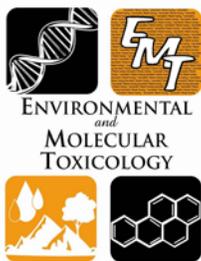


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The Graduate Programs in Environmental and Molecular Toxicology

PhD in Toxicology: Degree Requirements and Course of Study

Program Overview

The Environmental and Molecular Toxicology (EMT) Graduate Program focuses on creating, disseminating and applying new research knowledge in the areas of Molecular and Cellular Toxicology and Environmental Chemistry and Ecotoxicology to enhance the treatment and prevention of human disease, and to ensure the protection of the environment and public health. This integrated approach, combining both the biological and physical sciences, provides exciting training, research and professional development opportunities for graduate students, supported by our state-of-the-art and internationally competitive research programs. EMT offers a highly collegial and exceptionally collaborative, research and training environment dedicated to the success and advancement of all EMT students, faculty and staff. Degrees offered in the Toxicology Program include the Ph.D. and both a thesis and non-thesis M.S.

The curriculum provides students with a fundamental understanding of the trans-disciplinary science of toxicology, and prepares them for leadership positions in research and development, academia, government, or professional services. The curriculum is forward-looking and broadly organized around two concentration areas: **Environmental Chemistry and Ecotoxicology** and **Molecular and Cellular Toxicology**. Required core courses, advanced training in a specialized area, and interdisciplinary and team-based experiential learning and professional development opportunities together strengthen the student's training in the basic sciences and ensure a thorough knowledge of the basic research and applied science of toxicology. The curriculum is both broad-based (required core) and flexible (many elective choices), with an emphasis on individualized programs of study based on the individual student's educational background and designed to meet the students' training, educational and professional goals. A required seminar course (TOX 699 - students participant in all terms in residence) is a unique feature of our curriculum. Different current issue topics are addressed in a modular format using student-directed, team-based investigations that emphasis the breadth and integration of the science, from hazard identification to exposure, and from effects to risk analysis and communication.

Specific course requirements and a sample plan of study are detailed below.

1. Core Courses (21 credits)

The core courses consist of foundational studies in the molecular basis of environmental disease and target organ toxicology, environmental chemistry, and ecotoxicology and risk assessment. Supporting requirements include statistics and professional ethics.

- TOX 512 Target Organ Toxicology: Molecular Mechanisms of Environmental Disease (fall) (4)
- TOX 530 Chemical Behavior in the Environment (fall) (3)
- TOX 513 Environmental Toxicology and Risk Assessment (spring) (3)
- TOX 699 Special Topics: Integrated Environmental and Molecular Toxicology (fall, winter and spring, years 1-2) (6)
- ST 511 Methods of Data Analysis (fall or winter) (4)
- GRAD 520 Responsible Conduct of Research (fall, winter or spring) (1)

2. Restricted Electives (minimum 6 credits)

At least two of the student's electives must be chosen from a designated list; students thus develop additional expertise and understanding of the breadth and depth of the science of toxicology. In Academic Year 2014 – 2015, the following courses are approved:

- TOX 505 Reading and Conference (1-16)
- TOX 511 Fundamentals of Toxicology (3)
- TOX 529 Toxic Substances in Food (3)
- TOX 535 Genes and Chemicals in Agriculture: Value and Risk (3)
- TOX 554 Genome Organization, Structure and Function (4)
- TOX 555 Ecotoxicology: Aquatic Systems (3)
- TOX 575 Advanced Xenobiotic Metabolism (1-3)
- TOX 590 Environmental Forensic Chemistry (3)
- TOX 599 Special Topics: Computational Toxicology (3)
- TOX 611 Testing for Genotoxins (laboratory course) (3)
- TOX 699 Special Topics: Molecular Therapeutics (3)
- TOX 699 Special Topics (1-16)

3. Unrestricted Electives (minimum 9 credits)

Additional elective choices are unrestricted. Specific courses will be chosen by the student in consultation with the mentor and the Thesis/Dissertation Committee to enhance and support the student's research, educational and professional goals. Courses may include additional TOX classes, but may also be chosen from any area of study that will meet the student's needs and interests.

