CORE TOX GRADUATE PROGRAM COURSES

TOX 805.3 Next-Generations Methods in Toxicology
This course will provide an overview of 21st-century approaches in toxicology covering all levels of biological organization, from molecules to ecosystems. “Omics” methods to explore the impacts of chemical stressors on the diversity of transcripts (transcriptomics), proteins (proteomics), and metabolites (metabolomics) will be particularly emphasized. Exciting novel concepts, such as epigenetics and environmental DNA (eDNA) will be introduced and their use in toxicology and chemical risk assessment discussed. Last, students will be acquainted with various computational tools required to process the very large datasets resulting from these methods.

Prerequisite(s): Toxicology undergraduate degree/major, or permission from the instructor on a case-by-case basis.

TOX 821.3 Human Health Chemical Risk Assessment
Human health risk assessment is now playing a major role in the environmental management of chemicals, from both operational and regulatory perspectives. The overall objective of this course is to provide the basic knowledge to conduct, evaluate and interpret human health risk assessments of chemicals present in the natural and built environments.
Prerequisite(s): None.

TOX 840.3 Wildlife and Eco Risk Toxicology
Provides a broad exposure to the principles and practices of ecological risk assessment in Canada, with an emphasis on terrestrial habitats and wildlife receptors. In vitro and in vivo laboratory methods and field studies to assess toxicity and sub-lethal exposure in fish and wildlife will also be discussed.
Prerequisite(s): TOX 300 and TOX 301, or permission of instructor.

TOX 842.3 Biochemical Toxicology
Students will gain a comprehensive understanding of various biochemical mechanisms of toxicity, from both biomedical (human) and ecotoxicological perspectives. The focus will be on applying basic knowledge of biochemistry and physiology to the science of toxicology. Classes will involve discussions on topics related to the current scientific literature.
Prerequisite(s): Background knowledge in toxicology.

TOX 843.3 Environmental Chemodynamics
Provides students with an understanding of the processes that control the movement of organic and inorganic contaminants in the atmosphere, hydrosphere and lithosphere, and will also provide an understanding of the methods used to monitor environmental behaviour of potentially toxic contaminants in biotic and abiotic matrices.
Prerequisite(s): One course in ecology or environmental biology and one course in general or environmental chemistry, or permission of the instructor and student's advisor/advisory committee.

TOX 844.3 Toxicology Techniques
Provides theoretical background and hands-on experience in methods and techniques typically applied by toxicology professionals in academia, industry, and government. It is a modular course that covers a broad spectrum of procedures, ranging from proper handling of field equipment to biological test methods and analytical processing of samples. **Permission of course coordinator required.**
Prerequisite(s): Successful completion of Laboratory Safety course and GSR 962.

TOX 850.3 Aquatic Toxicology
A comprehensive overview of the technical aspects of predicting, monitoring, and evaluating the effects of toxic substances in aquatic systems. The class will cover levels of biological organization from sub-cellular to ecosystem. It is designed as an in-depth coverage of aquatic toxicology for students pursuing graduate

degrees in the aquatic sciences. Students will be exposed to materials that will be useful in setting exposure standards and assessing hazards to aquatic ecosystems due to point or non-point releases of toxic substances.
Prerequisite(s): Permission of the instructor.

TOX 870.3 Environmental Effects Assessment & Monitoring
This course will introduce students to key principles for designing robust environmental effects studies from industrial activities on the landscape. It will cover selection of appropriate ecological effects and measurable parameters (endpoints) that can be used for both pre-construction environmental assessments in regulatory approval applications and post-construction environmental effects monitoring programs, with an emphasis on mechanisms of physical and chemical effects on invertebrates, fish and wildlife.
Prerequisite(s): None

TOX 898.3 Contaminants in Plant-Soil Systems
An in-depth examination of a series of research articles, and reviews will be supported by lectures. Group discussions and workshops will be used to gain knowledge of remediation strategies used in natural plant-soil systems and the underlying mechanisms on which these strategies rely. The importance of soil properties, plant traits and plant-soil interactions in determining appropriate remediation approaches will be discussed.

BIOE 850.3 Synchrotron X-Ray Imaging
Will introduce some synchrotron specific imaging modalities such as K-edge subtraction, diffraction enhanced imaging, and phase contrast imaging with connections made to conventional imaging. The first part of the course will cover x-ray interactions, detection, dose estimation and source properties (conventional and synchrotron).

Prerequisite(s): Permission of the instructor.

BIOL 875.3 Ecotoxicology Theory & Practice
This course examines how principles and theories in ecology can better inform ecotoxicology problems at multiple levels of biological organization (individuals to ecosystems). Much of the science of this relatively young discipline has traditionally lacked a conceptual basis and major recent advances are being drawn from ecological theories, models and approaches to strengthen the field. Students will examine current advanced topics and contemporary approaches that add ecological relevance and predictive strength to both field and laboratory ecotoxicology studies.
Prerequisite(s): At least 1 undergraduate or graduate course in Ecotoxicology or permission from instructor – attendance of BIOL 475 undergraduate lectures may satisfy this prerequisite.

BIOL 865.5 Physiological Toxicology
Description: This course examines how various environmental stressors including contaminants alter vital physiological functions and cause toxic effects in aquatic animals. Students will explore the current state of science and also learn how the physiological knowledge and principles can be applied to regulatory decision making for the protection of aquatic life.
Prerequisite(s): Animal Physiology and Environmental Toxicology at Undergraduate level and permission of the Instructor.

ENVS 832.3 Risk Assessment & Negotiation of Environmental Issues
This course helps students develop a comprehensive understanding of the interdisciplinary nature of environmental issues, and will teach them the roles that science and society have in the assessment and management of such issues. The class will elucidate the perspectives of the different stakeholders using classic and interactive elements.

