PHARMACOLOGY (PHRM)

PHRM 495 High Throughput discovery: A multidisciplinary approach to cancer
The newly developed massively parallel technologies have enabled the simultaneous analysis of many pathways. There are several large scale international efforts to probe the genetics and drug sensitivity of cancer cell lines. However, there are some rare cancers that have not been analyzed in depth. One of these rare cancers is malignant peripheral nerve sheath tumors (MPNST). MPNST, although a rare cancer, are common in patients with neurofibromatosis type. In the course, students will take part in a high throughput discovery effort in two phases. Phase 1 is a training phase, which will consist of quantitative profiling the sensitivity of MPNST cell lines to a library of >120 common and experimental cancer drugs. These will be conducted in the UPenn High Throughput Screening Core (http://www.med.upenn.edu/core/High-ThroughputScreeningCore.shtml). While we call this a training phase, the data from this will be subject to rigorous quality control for eventual publication and development of a public database for rare tumors. Phase 2 is an independent research project. Examples of projects include, but are not limited to: Combinatorial screens (synthetic lethal); siRNA screens; novel compound screens; determining mechanisms of cell death; developing tools for data analysis and database development. During phase 2, students will also modify compounds of interest using the Penn Chemistry: Upenn/Merck High Throughput Experimentation Laboratory (https://www.chem.upenn.edu/content/penn-chemistry-upennmerck-high-throughput-e-xperimentation-laboratory), and then retest them for activity to determine structure activity relationships. We will sponsor phase 2 projects relevant to neurofibromatosis. However, in phase two students can also research other areas if they develop sponsorships from professors. We expect the course to be a hypothesis engine that generates ideas for further research. Prerequisites include a strong foundation in biology and chemistry. Students will prepare an abstract proposal by week four on their phase 2 projects, and a report in scientific paper style, due on the last day of the semester. In addition to attending the class lecture, an estimated 10 hours a week Independent Laboratory Research is expected. Taught by: Dr.s Jeffrey Field, David Schultz, and Simon Berritt Course usually offered in spring term Also Offered As: CHEM 495 Activity: Laboratory 1.0 Course Unit

PHRM 532 Human Physiology
This course will present a survey of the physiology of most of the major organ systems. It will integrate knowledge of cellular and molecular mechanisms into an understanding of function at the tissue, organ, and organism levels. It will begin with a brief review of membrane physiology, followed by electrophysiology and signaling in nerve. Then, after a brief outline of neural control systems and their role in homeostasis, it will present motility and muscle, the cardiovascular system, respiration, the renal and gastrointestinal systems, and selected topics from the endocrine system, the reproductive systems, environmental and exercise physiology. As well as providing a basis of integrative physiology for students in fields such as physiology, bioengineering and pharmacology, it should be of interest to students of cellular and molecular biology and genetic engineering who will need to appreciate the roles of specific systems and molecules at higher levels of organization. Prerequisite: Although not a formal prerequisite, a good foundation in cell bio level of BIOM/CAMB 600 (or an equivalent upper level undergraduat strongly recommended. A general understanding of the chemistry a biochemistry of macromolecules, and of basic molecular biology wi assumed. This course is primarily designed for 2nd year BGS stud year students in BGS or other programs will require the permission of instructor. This course is not open to undergraduates. Taught by: Tejvir Khurana, Ben Prosser, and Paul Titchenell Course usually offered in fall term Also Offered As: CAMB 532 Activity: Lecture 1.0 Course Unit

PHRM 534 Experimental Genome Science
This course will survey methods and questions in experimental genomics, including next generation sequencing methods, genomic sequencing in humans and model organisms, functional genomics, proteomics, and applications of genomics methods. Students will be expected to review and discuss current literature and to propose new experiments based on material learned in the course. Prerequisite: Undergraduates and Masters students need BIOL 431. Taught by: C. Brown, J. Murray Also Offered As: GCB 534 Prerequisite: BIOL 431 Activity: Lecture 1.0 Course Unit

