matthew_rand@urmc.rochester.edu
Student hours: 1:45 – 2:45, Tuesdays and Thursdays

Course Description:

This course is designed to introduce the student to the essential concepts of toxicology, including dose-response, toxicokinetics, toxicodynamics, metabolism, fundamental molecular and cellular mechanisms, modifiers of toxicity, overview of various agents and organ toxicities, environmental and clinical toxicology and forensics.

Lectures, readings and discussions of scientific papers, case studies, and reference to current and historical events will provide students opportunities to apply new knowledge and explore the applications of toxicological principles and their influence on society and the environment.

Collectively, this course aspires to support students in developing the interests, fundamental knowledge, and skills necessary to evaluate new discoveries in toxicology and introduce students to topics for advanced (graduate) studies in the field and career option that utilize the discipline.

Intended Audience:

The course is intended for students who wish to gain a broad understanding of the fundamental concepts and principles of cellular and molecular toxicology and to apply them to the study of environmental toxicology. It also serves as an introductory course for those students who wish to pursue more advanced study in the science of toxicology, pharmacology, epidemiology, environmental health, environmental policy, and regulatory science.

Pre-Requisites:

- Principles of Biology I and II (BIO 110 and BIO 111)
- Chemical Concepts (CHM 131 and CHM 132)
- Organic Chemistry (CHM 203-1)

Textbook (required, available online):

- Essentials of Toxicology, Casarett and Doull's, 4th Edition. https://rochester.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_askewsholts_vlebooks_9781260452303&context=PC&vid=01ROCH_INST:UR01&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central)

Course Goals:

The main goals for this course are:

- To provide students a fundamental understanding of toxicology, with a focus on environmental toxicology, as a foundation for future courses
- To introduce students to the principles governing the interactions of xenobiotics with biological systems
- To develop an understanding of the toxic manifestations that occur following xenobiotic exposure
- To provide students the opportunity to develop critical thinking skills through in-class discussions.

Student learning outcomes:

The anticipated learning outcomes include, but are not limited to, the following:

- Describe the biological processes which modulate the kinetics of xenobiotics, including dose-response relationships, toxicokinetic and toxicodynamic properties, and biotransformation activities
- Explain the significance of biotransformation reactions as a determinant of the toxicity profile of xenobiotics
- Describe molecular, cellular, and pathophysiological responses resulting from exposure to xenobiotics
- Identify underlying susceptibility factors and modifiers of toxicity that contribute to the ability of xenobiotics to elicit human disease
- Put into perspective the role of toxicology in health human, medicine and environmental and societal determinants of disease.

Course Format and Expectations:

This course will be mostly in person, traditional lectures, with occasional group discussion centered on a research topic and an associated study(ies) reported in primary literature. Work outside of class will involve preparation for group discussions on assigned readings that will occur four times/semester. In addition, students will participate in "Tox topics in 10" by surveying and reporting concisely on a current local, national or international/global news item topic related to toxicology (eight times/semester). Tox topics in 10 will be shared orally in class and submitted as a brief written statement. We will have several lectures provided by expert faculty from the University of Rochester School of Medicine tailored to their respective discipline of toxicology. These lectures will adhere to a similar format and draw from the required text, while also being supplemented with relevant and current material drawn from each Faculty member's experience and expertise. (The participating faculty and emails are listed below)

Assigned readings of scientific papers and case studies must be done before the class convenes for discussion. Active class participation is vital for the class and for the development of your critical reading and thinking skills. Therefore, you are expected to enthusiastically participate in class discussions. I hope that these in-class activities will a) give you an opportunity to think through your ideas, b) take some pressure off the formal testing process by accounting for a portion of your grade, and c) provide me with an impression of your understanding of the concepts we cover in class.

I will be using UR/URMC email and Blackboard to communicate. Course materials will be posted on Blackboard ahead of time. Please check both Blackboard and email on a regular basis to stay abreast with all course updates.

