Course Descriptions

Core courses and other didactic courses frequently taken by GMB students are described in the main text of the self study. Additional courses, including seminar courses, taken by GMB students are described below.

GNET 624 – Developmental Genetics
3 credits, Fall
Instructors: Vicki Bautch, Frank Conlon, others

We will quickly cover the genetic and molecular regulation of developmental processes, including new breakthroughs in systems analysis of developmental networks. We will discuss how organs form, using neural development as a model. We will also cover advanced topics such as sex determination, blood vessel formation, and the emerging developmental and therapeutic roles of stem cells.

GNET 625 – Seminar in Genetics: Molecular and Cellular Basis of Development
Instructors: Vicki Bautch and Mark Peifer
2 Credits, offerings vary between Fall and Spring

This seminar introduces first and second year graduate students to questions about the normal roles of human disease genes in development and physiology as well as how cells in an embryo self-assemble into tissues and organs. It emphasizes learning by reading papers and class participation.

GNET 625 – Seminar in Genetics: Meiosis, Recombination, and Sex
Instructors: Greg Copenhaver, Corbin Jones, and Jeff Sekelsky
2 Credits, Spring

This seminar introduces first and second year graduate students to questions ranging from molecular models of recombination to the evolution of sex. It emphasizes learning by reading papers and class participation. Various formats may be employed, from standard journal club to debate format to researching and writing a review article.

GNET 750 – The Genomics of Complex Human Disease (Seminar)
Instructor: Patrick Sullivan
2 Credits, offered Spring semester

Human complex diseases have become a major focus of modern human genomics. Conditions like type 2 diabetes mellitus, myocardial infarction, rheumatoid arthritis, non-syndromic cancers, and schizophrenia are major sources of morbidity, mortality, human suffering, and societal costs worldwide. Each of these conditions has an important genetic component, but the inheritance patterns are probabilistic and not deterministic (as in many Mendelian diseases). There have been significant advances in knowledge and technology in the past 5 years. This graduate seminar will cover the main approaches to complex diseases (genome-wide association, next-generation sequencing, and structural variation in case-control and pedigree studies) and cover current knowledge in the main disease areas.

GNET 850 – Training in Genetic Teaching
Instructor: Varies
3 Credits, offered Fall and Spring semesters

Students are responsible for assistance in teaching genetics and work under the supervision of the individual faculty instructors of various courses, with whom they have regular discussion of methods, content and evaluation of performance. Opportunities exist to teach both undergraduate and graduate level courses.

Courses outside GNET often taken by GMB students

CBIO 643 - Cell Structure, Function, and Growth Control 1
3 Credits, Fall
Instructors: Richard Cheney and others

This is a graduate-level cell biology course designed to provide a systematic and in-depth understanding of cell structure and function, and consists of 3 major blocks that focus on membrane trafficking, cytoskeleton, and cell adhesion/cancer biology. Our goal is to provide the key background required to understand research in these areas of cell biology and to begin to develop the ability to read and critique the primary literature. The course is taught in the fall by faculty from several departments, including Cell and Developmental Biology, Cell and Molecular Physiology, Biochemistry, Pharmacology, Microbiology, and Biology, and each lecturer is a faculty member whose research is relevant to the block of lectures they present. The course consists of lectures, reading, and small group discussions of classic or recent papers in the field. Grading is based on take-home exams at the end of each block as well as other factors such as participation in discussions. Undergraduate biochemistry or cell biology is a prerequisite.

CBIO 644 Cell Signaling and Growth Control
3 Credits, Spring
Instructors: Jean Cook and others

This a semester-long team-taught course covering principles and mechanisms of signal transduction and cell cycle control. The emphases are mammalian cell biology and oncogenesis. Faculty-taught lectures are interspersed with primary literature discussions. Students are evaluated in four take-home open-note exams. Note that for spring 2013 this course will be converted to three modular courses in signaling and cell cycle control that are under development.

