Aquatic Toxicology: Science and Applications
SWS 4504

3 credit hours – Spring Semester 2025

Instructor: P. Chris Wilson (lectures)
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Office hours: Open door policy (If not regularly on our hallway, email for an appointment)

Course location: McCarty Hall A, Room 2186
meeting times: Tuesdays 6:15 PM - 7:05 PM

CATALOG DESCRIPTION: Introduces foundational knowledge and concepts of the multi-disciplinary field of aquatic toxicology. Examines how environmental and chemical properties influence the fate and bioavailability of contaminants in the aquatic environment; introduces the principles of toxicology and methods used in the study of aquatic toxicology, as well as applications of knowledge gained from aquatic toxicology studies.

COURSE OBJECTIVES: Students will develop foundational knowledge needed to understand this multi-disciplinary field. After completing this course, students will be able to:

- identify and qualitatively describe how the unique, dynamic properties of chemicals and the environment influence the fate and bioavailability of contaminants in the aquatic environment.
- explain when and why some contaminants are toxic while others are not.
- identify and design toxicity tests based on data needs
- synthesize information from previous objectives and apply it for evaluating risks to aquatic organisms.

DELIVERY METHOD: Hybrid course. Online lectures with weekly face-to-face meetings during 1 class period each week. Online lectures (power point presentations) and other course materials delivered through the Canvas E-Learning System.

PRE-REQUISITES/CO-REQUISITES:

BSC 2005 & BSC 2005L or BSC 2010 & BSC 2010L
CHM 2045 & CHM 2045L
CHM 2046 & CHM 2046L
CHM 2200 & CHM 2200L or CHM 2210

COURSE SCHEDULE

Week	Topic	Lecture	Chat Session	Assignments
Week 1 (January 13th)	**Introduction to the Course, and Factors Influencing Exposures Part 1**	Course introduction	1/14	Quiz Due 1/19
		Historical Perspectives		
		Brief overview to aquatic toxicology		
	Factors Influencing Exposures	Introduction to Factors Influencing Exposures		
		Atmospheric properties affecting exposures		
		Biological properties affecting exposures		
		Soil properties affecting exposures		
Week 2 (January 20th)	**Factors Influencing Exposures Part 2**	Aging and Sequestration	1/21	Quiz Due 1/26
		Chemical Properties		
		The Aquatic Environment		
Week 3 (January 27th)	**Factors Influencing Exposures Part 3**	Sediment Properties	1/28	2/2
	Contaminants of Concern	Introduction to Contaminants of Concern		
		Inorganic Contaminants		
		Organic Contaminants		
		NAPLs		
EXAM 1: Open 2/7-9; due 2/9 by 11:59 pm				
Principles of toxicology				
Week 4 (February 3rd)	**Contaminant uptake and elimination (Bioavailability)**	1-Toxicokinetics and bioavailability	2/4	Quiz Due 2/9
		2- Uptake into cells		
		3- Kinetics of uptake		
		4-Distribution		
		5-Elimination of contaminants		
		6-Bioaccumulation		

Week 5 (February 10th)	**Principles of toxicology**	Basic concepts and principles of toxicology	2/11	Quiz Due 2/16
		Factors affecting toxicity		
		Molecular aspects of toxicology		
		Biomarkers		
	Detoxification strategies-Part 1	Overview of Phase 1 and 2 metabolisms		
		Cytochrome P450 monooxygenases		
		Diversity of Cytochrome P450		
Week 6 (February 17th)	**Detoxification strategies-Part 2**	Regulation and inducibility of Cytochrome P450	2/18	
		Considerations and use of Cytochrome P450		
		Other Phase 1 Biotransformation		
		Introduction to Phase 2 Metabolism		
		UDP-GTs		
		Glutathione-s-transferases		
		Sulfation		
		Other Phase 2 Conjugations		
		Biomarkers of Phase 2 Metabolism		
		Sequestration		
EXAM 2: Open 2/21-23; due 2/23 by 11:59 pm				
Stressor Effects, Oxidative Stress, Non-oxidative Effects, and Gene and Chromosome Damage				
Week 7 (February 24th)	**Oxidative stress**	Introduction to Stressors Effects	2/25	Quiz Due 3/2
		Stress due to Reactive Oxygen Species (ROS)		
		ROS Detoxification Strategies		
		ROS Sources and Modes of Action (MOA)		
		ROS Fate Review		
		ROS Biomarkers		
	Non-oxidative effects	Enzyme Disfunction		
		Stress proteins		

	Gene and Chromosome Damage Part 1	Gene and Chromosome Damage		
		Cancer		
Week 8 (March 3rd)	**Gene and Chromosome Damage Part 2**	Methods for Detecting Gene/Chromosome Damage	3/4	Quiz Due 3/9
	Effects on Populations and Tests Organisms	Cells, tissues, and organ introduction		
		Cell Death		
		Inflammation		
		Accumulation of Granules		
		More Examples of Effects		
	Effects at organism level	Sublethal Effects on Whole Organisms		
Week 9 (March 10th)	**Effects on populations**	Introduction to population	3/11	Quiz Due 3/16
		Population Size		
		Demographics		
		Genetics		
	Test organisms	Introduction to Test Organisms		
		Daphnia (Water Fleas)		
		Amphipods		
		Other Invertebrates		
		Fathead Minnows		
		Trout		
		Bluegill		
		Zebra fish		
		Killifish		
		Sheepshead Minnow		
		Green Plants		
Spring Break (March 17-21) – no class				
Week 10 (March 24th)	**Toxicity Testing Systems and Considerations Part 1**	Introduction to Toxicity Testing	3/25	Quiz Due 3/30
		General Test Designs		
		Exposure Systems		
		Facilities and Materials		
		Cleaning and Maintenance		
		Test Materials		