PHRM 510 Neurotransmitter Signaling & Neuropsychopharmacology
The goals of this course are three-fold: 1) Provide an overview of major psychiatric disorders. 2) Provide in-depth information on neurotransmitters, emphasizing the wealth of new molecular information on how neurons function and communicate, as well as the basis for psychotherapeutics (one class per week). 3) Develop skills to appreciate, present and critically evaluate the current literature in neurotransmitter signaling and neuropsychopharmacology (one class per week). Prerequisite: Permission of course director. Taught by: Staff Dr. Steve Thomas; Dr. Chris Pierce; Dr. Wade Berrettini; Dr. Liz Heller Course offered spring; even-numbered years Also Offered As: NGG 510 Activity: Lecture 1.0 Course Unit

PHRM 510 Neurotransmitter Signaling & Neuropsychopharmacology
PHRM 535 Introduction to Bioinformatics
This course provides overview of bioinformatics and computational biology as applied to biomedical research. A primary objective of the course is to enable students to integrate modern bioinformatics tools into their research activities. Course material is aimed to address biological questions using computational approaches and the analysis of data. A basic primer in programming and operating in a UNIX environment will be presented, and students will also be introduced to Python R, and tools for reproducible research. This course emphasizes direct, hands-on experience with applications to current biological research problems. Areas include DNA sequence alignment, genetic variation and analysis, motif discovery, study design for high-throughput sequencing RNA, and gene expression, single gene and whole-genome analysis, machine learning, and topics in systems biology. The relevant principles underlying methods used for analysis in these areas will be introduced and discussed at a level appropriate for biologists without a background in computer science. The course is not intended for computer science students who want to learn about biologically motivated algorithmic problems; BIOL 437/GBS 536 and GCB/CIS/BIO537 are more appropriate. Prerequisites: An advanced undergraduate course such as BIOL 421 or a graduate course in biology such as Biol 526 (Experimental Principles in Cell and Molecular Biology), BIOL 527 (Advanced Molecular Genetics), BIOL 540 (Genetic Systems), or equivalent, is a prerequisite.

Taught by: B Voight, C Greene
Course usually offered in fall term
Also Offered As: CAMB 542
Prerequisite: BIOL 421 OR BIOL 526 OR BIOL 527 OR BIOL 528 OR BIOL 540
Activity: Lecture
1.0 Course Unit

PHRM 542 Topics in Molecular Medicine
TiMM is planned as a once-weekly seminar course whose goal is to introduce students to the ways in which biomedical research can provide new insights into clinical medicine and, conversely, how knowledge of clinical disease impacts scientific discovery. There are two sections for the course -- 401 and 402. Section 401 is for first year MD/PhD students only and section 402 is for VMD/PhD and PhD students.

Taught by: Section 401: Johnson, Kohli Section 402: Atchison, Mason
Course usually offered in fall term
Also Offered As: CAMB 542
Activity: Seminar
1.0 Course Unit

PHRM 564 Drug Delivery
The topics include drug transport, distribution and interactions in the body, specific challenges for biotherapeutics, pharmacokinetics, drug delivery systems and nanocarriers, gene delivery systems, targeted drug delivery, and translational aspects of new drug delivery systems. Faculty from engineering and medicine will give lectures related to their research interests. The students read current journal articles on drug delivery systems. The major group assignment for the course is a written and oral group proposal on a new drug delivery system.

One-term course offered either term
Also Offered As: CBE 564
Activity: Lecture
1.0 Course Unit

PHRM 570 Principles of Cardiovascular Biology: Vascular biology, medicine and engineering
Lectures to be presented by various Medical School faculty members. Topics covered include: general principles of vascular biology and hemodynamics, endothelial cells and integral vascular functions, signaling in the cardiovascular system, angiogenesis, hemostasis and thrombosis, platelets, platelet-vascular interactions, vascular integrins and adhesion molecules, vascular inflammation and oxidative stress, white blood cells, vasoactive compounds and drugs, mechanisms of atherosclerosis, cholesterol and lipid metabolism, hypertension, novel vascular directed gene and enzyme therapies. Permission of course director required to enroll.