4. Supervised Thesis Research (minimum 36 credits)

Each candidate for the PhD degree must complete and successfully defend a thesis embodying the results of research and giving evidence of originality and ability in independent investigation. The thesis must be a real contribution to knowledge in the field of toxicology, based on the candidate's own investigation. It must show a mastery of the literature of the subject and be written in creditable literary form. Given the interdisciplinary nature of toxicology, students are strongly encouraged to develop an interdisciplinary and collaborative project working with collaborators in the program, in other programs on campus, and/or from outside the university.

5. Experiential Learning and Professional Development

Students, in consultation with their advisor/research mentor, will develop an Individual Professional Development Plan that includes elements of experiential learning, outreach and professional development. Individual activities for the student's plan are chosen from a designated list and are assigned point values depending on the anticipated time commitment and expectations of the activity. Ph.D. students must complete all required training activities and a minimum of 8 units of elective training opportunities. Required training activities and a partial list of elective opportunities are below; a current list of additional elective training activities is maintained in the department.

Required Experiential Training Activities

- Oral presentation
- Ethics training - IST 520 or equivalent
- Participate in Trainee Webinars and Seminars - 3/year
- Risk e-Learning Webinars - examples include: clu-in.org/ or *PEPH webinars*
- Participate in TEAM-Tox events - 1/year - *scheduled independently*
- Superfund 101 - *online presentation*

Elective Training and Activities (select at least 6 units for PhD)

- EPA externship in regulatory and risk assessment - 2 units - see www.trainex.org to sign up for offerings

- Aquatic toxicology laboratory training for risk assessment - 1 unit
- Participate in NIEHS SRP Student/Postdoc/Alumni Network (SPAN) - 1 unit = 3 events
- Good Laboratory Practices - 0.5 units
- Field sampling training - 1 units
- Continuing Education Courses (e.g. SOT, SETAC) - 1 unit
- Systems toxicology training - 2 units
- Human micro-dosing and physiologically-based pharmacokinetics - 2 units
- Bioinformatics, statistics and study design at PNNL - 1 day = 2 units; 1 1/2 days = 3 units
- Biological monitoring of human populations - 2 units
- USGS field and laboratory-based activities on contaminants in ecological communities - 2 units
- Community-based Research and Outreach to Three Pacific Northwest Tribal Communities - 2 units
- National Workshop on Conducting Community Based Participatory Based Research (CBPR) with Tribal Communities - 2 units
- Risk communication workshop at the National Pesticide Information Center - 2 units
- EMT Research Day presentation - 0.5 unit
- Science Communication and Outreach - Blogging - 1-3 units
- UC Entrepreneurship Academy @ UC Davis, 3 day event - 2 units
- Leadership in TEAM-Tox, SRP, SPAN or other relevant group - 1 unit
 - EMT Seminar on Current Topics in Toxicology - 1 unit

Professional Development Colloquium

- Manuscript and abstract writing workshop
- Grant writing workshop
- Building an effective scientific poster and oral presentation
- Platform and poster presentation skills
- Communicating your science
- Press release training
- Resume/CV development workshop
- Conducting effective literature reviews
- Experimental design
- Data interpretation and study inferences
- Pursuing a scientific career strategies - *seminar speakers invited to a meeting with the SRP trainees*
- Transitioning development - *major advisor/mentor and committee*
- Effective teaching skills - *graduate certification - gradschool.oregonstate.edu/gccut, training at oregonstate.edu/ctl, teaching opportunities*

A sample plan of study and schedule is included below.

<i>Summary: Credit Requirements for the PhD in Toxicology</i>			
	Non-Blanket	Total	
Core courses	21	21	
Elective courses (restricted + unrestricted)	15 (min)	15 (min)	
Research and Thesis		36 (min)	
	36 (min)	108 (min)	
<i>Sample PhD Course of Study Schedule (minimum 36 credits non-blanket courses)</i>			
Academic Year 1	Fall	Winter	Spring
	TOX 512 (4 credits)	ST 511 (4 credits)	TOX 513 (3 credits)
	TOX 530 (3 credits)	GRAD 520 (1 credit)	
	TOX 699 (1 credit)	TOX 699 (1 credit)	TOX 699 (1 credit)
	Electives (0-4 credits)	Electives (3-6 credits)	Electives (3-8 credits)
	Research Rotation (1-4 credits)	Research Rotation (1-6 credits)	Research Rotation (1-8 credits)
Summer Year 1	Thesis Research (3 credits)		
Academic Year 2	Fall	Winter	Spring
	TOX 699 (1 credit)	TOX 699 (1 credit)	TOX 699 (1 credit)
	Electives (3-11 credits)	Electives (3-11 credits)	Electives (3-11 credits)
	Thesis Research (3-11 credits)	Thesis Research (3-11 credits)	Thesis Research (3-11 credits)
Summer Year 2	Thesis Research (3 credits)		
Academic Years 3-4	Fall	Winter	Spring
	TOX 699 (1 credit)	TOX 699 (1 credit)	TOX 699 (1 credit)
	Thesis Research (8-11 credits)	Thesis Research (8-11 credits)	Thesis Research (8-11 credits)
	Electives (possibly 1-3 credits)	Electives (possibly 1-3 credits)	Electives (possibly 1-3 credits)

