TOX 350 INTERDISCIPLINARY FORENSIC SCIENCES. (3)
This course broadly introduces the interdisciplinary field of Forensic Science. The class will survey the areas of (i) legal/scientific considerations in evidence collection, (ii) physico-chemical, biological-medical, computational, and sociological methods in evidence analysis and (iii) the professional and social implications of the application of these methods. Students will research, evaluate, and present information on, and lead discussion about, how the proper exercise of Forensic Science relates to representations of this discipline in popular media. Prereq: BIO 148 (lecture) + BIO 155 (lab) and CHE 105 (or by permission of the instructor).

TOX 395 INDEPENDENT RESEARCH. (3-6)
An independent experimental research project for 3-6 credits in a contemporary area of Toxicology or Cancer Biology, under the mentorship of a department faculty member. May be repeated up to a maximum of 12 credits. A course research contract agreed to by the student and faculty mentor must be approved by the Course Coordinator (who is the Instructor of Record). Prereq: Must have passed at least 60 credit hours of coursework leading towards a Bachelor of Science or other degree in a life sciences- or health-related curriculum, or as otherwise in special cases approved by the Course Coordinator, in compliance with Senate policies.

TOX 409G TOXICOLOGY AND HUMAN HEALTH. (3)
Principles of Toxicology is a course for students in the biological and health sciences and others interested in understanding the major principles of toxicology and the consequences of toxins on human health and the environment. The course describes how different organs in the body respond to and biochemically metabolize toxins, the wide range of toxic agents present in the environment from pesticides to radiation, how the genome is effected by exposures, and special problems in toxicology that effect the world. Prereq: CHE 105 and 107 or equivalent general chemistry, BIO 148 and 152 or equivalent introductory biology, CHE 230 and 232 or equivalent organic chemistry.

TOX 508 RESEARCH METHODS IN TOXICOLOGY. (1-3)
The course provides students with ‘hands on’ experience in research methods used to solve toxicological problems. Students will be under the direction of a GCT faculty member, who will supervise the student’s efforts on a research project. The student will be trained not only in the ‘hands on’ techniques but also in how to independently design and interpret research experiments. Students will prepare a final report on their research project, which will be designed to provide instruction and training in preparing ‘publication-style’ research reports. This course is distinct from ‘topical seminar’ or ‘library survey’ courses, since such courses are not ‘hands on’ in experimental methods. May be repeated to a maximum of six credits. Laboratory, two-six hours per week. Prereq: Status as upperclass undergraduate, post bac, or graduate student.

TOX 509 ENVIRONMENTAL AND REGULATORY TOXICOLOGY. (2)
Presentation of basic and advanced concepts to provide an integrated description of toxicology, its scope, the unique application of principles that characterize it as a science, and its professional practice. Emphases will include an extensive treatment of relationships between toxicology and environmental exposures and the influence of federal regulations on the practice of toxicology. Prereq: BCH 501 or BCH 401G or other equivalent or consent of instructor.

*TOX 560 ECOTOXICOLOGY. (4)
This course is an introduction to the science of environmental pollution with an emphasis on fate and transport of contaminants and adverse effects on biological systems. Pollutants covered include metals, pesticides, organics, radionuclides, nanomaterials, and nutrients. The course covers physiological and toxicological effects of chemicals on natural biota, including considerations at cellular, organismal, population, community, and ecosystem levels. Topics include: absorption, distribution, bioaccumulation, and biomagnification of pollutants; biochemical and physiological mechanisms involved in stress-induced responses and stress reduction; evolution of toxicant resistance and multi-generational effects; fate and transport of contaminants; dose-response modeling; risk assessment, and environmental regulations. Prereq: CHE 105 and BIO 148 or equivalents or consent of instructor. (Same as PLS 560.)

TOX 600 ETHICS IN SCIENTIFIC RESEARCH. (1-2)
The course will commence with an overview of good laboratory practices and present them as the basis of good scientific research, along with an overview of quality assurance and appropriate practices in data analysis and data interpretation. The course will then move to the ethics of human and animal experimentation and discuss the concepts of data and intellectual property, their ownership and access to them. The problems of reviewing other workers’ intellectual property such as grant applications, research papers and other intellectual property will be addressed. Prereq: Research experiences; consent of instructor. (Same as VS 600.)
TOX 616 BIOLOGY AND THERAPY OF CANCER. (3)
Biology of cancer will be discussed at the molecular, cellular and organismic level. Emphasis will be placed on cellular signaling, genomic instability, apoptosis and cell cycle pathways unique to cancer cells that affect tumor cell behavior and its interactions with the host immune system. The biology of hematopoietic cells will also be included. Clinicians active in treatment and research of various types of cancer will be invited to participate in the lectures. Prereq: IBS 601, IBS 602, and/or IBS 603 (or comparable course in biochemistry, molecular biology or cell biology) or otherwise by consent of course director. (Same as MED/MI/PHA 616.)