Instructors:

Matthew Rand	matthew_rand@urmc.rochester.edu
Martha Susiarjo	Martha_Susiarjo@urmc.rochester.edu
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John O'Donoghue	jlod@rochester.rr.com
Nick Nacca	nicholas_nacca@urmc.rochester.edu

Attendance:

I will not take attendance, but attendance to all lectures is strongly encouraged as it is essential for your success in this course. Lectures will include in-class activities and discussions of the course material in ways not emphasized in out-of-class readings. Positive attendance means being present at the start of class (12:30pm) and remaining present throughout class (1:45am).

You do not need to email me if you will or did miss a lecture. If you miss class, review the slides on your own, get notes from friends, and stop by during student hours if you have questions. Be pro-active and take responsibility for what you missed.

Quizzes and Exams:

There will be 4 quizzes and 3 exams over the course of the semester. See the course calendar for the dates of these quizzes. The quizzes will include a variety of question styles that require students to recall, evaluate, apply, and reflect on what was learned. Question styles will appear in the format of multiple choice, fill-ins, and short answers pertinent to class lectures and case studies. Quizzes will cover concepts discussed in lecture and in-class activities. Questions, problems, and discussion prompts from class are also likely to appear as quiz questions. Exams will have a format of multiple choice, fill-ins, word problems and short answers pertinent to class lectures and case studies. Exams will be tailored to content in the preceding section, i.e. the second and final exams will not be cumulative. That said, concepts covered in the latter part of the course will build on knowledge established in the first section. It will be expected that students will be prepared with knowledge gained from the beginning of the semester.

Note: There are 5 planned quizzes throughout the semester. *Students will be allowed to drop their lowest quiz grade*.

If you miss a quiz due to a verifiable, unplanned emergency, you must notify me by e-mail of the problem prior to the quiz and schedule to make up the quiz within 1 week of the original quiz date.

Grading:

PH 203-1 is a 4-credit course. Quizzes will comprise 10% of the final grade while Group discussions will comprise another 10% and Tox Topics in 10 will comprise 5% of the final grades. The three exams will comprise 75% of the final grade.

Grades will be based on the percentage of total points earned. As an instructor, I do not decide your grade, but rather you as a student do the work to earn your grade.

Credit hours: This Course follow the College credit hour policy for a four-credit course. This course meets twice a week for three academic hours per week. The course also includes an additional hour of equivalent instruction with out-of-class independent assignments.

Online Sources for Additional Learning:

There are many websites available for you to research additional information for Tox topics in 10, and to gain insight into the field of Toxicology and its applications to public health and policy. A partial list of informative sites is provided below:

- **PubMed:** https://pubmed.ncbi.nlm.nih.gov/
  PubMed is a free search engine accessing primarily the MEDLINE database of references and abstracts on life sciences and biomedical topics. The United States National Library of Medicine (NLM) at the National Institutes of Health maintains the database as part of the Entrez system of information retrieval.

- **NIEHS:** https://www.niehs.nih.gov
  The National Institute of Environmental Health Sciences (NIEHS) conducts research into the effects of the environment on human disease, as one of the 27 institutes and centers of the National Institutes of Health (NIH).

- **ECOTOX Knowledgebase:** https://cfpub.epa.gov/ecotox/
  ECOTOX is an EPA hosted site for comprehensive Knowledgebase providing single chemical environmental toxicity data on aquatic and terrestrial species.

- **ATSDR:** http://www.atsdr.cdc.gov
  The Agency for Toxic Substances and Disease Registry (ATSDR), based in Atlanta, Georgia, is a federal public health agency of the U.S. Department of Health and Human Services. The agency focuses on minimizing human health risks associated with exposure to hazardous substances. It works closely with other federal, state, and local agencies; tribal governments; local communities; and healthcare providers.