MCRO 614 – Immunobiology
Instructors: Ed Collins
3 Credits

Immunobiology is a survey of immunology with a focus on how the information has been obtained. The course will include: innate immune response to pathogen-associated patterns; triggering the adaptive immune response (both B and T cell responses); mechanisms of B and T cell antigen recognition; development of immune cell; autoimmunity; and pathogen escape from immune response.

MCRO - 630 Virology
Instructor: Ray Pickles
3 Credits

Course is designed to provide students with a comparative framework for understanding the broad molecular, biochemical and cell biological concepts in virus replication. Thus rather than focus in a vertical fashion on the replication of representative virus families, much of the course is taken over by a horizontal exploration of a particular step in virus replication across the diversity of animal viruses. To that end we emphasize the approach and organization taken in the text "*Principles of Virology*", eds. Flint, Enquist, Racaniello and Skalka. Because we can't cover all the material, some aspects of viral replication are simply assigned as outside reading. Since our target audience are graduate students, we do encourage them to undertake reading of additional primary literature to supplement the lecture topics, as well as devote course time to discussion of papers that are illustrative of a particular concept or an emerging issue in virus replication. Finally, there is the hope of always encouraging in-lecture class discussion of material and to make connections with other topics presented in the course. Prerequisites are a familiarity with basic concepts in molecular cell biology/biochemistry, or previous course work in virology.

MCRO 640 - Viral Pathogenesis
Instructor: Mark Heise
3 Credits

The course is designed to introduce graduate level students to fundamental concepts in understanding virus-induced disease. At the end of this course, students are expected to have a basic understanding of the types of virus/host interactions that drive virus-induced disease, be exposed to key unresolved questions within the field, and have a firm grasp of the types of experimental approaches that can be used to study viral pathogenesis from the standpoint of both the host response and the virus. The course grade is determined by the student's performance on two exams and a writing assignment, each of which comprises one third of the final grade.

PATH 713 - Mechanisms of Disease

Instructors: Alisa Wolberg and Jonathan Homeister
3 Credits

A graduate course on cell injury and pathogenesis of disease with emphasis on basic mechanisms at the molecular, cellular and organismal levels. This is a team-taught course, whereby members of the Pathology and Laboratory Medicine faculty and guest faculty lecturers will present information on histology and pathologic mechanisms of disease. Course content will be derived from the leading pathology textbook and primary literature. Grades will be determined based on in-class and take-home exams.
Course Objectives: 1) Understand pathophysiologic processes including cellular injury, inflammation, immune responses, neoplasia, hemodynamic disorders, and vascular disease, and 2) Recognize and describe normal histology and histologic changes manifest in certain pathophysiologic processes including cellular injury, inflammation, immune responses, neoplasia, hemodynamic disorders, and vascular disease. Topics (subject to modification): Basic normal histology and histology of disease processes, mechanisms of cell injury, inflammation, wound healing and repair, infectious disease, immune response and disease, neoplasia, genetic disease, hemostasis and thrombosis, vascular physiology and pathology.

PATH 715 Molecular and Cellular Pathophysiological Basis of Disease: Systemic Pathology

Instructors: William Coleman
3 Credits

A graduate course on systemic pathology that emphasizes diseases of the major organ systems. The objectives of this course of study are to (i) illustrate pathology of organ systems, (ii) describe pathogenesis of the diseases of organ systems, and (iii) present the abnormal physiology that is associated with disease of organ systems. Thus, the three-part focus of the course is pathology, pathogenesis, and pathophysiology. This course builds upon the content of Pathology 713 which emphasizes mechanisms of disease. Pathology 713 is a prerequisite for this course, but some other courses can substitute (contact the course director for permission). The course is organized into eight instructional blocks covering (1) disorders of the cardiovascular system and blood, (2) disorders of the respiratory system, (3) disorders of the gastrointestinal system, (4) disorders of the liver, biliary tract, and exocrine pancreas, (5) skin, bones, joints, skeletal muscle, and connective tissue, (6) disorders of the endocrine and reproductive systems, (7) disorders of the kidney and urinary system, and (8) disorders of the central and peripheral nervous system. Each instructional block will contain lectures on (a) the normal histology of the organ system, (b) pathology and pathogenesis of diseases of that organ system, and (c) normal physiology of the organ system and abnormal physiology associated with disease. Lecturers in this course represent faculty members from the Department of Pathology and Laboratory Medicine, as well as numerous other departments. Course content is derived from textbook material, supplemental material from lecturers, and in some cases the primary literature. Student performance is assessed through four take-home examinations.