TOX 649 ADVANCED MOLECULAR PHARMACOLOGY. (2)
This course will provide in-depth coverage of the molecular pharmacology of growth factors, transcription factors, receptors, and ion channels. Emphasis will be placed on both the normal functions of these cell-signaling molecules and perturbations that result in several prevalent human diseases, including cancer, Alzheimer’s, diabetes, osteoporosis, and inherited human illnesses. Students will be introduced to experimental approaches to diagnosing and treating these illnesses in the light of our evolving knowledge of molecular pharmacology. Prereq: IBS 601-606 or consent of instructor. (Same as PHA/PHR 649.)

TOX 680 MOLECULAR TOXICOLOGY AND CARCINOGENESIS. (3)
An intensive examination of 1) the key molecular and cellular mechanisms related to toxicity and carcinogenesis, and 2) the established relationships between exposures to toxicants and development of cancer and other human diseases. Prereq: TOX 509, TOX 663 or consent of Director of Graduate Studies.

TOX 690 PRACTICAL ANALYTICAL TOXICOLOGY. (3)
An evaluation of techniques for the isolation, identification, and quantitation of drugs, pesticides and other toxicants in biological samples. Concepts and theory will be presented in the lecture portion, while the laboratory will be devoted to actual sample analysis by the students. Lecture, 1 hour; laboratory, six hours. Prereq: Consent of the instructor and graduate standing in toxicology. (Same as VS 690.)

TOX 748 MASTER’S THESIS RESEARCH. (0)
Half-time to full-time work on thesis. May be repeated to a maximum of six semesters. Prereq: All course work toward the degree must be completed.

TOX 749 DISSERTATION RESEARCH. (0)
Half-time to full-time work on dissertation. May be repeated to a maximum of six semesters. Prereq: Registration for two full-time semesters of 769 residence credit following the successful completion of the qualifying exams.

TOX 767 DISSERTATION RESIDENCY CREDIT. (2)
Residency credit for dissertation research after the qualifying examination. Students may register for this course in the semester of the qualifying examination. A minimum of two semesters are required as well as continuous enrollment (Fall and Spring) until the dissertation is completed and defended.

TOX 768 RESIDENCE CREDIT FOR THE MASTER’S DEGREE. (1-6)
May be repeated to a maximum of 12 hours.

TOX 769 RESIDENCE CREDIT FOR THE DOCTOR’S DEGREE. (0-12)
May be repeated indefinitely.

TOX 770 TOXICOLOGY SEMINAR. (0-2)
A specialized seminar focusing on current topics of toxicological significance. Registration each fall and spring semester required of all toxicology majors until residency requirements for the degree have been completed. May be repeated to a maximum of three times during a semester and for a maximum number of two credits during entire graduate course work.

*TOX 780 SPECIAL PROBLEMS IN TOXICOLOGY. (1-3)
Exposure to and actual research experience in an area of toxicology other than that encountered by students in their graduate thesis and dissertation research, or in their professional degree. May be repeated to a maximum of ten credits. Prereq: Consent of graduate advisor or professional degree advisor.
TOX 790 RESEARCH IN TOXICOLOGY AND CANCER BIOLOGY. (1-6)
Research in Toxicology and Cancer Biology. Research will be conducted in specific areas of toxicology and cancer biology. Learning Outcomes: 1. Conduct independent, hypothesis driven research; 2. Demonstrate the ability to read, understand and apply the scientific literature that is relevant to the research activities; 3. Demonstrate the ability to develop original hypotheses, develop strategies and design experiments to test hypotheses; 4. Demonstrate competency in the collection, analysis and interpretation of data that is relevant to the research activities. Prereq: Consent of Director of Graduate Studies.

#TOX 800 FUNDAMENTALS IN FORENSIC SCIENCE. (4)
This course will broadly survey the disciplines and technology within the field of Forensic Sciences. These disciplines include crime scene investigation techniques, medicolegal death investigation, and patterned evidence examination, and traditional forensic laboratory (criminalistics) disciplines—specifically forensic drug chemistry, forensic toxicology, trace evidence, fire debris, explosives, and forensic molecular biology. A laboratory component provides hands-on exercise with current instrumentation used in Forensic Sciences. This course can be enrolled in by persons not admitted to the professional program, with approval of the Instructor of Record. Prereq: A Bachelor of Science in Chemistry, Biology, Toxicology, Biochemistry, or related disciplines as approved by the Instructor of Record.

#TOX 810 COMMUNICATING IN THE FORENSIC SCIENCE PROFESSION. (1)
This course will introduce students to the science and art of effective communication with a focus on enhancing communication and presentation skills related to the profession of forensic science. The course will prepare students to communicate (in written and oral format) highly technical and scientific information to lay audiences, which could include government and/or political policymakers, attorneys, juries, judges and the like.

#TOX 820 PREPARING PROFESSIONALS IN FORENSIC SCIENCE AND ANALYTICAL GENETICS. (1)
This course will introduce and develop professional skills required for obtaining workplace employment in the areas of Forensic Chemistry/ Toxicology and Forensic/Analytical Genetics. It will prepare students to understand workplace professionalism including proper use of social media, how to search and apply for jobs, and understand goal setting and the importance of work-life balance. Students will learn how to clearly articulate their skill sets, their understanding of their training and how to apply their training as professionals in the workplace environment. Prereq: TOX 810: Communicating in the Forensic Science Profession.