- **CDC:** https://www.cdc.gov
  The Centers for Disease Control and Prevention (CDC) is the leading national public health institute of the United States. The CDC is a United States federal agency under the Department of Health and Human Services, headquartered in Atlanta, Georgia.

- **NYS Department of Health:** https://www.health.ny.gov
  The New York State Department of Health (NYSDOH) is the department of the New York state government responsible for public health.

- **U.S. Department of Health & Human Services, National Toxicology Program:** https://ntp.niehs.nih.gov/

The National Institute of Environmental Health Sciences (NIEHS) is home to the National Toxicology Program, a Health and Human Services interagency program dedicated to testing and evaluating substances in our environment. The National Toxicology Program provides the scientific basis for programs, activities, and policies that promote health or lead to the prevention of disease. Founded in 1978, NTP plays a critical role in generating, interpreting, and sharing toxicological information about potentially hazardous substances in our environment.

A few comments on your success in this course:

To optimize your success in this course, you should:

- Be open to learning in different ways and trying new learning and study strategies
- Approach me for help early and often
- Seek out additional information through online resources (partial list provided above)
- Use text and other readings to clarify information and extend knowledge
- Take responsibility for your own learning by staying attentive and organized
- Refrain from engaging in any personal internet/communication activities while in the classroom. Ensure that your cell phones, tablets, etc., are turned off during class time.
- Arrive to class on time. In the event that you are late, enter quietly and non-disruptive. Complete class attendance means being present at the start of class (12:30am) and remaining present throughout class (1:45am).

A word on email etiquette: You are encouraged to contact me via email for questions that do not require expansive answers. If questions require more than a few lines, I will direct you to visit me during office hours or to schedule an appointment.

Statement on Plagiarism and Cheating:

Students are expected to maintain academic integrity in all work. Cheating on exams may result in automatic disqualification of the test and the student receiving zero points for that test.

Academic Integrity

Academic integrity is a core value of the University of Rochester. Students who violate the University of Rochester University Policy on Academic Honesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since academic dishonesty harms the individual, other students, and the integrity of the University, policies on academic dishonesty are strictly enforced. For further information on the University of Rochester Policy on Academic Honesty, please visit the following website:

https://www.rochester.edu/college/honesty/policy/index.html

Accommodations for Students with Disabilities

UR is committed to providing reasonable accommodations to students with disabilities. If you would like to request accommodations such as special seating or testing modifications due to a disability, please visit the Student Disability Services in Taylor Hall and/or the following website:

http://www.rochester.edu/disability/

After you receive accommodation approval, it is imperative that you speak with me so that we can work out whatever arrangement(s) is necessary.

Diversity and Inclusion Statement

In an ideal world, science would be objective. However, this is not true as much of science can be subjective. In this class, we will read scholarly work and case studies from a diverse group of scientists, but limits still exist on this diversity. Moreover, I recognize that there may be both overt and covert biases in the material due to the lens with which it was written, even though the material is primarily of a scientific nature.

Likewise, integrating a diverse set of experiences is important for a comprehensive understanding of toxicology. That being said, I will strive to create a learning environment that supports a diversity of thoughts, perspectives and experiences, and honors your identities (including, but not limited to, race, gender, sexuality, religion, and ability). To help accomplish this:

- If you have a name and/or set of pronouns that differ from those that appear in your official UR records, please let me know.
- If you feel like your performance in the class is being impacted by your experiences outside of class, please talk with me. I want to be a resource for you. Remember that you can also submit anonymous feedback to address your concerns.
- Like many of us, I am still in the process of learning about diverse perspectives and identities. If something was said in class that made you feel uncomfortable, please talk to me. (Again, anonymous feedback is always an option).
- As a participant in course discussions, you should also strive to honor the diversity of your classmates.