Potential Plan of Study (roadmap) for PhD students

Year 1 (12 cr per term)			(9 cr total)	Year 2 [#] (12 cr per term)		
Fall	Winter	Spring	Summer	Fall	Winter	Spring
TOX 512 (4 cr) Mechanisms/ Target Organs (Buermeyer)	TOX xxx (3 cr) Computational Tox (Tilton) – alternate years?	TOX 513 (3 cr) Env Tox & Risk Assessment (Jenkins)	TOX 611 (3 cr) Testing for Genotox. (Buermeyer & Iverson)	TOX 529 (3 cr) Toxic Substances in Food (Buermeyer)	TOX 555 (3 cr) Ecotox: Aquatic Systems (Stubblefield)	TOX 699 (3 cr) Mol. Therapeutics (Kolluri)
TOX 530 (3 cr) Chem Behavior in the Environ. (Field)	GRAD 520 (1 cr) Resp. Conduct of Research (offered F/W/Sp)	TOX 514 (3 cr) Advanced Molecular in alternate years? (Instructor TBD)		TOX 535 (3 cr) Genes & Chem. In Agriculture (Stone/Strauss) e- campus, F/W/Sum)	TOX 590 (3 cr) Environ. Forensic Chemistry (Anderson)	
TOX 607 (1 cr) Seminar Professional Development	TOX 607 (1 cr) Seminar Module (rotating faculty, 2/term)	TOX 607 (1 cr) Seminar Module		TOX 607 (1 cr) Seminar Professional Development	TOX 607 (1 cr) Seminar Module	TOX 607 (1 cr) Seminar Module
ST 511 (4 cr) Statistics	ST 512 (4 cr) Statistics	ST 513 (4 cr) Statistics				
TOX 601 (1-3 cr) Research	TOX 601 (1-3 cr) Research	TOX 601 (1-3 cr) Research	TOX 603 (9 cr) Thesis	TOX 603 (3-8 cr) Thesis	TOX 603 (3-8 cr) Thesis	TOX 603 (3-8 cr) Thesis
H 524 (3 cr) Intro. to Biostats *Alter. to ST 511	GRAD 521 (2 cr) Research Data Management	MCB 557 (3 cr) Skills & Ethics *Alter. to GRAD 520		TOX/MCB 554 (4 cr) Genome Org, Str. & Main. (Burke)	MCB 555 (4 cr) Gene Expression (Fowler)	TOX 511 (3 cr) Fundamentals of Tox (Williams)
BB 590 (3 cr) Biochemistry	BB 591 (3 cr) Biochemistry	BB 592 (3 cr) Biochemistry			Z 531 (4 cr) Vertebrate Physiology	Z 532 (4 cr) Vertebrate Physiology
* BB 550 (4 cr) Alternative for 590 series (F/W/Sp)	* BB 551 (4 cr) Alternative for 590 series (F/W/Sp)					

- Students generally register for 12 credits (F, W, S) and 9 credits (S), using TOX 601 *Research* or TOX 603 *Thesis* to fill space in their schedule to have 12 credits total. There may be exceptions, e.g. students appointed on the NIEHS Training Grant should register for 3

credits in summer term. Students in their first term may require 13 credits to include GRAD 511, ST 511 and at least 1 credit of TOX 601. Students should always include at least 1 credit of *Research* or *Thesis*.

- Required classes in grey shaded boxes.
- Classes planned, but not currently offered in green shaded boxes.
- # Toxicology electives mostly listed in year 2 for clarity; several may be taken in year 1.
- Not meant to include an exhaustive list of potential electives, just those that might be considered “fundamental”
 - More complete list of potential electives maintained for students & faculty by the program