Week 11 (March 31st)	**Toxicity Testing Systems and Considerations Part 2**	Test Materials	4/1	No Quiz
		Endpoints		
		Description of Methods		
		Acute Toxicity Testing Methods		
		Chronic Toxicity Testing		
		Effluent Testing		
		Other Toxicity Testing		
EXAM 3: Open 4/4-6; due 4/7 by 11:59 pm				
Week 12 (April 7th)	**Estimators of Effects**	Introduction to Estimators to Effects	4/8	Quiz Due 4/13
		Estimating EC50/LC50		
		Hypothesis Test to Determine NOAEC/LOAEC		
		Ensuring Independence (Randomization)		
		Testing for Normality		
		Testing for Homogeneity of Variance		
		Endpoint Assessment		
		Time to Death		
Week 13 (April 14th)		Graduate Student Presentations/Projects	4/15	
Week 14 (April 21st)		Review for final exam	4/22	
Week 15 (April 28th)		Final Exam	TBA	

STUDENT ASSESSMENT:

1. You are expected to attend and be prepared to participate in all class sessions. A portion of the grade is based on meaningful class participation, demonstrated student interest, and overall student dedication.

2. Assessments are based on exams, quizzes, and participation in class.

3. Course grades will be determined as follows (%):

Undergraduate students

Evaluation endpoint	Frequency	% of total grade
Participation	Weekly	5
Quizzes and assignments	As announced	10
Exams	4	60

Final exam	1	25

Grading Scale

A	93% and above	C	73-76%
A-	90-92%	C-	70-72%
B+	87-89%	D+	67-69%
B	83-86%	D	63-66%
B-	80-82%	D-	60-62%
C+	77-79%	E	Below 60

Current UF grading policies for assigning grade points may be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx.

ATTENDANCE AND CONDUCT: Students should be ready to begin class as soon as the scheduled start time is reached (i.e. arrive early). Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx. Cell phones should be silenced during class.

COMMUNICATION. Students are encourage to always ask questions during class regarding subject material, assignments, etc. that they do not understand so that others may also benefit. Questions and discussions about personal issues (e.g. grades, make-up work, etc.) should take place one-on-one before/after class, during office hours, or by email.

TEXTBOOK (SUGGESTED, NOT REQUIRED): *An Introduction to Aquatic Toxicology* (Mikko Nikinmaa, 2014) ISBN 978-0-12-411574-3.

RECOMMENDED BOOKS: Additional texts that may be useful include: *Fundamentals of Aquatic Toxicology* (Gary Rand ed., 1995) and *Fundamentals of Ecotoxicology* (Michael Newman 2015 or earlier). Additional handouts and references to specific topics may be given during the semester.

COURSE FEEDBACK AND EVALUATION: Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES: If you require classroom accommodation because of a disability, you must first register with the Disability Resource Center (352-392-8565; www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, you will receive an accommodation letter that must be presented to the instructor when requesting accommodation. The College is committed to providing reasonable accommodations to assist students in their coursework. Students needing accommodations should request them as early as possible in the semester.

ACADEMIC HONESTY: UF students are bound by The Honor Pledge, which states, " We, the members of the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity by abiding by the Honor Code." On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my

honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor in this class.

SOFTWARE USE: All faculty, staff and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate.

CAMPUS RESOURCES

Students may occasionally have personal issues that arise in the course of pursuing higher education or that may interfere with their academic performance. If you find yourself facing problems affecting your coursework, you are encouraged to talk with an instructor and to seek assistance from appropriate University resources.

Health and Wellness

U Matter, We Care

If you or a friend is in distress, please contact umatter@ufl.edu or 352-392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center

http://www.counseling.ufl.edu/cwc/Default.aspx, 392-1575; and the University Police Department: 392-1111 or 911 for emergencies.

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

The Student Health Care Center

Primary and specialty health care. http://shcc.ufl.edu/.

Alachua County Crisis Center

Crisis intervention is always available 24/7: (352) 264-6789.

Academic Resources

E-learning technical support

352-392-4357 (select option 2) or email to Learning-support@ufl.edu.
http://lss.at.ufl.edu/help.shtml.

Career Resource Center

Reitz union, 392-1601. Career assistance and counseling. http://www.crc.ufl.edu.

Library Support

http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center
Broward Hall, 392-2010 or 392-6420. General skills and tutoring. http://teachingcenter.ufl.edu.

Writing Studio
302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
http://writing.ufl.edu/writing-studio/.

Student Complaints
Campus: https://www.dso.ufl.edu/documents/UF_Complaints_Policy.pdf.
On-Line Students: http://www.distance.ufl.edu/student-complaint-process.