Principles of Toxicology PHLP 203

Class #	Date	Description	Lecturer	Presentations, Quizzes and Exam Dates
1 (Tu)	8/27	Class Introduction, History of Toxicology	M. Rand	
2 (Th)	8/29	Principles of Toxicology I: Disciplines and Dose-response relationships I	M. Rand	
3 (Tu)	9/3	Principles of Toxicology II: Dose-response relationships II, Toxic Responses and testing, systems toxicology.	M. Rand	
4 (Th)	9/5	Disposition of Toxicants I: ADME	M. Rand	*Tox Topics in 10 (#1)*
5 (Tu)	9/10	Disposition of Toxicants II: Toxicokinetics II	M. Rand (remote)	**Quiz #1** (Moved to 9/11)
6 (Th)	9/12	Disposition of Toxicants III: Phase I Metabolism	M. Rand (remote)	*Tox Topics in 10 (#2)*
7 (Tu)	9/17	Disposition of Toxicants IV: Phase II Metabolism	M. Rand	
8 (Th)	9/19	Disposition of Toxicants V: Phase III Metabolism	M. Rand	*Tox Topics in 10 (#3)*
9 (Tu)	9/24		M. Rand	**Exam #1**
10 (Th)	9/26	*Case Study: Tuna for Lunch? A Case Study Examining Mercury Bioaccumulation and Biomagnification. Companion Scientific Paper:* Caito *et al*., 2018. Variation in methylmercury metabolism and elimination status in humans following fish consumption. Tox Sci.	M. Rand	Group discussion #1
11 (Tu)	10/1	Non-Organ-Directed Toxicity I: Carcinogens and genetic toxicology	Recorded Presentation	https://vimeo.com/channels/1009234/210424933
12 (Th)	10/3	Non-Organ-Directed Toxicity II: Toxicant-receptor interactions	M. Rand (remote)	*Tox Topics in 10 (#4)*
13 (Tu)	10/8	Non-Organ-Directed Toxicity III: Epigenetics.	M. Susiarjo	
14 (Th)	10/10	Organ-Directed Toxicity I: Liver.	M. Rand	
	10/15	*No Class, Columbus Day		
15 (Th)	10/17	Organ-Directed Toxicity II: Kidney	J. Wu	**Quiz #2** (due end of day 10/18)
16 (Tu)	10/22	Organ-Directed Toxicity III: Neurotox	M. Sobolewski	
17 (Th)	10/24	*Case Study: PFAS compounds in 3M factory*	M. Rand	Group discussion #2

		workers Companion Scientific Paper: Olsen et al, 2007 EHP Half-Life of Serum Elimination of Perfluorooctanesulfonate, Perfluorohexanesulfonate, and Perfluorooctanoate in Retired Fluorochemical Production Workers		
18 (Tu)	10/29	Organ-Directed Toxicity IV: Lung tox, inhalation	A. Elder	
19 (Th)	10/31	Organ-Directed Toxicity V: Heart, Immune, Other systems Tox	M. Rand	
20 (Tu)	11/5	Organ-Directed Toxicity V: Heart, Immune, Other systems Tox	M. Rand	*Tox Topics in 10 (#5)*
21 (Th)	11/7			**Exam #2 (**Covering lectures 11-16, 18-20. Does not cover case studies)
22 (Tu)	11/12	Agents I: Pesticides, EDCs	E. Plunk	
23 (Th)	11/14	Agents III: Particles, plastics, Solvents and Vapors	A. Elder	
24 (Tu)	11/19	Reproductive Toxicity	H.R. Park	
25 (Th)	11/21	Environmental toxicology	M. Rand	*Tox Topics in 10 (#6)*
26 (Tu)	11/26	Applications of Tox: Forensics,	J. O'Donahue	**Quiz #3** (due end of day 11/27)
27 (Tu)	12/3	Applications of Tox: Clinical Tox.	N. Nacca	
28 (Th)	12/5	Case Study: Microplastics, Regulatory issues *w/ Companion Scientific Paper*	M. Rand	Group discussion #3
	12/13-18			**Exam #3**