Taught by: Drs. Vladimir Muzykantov and Tilo Grosser
Course usually offered in spring term
Activity: Lecture
1.0 Course Unit

PHRM 580 Pharmacogenetics
This is a "literature-based" course (i.e. a seminar course/literature survey). It will survey the emerging technologies and computational advances that have permitted the field of Pharmacogenomics to mature into a major biomedical discipline over the past few years. It will consider the likely impact on disease target identification; the development of new drugs for established and "niche" markets; the advent of "personalized medicine" including the selection of therapies that have maximum efficacy and minimum side-effect profiles. This course will also touch on some of the ethical issues associated with the routine genetic testing of patients to facilitate treatment choices and clinical monitoring.

Taught by: Steve Whitehead
Course usually offered in spring term
Activity: Seminar
1.0 Course Unit

PHRM 590 Molecular Toxicology: Chemical and Biological Mechanisms
Course Goals: Exposures to foreign compounds (drugs, carcinogens, and pollutants) can disrupt normal cellular processes leading to toxicity. This course will focus on the molecular mechanisms by which environmental exposures lead to end-organ injury and to diseases of environmental etiology (neurodegenerative and lung diseases, reproduction disruption and cardiovascular injury). Students will learn the difficulties in modeling response to low-dose chronic exposures, how these exposures are influenced by metabolism and disposition, and how reactive intermediates alter the function of biomolecules. Mechanisms responsible for cellular damage, aberrant repair, and end-organ injury will be discussed. Students will learn about modern predictive molecular toxicology to classify toxicants, predict individual susceptibility and response to environmental triggers, and how to develop and validate biomarkers for diseases of environmental etiology. Students are expected to write a term paper on risk assessment on an environmental exposure using available TOXNET information. Pre-requisites: Must have taken or will take Fundamentals of Pharmacology concurrently. Undergraduate course work in biochemistry and chemistry essential. Exceptions allowed based on past course work. Please consult with students with required prerequisites; residents in in Environmental and Occupational Health, and professional masters students (MPH and MTR).

Taught by: Dr. Trevor M. Penning
Course usually offered in spring term
Also Offered As: REG 590
Activity: Lecture
1.0 Course Unit
PHRM 605 Drug Discovery and Development
This course will expose graduate-level students to the process of drug discovery and development. The course will be structured to cover topics from the identification of a disease-relevant target through to Phase III Clinical Trials. The course will be lecture based and there will also be student-led journal club presentations as part of the course. There will also be a writing project consisting of a 3 page proposal of how to advance one of the areas of Drug Discovery & Development covered in the course.
Taught by: Dr. Ben E. Black, UPenn and Dr. Craig A. Leach, GlaxoSmithKline
Course usually offered in spring term
Also Offered As: BMB 605, CAMB 710
Activity: Lecture
1.0 Course Unit

PHRM 623 Fundamentals of Pharmacology
This course is designed to introduce students to basic pharmacological concepts with special emphasis on the molecular actions of drugs. Subject matter includes use of microcomputers to analyze pharmacological data. Prerequisite: Permission of course director
Taught by: Dr. Jeffrey Field and staff
Course usually offered in fall term
Also Offered As: REG 623
Activity: Lecture
1.0 Course Unit