#TOX 830 ADVANCED HUMAN GENETICS. (2)
This course will train students in advanced genetics and the rapidly progressing and influential field of human genetics. Through lectures, the primary literature and review articles, students will gain in-depth knowledge of inheritance, genetic variation, genetic diseases and the impacts of epigenetic alterations and the environment. Students will gain advanced knowledge of contemporary methods used to investigate the human genome and their applications to genetic testing. Students will improve their critical reading skills of relevant primary scientific literature and apply their knowledge in the writing and oral presentation of a term paper. Prereq: IBS 602: Molecular Biology and Genetics, IBS 611: Practical Statistics, TOX 800: Fundamentals in Forensic Science, TOX 810: Communicating in the Forensic Science Profession.

#TOX 840 FORENSIC SCIENCE STANDARDS AND PRACTICES. (3)
This course will examine the day to day considerations of operating a forensic laboratory with emphasis on quality assurance and quality control. Discussions will include considerations of laboratory accreditation and individual certification, employee continuing education, equipment qualification, method validation, rates of error in analytical procedures, proficiency testing, calibration issues, choosing the appropriate sample preparation and analytical technique, and quality control considerations of the actual analysis. Proper documentation with respect to chain of custody, record keeping, and uniform language in reports will also be discussed. Prereq: BCH 401G: Fundamentals of Biochemistry, TOX 810: Communicating in the Forensic Science Profession, TOX 800: Fundamentals in Forensic Science, IBS 611: Practical Statistics.

#TOX 860 FORENSIC AND ANALYTICAL TOXICOLOGY. (3)
#TOX 880 ETHICS AND PROFESSIONAL PRACTICE IN FORENSIC SCIENCE AND ANALYTICAL DNA. (3)
This course will train students in professional practices as they relate to the forensic scientist or the professional working in a modern crime laboratory or DNA testing laboratory (public or private). The course will focus on scientific integrity, ethical behavior, ethics standards and various examples of ethics violations and misconduct in the forensic scientific and DNA analysis fields. A second focus is on education and training in quality assurance programs and practices and the audit and accreditation processes. The third major focus is on the relationships between forensic science or DNA analysis and the legal system and will include courtroom testimony procedures and oral mock court scenarios to train the student as an expert witness in the courtroom setting. Prereq: TOX 800: Fundamentals in Forensic Science, TOX 810: Communicating in the Forensic Science Profession, TOX 780: Preparing Professionals in Forensic Science and Analytical Genetics, TOX 840: Forensic Science Standards and Practice, IBS 611: Practical Statistics, or consent of Program Director.

#TOX 910 FORENSIC AND ANALYTICAL DNA. (4)
This course will train students to become experts in the collection, identification and evaluation of biological evidence in criminal matters and DNA testing using current DNA technologies. Methods routinely used for the isolation of DNA from cells, DNA quantitation, PCR, electrophoretic separation, and DNA sequence determination will be discussed and studied in detail. Students will implement the information obtained from lectures in complementary laboratory sessions. Students will demonstrate an understanding of the theory and practice underlying the use of instrumentation in PCR, Real-Time PCR, capillary electrophoresis, next generation sequencing, the applications of robotics and the use of DNA data bases. The complex range of considerations that need to be considered in data collection, sample storage, data interpretation, analysis and reporting will also be covered in detail. Current uses of single nucleotide polymorphisms, mitochondrial DNA analysis, Y or X chromosome analysis and nonhuman DNA will be described. The legal aspects specific to DNA testing will be incorporated to prepare students for expert witness testimony. Prereq: TOX 820: Preparing Professionals In Forensic Science and Analytical Genetics, TOX 830: Advanced Human Genetics, ABT 461: Population Genetics, TOX 810: Communicating in the Forensic Science Profession, TOX 800: Fundamentals in Forensic Science, IBS 611: Practical Statistics, TOX 840 Forensic Science Standards and Practices; IBS 602: Molecular Biology and Genetics.

#TOX 920 INSTRUMENTAL TECHNIQUES IN FORENSIC CHEMISTRY. (4)

#TOX 980 INTERNSHIP IN FORENSIC TOXICOLOGY AND ANALYTICAL GENETICS. (1-6)
The internship component of the program provides the student with an opportunity for immersed participation in the professional work environment associated with a laboratory practicing methods in forensic toxicology or analytical genetics. Through hands-on experience in a real work site the student applies the formal classroom knowledge to the real work setting. The work/learning arrangement is supervised by a program faculty member plus the designated representative of the internship site, which will be a private industry, governmental, hospital or other appropriate setting providing real world training in practices and procedures of forensic toxicology or analytical genetics. Prereq: Enrollment in the Master of Forensic Toxicology and Analytical Genetics Program; Approval of Director of Graduate Studies.