Prerequisite(s): None

ENVS 898.3 Chemical Risk Assessment
The safe and sustainable management of chemicals requires a precise assessment of the risk posed by those chemicals. While many chemicals pose hazards to the environment the application of risk assessment techniques can be used to identify concerns and can provide strategies for minimizing those risks. Similarly when chemicals are already in the environment the development of appropriate clean-up strategies requires the use of risk assessments to identify clean-up goals and procedures. Accurate risk assessments are based on a combination of appropriate sampling design and collection, appropriate and accurate chemical analysis and application of appropriate risk assessment paradigms. This class will address all aspects of the risk assessment process by looking at several case studies.
Prerequisite(s): None

GEOG 7010.3 Environmental Monitoring (University of Manitoba Course)
This is a mixed classroom and field-based course in the science and social considerations behind the protection and evaluation of water quality and biota. The focus is on surface waters (lentic and lotic) within a Boreal/Manitoba context. We aim to understand the potential impacts that resource development (e.g., mining, pulp and paper, oil and gas, as well as municipal wastewaters) can have on freshwater systems from an ecological and human health perspective, as well as socio-cultural. Special emphasis will be given to First Nation, northern, and rural perspectives, with the aim to inform community-based monitoring programs.

Prerequisite(s): There is no formal prerequisite for the course, but a reasonable background/interest in ecology, chemistry and biology (ideally at 3rd and 4th year level) is required.

GEOL 851.3 Synchrotron Hard X-ray Absorption Spectroscopy
The course will describe the physical principles, experimental technique and data analysis of X-ray absorption spectroscopy. Frequent reference to practical applications will be included, and relevant synchrotron technology will also be reviewed. This course will equip the student with a practical working knowledge of the technique and its capabilities.
Prerequisite(s): Permission of the instructor.

PHAR 848.3 Advanced Pharmacokinetics and Pharmacodynamics
Qualitative and quantitative aspects of drug absorption, distribution, metabolism and excretion, and drug pharmacodynamics. The course emphasizes the use of pharmacokinetic/pharmacodynamic equations and the analysis of the data.
Prerequisite(s): Basic course in pharmacokinetics or permission of the instructor.

PHAR 854.3 Metabolic Transformation of Xenobiotics
An advanced study of the basic principles of the metabolism of foreign compounds in mammals. The xenobiotics covered will include drugs, food additives, agricultural chemicals, and industrial chemicals. The detoxification and toxicological implications of metabolism are emphasized.
Prerequisite(s): None

PHAR 865.3 Analytical Mass Spectrometry
This course will cover modern state-of-the-art mass spectrometry techniques and their usefulness in research and discovery. The course will examine instrumentation-related topics, such as ionization sources, mass analyzers and hybrid tandem mass spectrometers. The advantages of each technique will be highlighted and discussed. A second portion of the course will focus on mass spectra interpretation and the various applications of applied mass spectrometry, namely structural elucidation, quantification, proteomics, and related biomedical and environmental applications. The course will also include practical demonstration of the use of tandem mass spectrometry.
Prerequisite(s): None

SLSC 819.3 Remediation & Reclamation of Contaminated Sites
This course explains how one characterizes a contaminated terrestrial site; the risks associated with that site and identify remediation technologies that will mitigate the risks associated with the contaminated site. It will discuss how contamination interacts with industrial processes to created degraded landscapes and natural processes that help ameliorate this degradation of the ecosystem. Discussion of remediation will focus on the use of in situ and ex situ technologies for contaminated soil ecosystems and how these technologies reduce risk to not only soil, but also human and aquatic receptors.

VBMS 833.3 Subclinical Toxicology
Discusses subclinical manifestations to toxic agents. The emphasis will be on immunological and behavioral alterations produced by a variety of chemical agents. Animal models and testing methods used to evaluate the effects will be discussed, along with various public health considerations and significance.
Prerequisite(s): Permission of the instructor or registration in the Toxicology Graduate Program.

VBMS 855.3 Integrative Cardiovascular Physiology & Toxicology
The course will build on the content of VBMS 840 (Vascular Physiology & Toxicology) which is focused strictly on vascular tissue, examine ventricular/arterial coupling as well as how cardiac, pulmonary, renal, endocrine and/or neural systems integrate with cardiovascular responses for homeostatic control of blood pressure, examine how these homeostatic mechanisms are altered in pathological processes associated with major human diseases and toxic agents encountered by humans. Relative emphasis on disease versus toxicants will be adjusted according to students' backgrounds each year.
Prerequisite(s): Permission of the Instructor.

VTPA 841.3 Toxicologic Pathology
Covers mechanisms of toxicology as well as basic pathology, focusing on several major organ systems, but is geared toward DVM graduate students studying for pathology boards. This course is not suitable for students without a strong histology and pathology clinical background. The students' understanding of how clinical, environmental or pharmacological toxicants damage specific organs will be supported through didactic instruction, case studies, web-based cases, directed readings and structured group discussion.
Prerequisite(s): VTPA 342 & 343, or equivalent; or, TOX 402 & PATH 205, or permission of the instructor.

Required courses which students must maintain continuous registration for the duration of their program:

TOX 990 Toxicology Seminar
Weekly seminars presented by graduate students and invited speakers. Graduate students are required to attend and to present seminars.

TOX 994 Research
Students writing a Master's thesis must register for this course.

TOX 996 Research
Students writing a PhD thesis must register for this course.

All graduate students at the University of Saskatchewan are required to complete GPS 960: Research Ethics, and may be required to take either GPS 961: Ethics and Integrity in Human Research or GPS 962: Ethics and Integrity in Animal Research, depending on the nature of their project, thesis, or dissertation work.