

Syllabus: EnvH 405 - Toxic Chemicals and Human Health

Spring quarter, 2018; 3 credits

MWF 11:30 - 12:20, Room: Health Sciences RR134

Instructor: Dr. Evan Gallagher; email: evang3@u.washington.edu

Guest lecturer: Dr. Terry Kavanagh; email: tjkav@uw.edu

Teaching Assistant: Rebekah Petroff; email: petroffr@uw.edu

TA Office hrs by arrangement only.

Optional Review Session: to be arranged

Course Description

Basic principles governing the behavior and effects of toxic chemicals on biological systems, including: toxicity testing; the disposition of chemicals in the body; modifiers of toxic response; fate and effects of chemicals in the environment; chemicals and cancer; chemicals and birth defects; toxicity risk assessment and government regulation of chemical hazards in the home, the workplace and the general environment. Focus is on human and environmental health impacts of chemicals.

Learning objectives for ENV H 405

The learning objectives for this course are based on fundamental concepts in the science and practice of toxicology. After having taken this course students will be able to:

- Identify significant figures and seminal events important in the history of toxicology, and the professional disciplines, job classifications and scientific fields occupied by toxicologists.
- Explain the principles of chemical dose-response, including quantal vs. continuous measures of response and the descriptors used to define individual susceptibility to toxicants.
- Discuss the different types of testing paradigms used to evaluate the toxicity of chemicals, including tests for acute, subacute and chronic toxicity; the various biochemical assays used to investigate mechanisms by which chemicals cause injury; and the ethical principles surrounding *in vitro* and *in vivo* testing.
- Explain the concepts of absorption, distribution, metabolism and excretion, and their integral roles as determinants of toxicity.
- Explain the biochemical basis of toxicant biotransformation including the key enzymes systems involved, phases of metabolism, and their consequences for toxicant disposition.
- Discuss the impact of genetic variation, diet, age, gender, and infectious disease status on toxicant disposition and dose-response relationships.
- Discuss the consequences of toxicant exposure for different organs, especially the liver, the kidneys, the brain, and the cardiovascular and endocrine systems, and why some toxicants target these organs.
- Identify susceptible periods of embryonic/fetal development that predispose to various kinds of chemically-induced birth defects, and explain the value of comparative animal approaches for understanding mechanism of action for developmental toxicants.
- Describe the basic processes of chemical carcinogenesis, including initiation, promotion and progression, and the types of chemically-induced genetic, molecular and cellular changes that lead to cancer.
- Discuss occupational practices and regulations designed to limit chemical exposures and toxicity in the workplace, biomonitoring and the roles of occupational health professionals in workplace safety.
- Categorize toxicants with respect to chemical class, mode of action, and potency, including pesticides, heavy metals, solvents, gases, halogenated hydrocarbons, polycyclic aromatic hydrocarbons, drugs, food additives and contaminants, and toxins produced by bacteria, plants and animals.
- Identify toxicants commonly found in the home environment, discuss the design of consumer products that limit chemical exposures and explain how the Poison Control System works.
- Describe the major sources of pollution in air, water and soil, the chemicals of concern in the environment, and the distribution, fate and ecological effects of various pollutants.

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- Integrate the concepts of chemical exposure and hazard as they relate to risk, distinguish between risk assessment scenarios that assume threshold vs. non-threshold responses, and discuss various risk management strategies used to limit toxicant exposures.
- Define the statutory authority governmental agencies use to control toxicant releases to the environment, exposures in the workplace, and clean-up of chemical contamination; describe the means by which exposure criteria and standards are established, and discuss the economic, political, and ethical dilemmas associated with the regulation of toxicants.

Required Textbook:

Casarett & Doull's Essentials of Toxicology, 2nd Edition, Curtis D. Klaassen & John B Watkins III, McGraw Hill, 2010
The text is available as an eBook through the UW Libraries. Or go directly to this website:
<http://accesspharmacy.mhmedical.com.offcampus.lib.washington.edu/book.aspx?bookid=449>

Optional-Introduction to Toxicology, 3rd Edition by John Timbrell, published by Taylor & Francis, 2002

ENVH 405 Website

Canvas Website to be announced.

Prerequisites

2.0 in BIOL 220; either 2.0 in CHEM 224, 2.0 in CHEM 239, or 2.0 in CHEM 337.

Grading

Midterm Exam I	30%
Midterm Exam II	30%
Final Exam	40%

Exams will be worth a total of 110 points each (100 points and 10 points bonus question). The final exam will be approximately 25% content that is comprehensive for the quarter with the remaining 75% of content covering material from May 10 through June 2s.