PHRM 624 Medical Pharmacology
This course surveys the major classes of drugs used to treat human conditions, and focuses in the detail on their molecular mechanisms of action. It consists of two 2-hour lectures per week and problem sets. Student evaluation is based 50% on exams and 50% on problem sets. PHRM 624 is required of all 2nd year PGG students. PGG students must co-enroll in PHRM 532/CAMB 532 (Human Physiology). Prerequisite: Non-PGG students must have permission from course director to enroll.
Taught by: Course Directors: Paul H. Axelsen, Park Cho Park, Akiva Cohen, Steve Whitehead
Prerequisite: PHRM 623 AND BIOM 600
Activity: Lecture
2.0 Course Units

PHRM 632 Cell Control by Signal Transduction Pathways
This course, “Targeting the cancer cell: from mechanism to precision medicine”, will examine how various signal transduction mechanisms influence cell functions including replication, growth, transcription, translation and intracellular trafficking. We will also consider how non-cell autonomous mechanisms, such as the tumor microenvironment and the immune system influence cancer cell signaling. We will consider how important signaling pathways, such as Ras, Raf, Notch, Wnt, TGF beta, and various kinases/phosphatases become dysregulated in cancer, as well as delve into how the DNA damage response, immune system, and tumor microenvironment exert important influences on oncogenic signaling. In the first half of the course, invited faculty members will pick 2 relatively recent papers from their field that highlight important areas. Each paper will be assigned to a student, who will meet with the faculty mentor prior to the class to discuss the paper and their presentation. During the class, students will present each paper for approximately 45 minutes with time for discussion. Students will present the important background, break down the paper, look for strengths and weakness and come up with a plan of what the next set of experiments could or should be. In the second half of the course, students will independently pick a relevant paper for in class presentation and will also write a short “News and Views” style article based on the paper they have chosen. The goal of the course is to provide students with a view of the cancer cell that integrates both cell autonomous and non-cell autonomous signals and to use this information to consider how to successfully treat cancer.
Taught by: X. Hua, J. Field, A. Resnick, and W. Pear
Course usually offered in spring term
Also Offered As: CAMB 632
Prerequisite: BIOM 600
Activity: Seminar
1.0 Course Unit

PHRM 650 Current Biochemical Topics
Participation in the “Dr. George W. Raiziss Biochemical Rounds”, a weekly seminar program sponsored by the Department of Biochemistry and Biophysics. Program deals with a wide range of modern biochemical and biophysical topics presented by established investigators selected from our faculty, and by leading scientists from other institutions. Prerequisite: Permission needed from Department
Taught by: Black and Shorter
Course offered summer, fall and spring terms
Also Offered As: BMB 650, CAMB 702
Activity: Seminar
1.0 Course Unit
PHRM 657 Introduction to Superfund Sites and Health Effects of Hazardous Waste
Superfund hazardous waste sites are prevalent in our nation and the exposures to toxicants from these sites raise immediate health concerns. The aims of this course are to educate students about such sites and provide a scientific basis for hazard identification, hazard characterization, risk communication and risk management. The course will describe the effect of these hazardous chemicals on the ecosystem and vice-versa, and remediation and mitigation approaches. These environmental science issues will lead into the environmental health aspects of exposures including: biomonitoring (external and internal dose, biomarkers and the exposome), toxicological properties of contaminants and mode-of-action. The course will be complemented with visits to two Superfund sites in the region: Ambler (asbestos) and Palmerton (heavy metals). Prerequisite: 400 level course in Biology/Chemistry and Biochemistry
Taught by: Jane Willenbring, Richard Pepino, Trevor Penning
Also Offered As: ENVS 657
Activity: Lecture
1.0 Course Unit

PHRM 699 Laboratory Rotation
Activity: Laboratory
1.0 Course Unit

PHRM 799 Independent Study
One-term course offered either term
Activity: Independent Study
0.5 Course Units

PHRM 899 Pre-Dissertation Lab Rotation
Activity: Laboratory
0.5 Course Units

PHRM 970 Candidacy Examination
One-term course offered either term
Activity: Lecture
2.0 Course Units

PHRM 995 Dissertation
Activity: Dissertation
1.0 Course Unit