Course Absence Policies

- It is your responsibility to notify the instructors **by the end of the first week** of any conflicts you may have with the exam schedule.
- There will be no make-up examinations unless approved by the instructor in advance. If a test is missed because of an unexcused absence, it will not be rescheduled. Contact your instructors **prior to or same day** to notify them that you are unable to take the exam.
- Your instructor will then set a date for a makeup exam, contingent on the test taking person showing **as soon as possible** a valid medical note issued by a medical professional, on the original exam date. Other reasons for missing the exam (car accident, death in the family etc.), arrange to speak with the instructors to explain the circumstances. Within reason we will expect to be notified prior to or day of the exam for these instances.
- If you have any concerns about the class or the TA, please see the TA about these concerns as soon as possible. If you are not comfortable talking with the TA or not satisfied with the response that you receive, you may contact Drs. Gallagher by phone or email, to arrange a meeting with either of them. If you are still not satisfied with the response that you receive, you may contact the Department Chair. You may also contact the Graduate School at G -1 Communications Bldg, by phone at (206) 543-5139 or by email at raan@uw.edu.

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The University of Washington and Academic Integrity

All written work you submit will be your own. Plagiarism is a serious offense that will be met with an appropriate penalty and the possibility of disciplinary action. Remember to cite your references and do not paraphrase any references you use for writing assignments.

The University of Washington expects its students "to maintain the highest standards of academic conduct," as per its Statement of Academic Responsibility. Students who plagiarize are not only jeopardizing their grade and losing the opportunity to really learn, but they also are devaluing the work of their fellow classmates and diminishing the reputation of the University of Washington--which can make your degree less valuable.

University of Washington general policy statement

"Admission to the University carries with it the presumption that students will conduct themselves as responsible members of the academic community. As a condition of enrollment, all students assume responsibility to observe standards of conduct that will contribute to the pursuit of academic goals and to the welfare of the academic community. That responsibility includes, but is not limited to: practicing high standards of academic and professional honesty and integrity."

[Reference: WAC 478-120-020 Standards of Conduct (2a),<http://www.washington.edu/students/handbook/conduct.html#020>]

For web-resources on understanding and avoiding plagiarism, go to:

<http://courses.washington.edu/hsstudev/studev/plagiarism.htm>

Accommodations for Students with Disabilities

The UW Disability Resources for Students office is your partner in identifying learning challenges and enabling access to our educational programs. We encourage students with concerns to consult with the office. If you have a letter from the office indicating you have a disability that requires academic accommodations, please contact me as early as possible in order to discuss the accommodations you might need per distance-based delivery of the course content.

If you would like to request accommodations for this course due to a disability, please contact Disability Resources for Students, 448 Schmitz, (206) 543-8924 (Voice), 543-8925 (TTY) or uwdss@u.washington.edu.

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<u>Date</u>	<u>Topic</u>	<u>Reading Assignment</u>
March 26	Introduction/History of Toxicology (Gallagher)	Chapter 1
March 28	Basic Principles of Toxicology (Gallagher)	Chapter 2
March 30	Biological Disposition I-absorption, distribution (Gallagher)	Chapter 5
April 2	Biological Disposition II - biotransformation (Gallagher)	Chapter 6
April 4	Biological Disposition III - excretion (Kavanagh)	Chapter 5 & 7
April 6	Factors that Modify Toxic Responses (Kavanagh)	Chapter 3
April 9	Testing Procedures/Types and Routes of Exposure (Kavanagh)	Chapter 2
April 11	Toxicity in the Liver and Kidney (Kavanagh)	Chapter 13 & 14
April 13	Developmental and Reproductive Toxicology (Petroff)	Chapter 10, 20, 21
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April 16	Toxicity in the Nervous System (Kavanagh)	Chapter 16
April 18	Genetic Toxicology (Kavanagh)	Chapter 9
<u>April 20</u>	Exam 1 (covers material through April 13)	
April 23	Cancer (Gallagher)	Chapter 8
April 25	Toxic Metals I (Kavanagh)	Chapter 23
April 27	Toxic metals II (Kavanagh)	Chapter 23
April 30	Industrial Chemicals (Kavanagh)	Chapter 24 & 33
May 2	Household Products (Gallagher)	Handout
May 4	Drugs as Toxic Substances (Kavanagh?)	Chapter 32
May 7	Air pollution/toxicology of the lung (Kavanagh)	Chapter 15 & 28
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May 9	Ecotoxicology (Gallagher)	Chapter 29

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May 11 Exam 2 - (Covers April 16 through May 7)

May 14	Pesticides I (Gallagher)	Chapter 22
May 16	Pesticides II (Gallagher)	Chapter 22
May 18	Natural toxicants/microbials (Kavanagh)	Chapter 26 & 27
May 21	Food Additives & Contaminants (Petroff)	Chapter 30
May 23	Risk Assessment / Risk Management I (Gallagher)	Chapter 4
May 25	Risk Assessment / Risk Management II (Kavanagh)	Chapter 4

May 28 Memorial Day

May 30	Regulation of Toxic Chemicals (Kavanagh)	Handout
June 1	Review, summary, course evaluation (Gallagher)	

Final Exam.

Final Exam determined by UW Spring 2018 Final Exam Schedule (covers May 9 through June 1).