PATH 725 - Cancer Pathobiology
Instructors: William Kaufmann
3 Credits

This course will cover a range of topics including cancer etiology, pathogenesis, clinical features, and treatment. Lecturers will emphasize an interdisciplinary approach drawing on observations from epidemiology, genetics, molecular biology, animal modeling, histopathology and clinical medicine. The intent is to provide a firm foundation in pathobiologic features of cancer and thereby facilitate the translation of bench science into the clinical laboratory. For each of three organ systems (lung, breast, colon) several sessions will include discussions of: epidemiology, genetics, molecular oncogenesis, animal models, histopathology, and clinical management.

PATH 792 - Seminar in Carcinogenesis
Instructors: William Coleman
2 Credits

Seminar in Carcinogenesis will feature presentations by students and faculty covering a broad range of topics on mechanisms of neoplastic transformation, with special emphasis on the molecular basis of cancer induction. There will be no single text for this course. Rather, background material will be taken from the classic carcinogenesis literature, and from recently published original research and reviews. Discussions will consider experimental methodology and observations, as well as general concepts and theories. Each student will be required to give an oral presentation on a current issue in carcinogenesis (topic to be chosen by the student), and to write a short review of the chosen subject. Students will be critically evaluated on the quality of their presentation in order to enhance development of good presentation skills. Grades will be based upon level of participation during the course, the individual oral presentation, and a written review paper.
Topics: the history of carcinogenesis research; risk assessment in carcinogenesis and toxicology; interspecies comparison of carcinogenic risk; overviews of chemical and physical carcinogenesis; cell cycle dysregulation in neoplastic cells; positive mediators of cell proliferation (growth factors and classic oncogenes); negative mediators of cell proliferation (tumor suppressor genes); mechanisms of endogenous carcinogenesis; human tumor systems (prostate, breast, colon, and others); aging and cancer risk; genomic instability in cancer development; transgenic models of cancer induction; viral oncogenesis; molecular epidemiology; application of molecular diagnostics to human cancer detection.

PATH 801 - Scientific Critical Thinking
Instructor: Cyrus Vaziri
3 Credits

A graduate-level course designed to teach the ‘scientific method' and based on student presentations of primary literature and group discussions. Teaches students the process by which scientists identify problems, formulate testable hypotheses, collect data through experiments, and eventually establish new models describing biological processes.

PHCO 724 - Ras Superfamily Proteins and Signal Transduction
Instructors: Adrienne Cox & Channing Der
2 Credits

Seminar course covering recent advances in the role of these proteins in signaling and growth.

PHCO 725 - Signal Transduction
Instructors: Ken Harden and Henrik Dohlman
2 Credits

This is a lecture course on molecular aspects or receptors/heterotrimeric G-proteins/effector proteins/regulatory proteins that mediate hormone, neurotransmitter, growth factor, and sensory signaling. A series of introductory lectures that take a historical look at the the discovery of G proteins will be followed by discussions of seminal papers in the field over the past three decades.

PHCO 737 - Target-Based Drug Discovery and Cancer Treatment
Instructors: Channing Der and Adrienne Cox
2 Credits

A lecture course that emphasizes preclinical and clinical studies for the development of anti-cancer drugs that target signal transduction. Topics include: target identification and validation, drug discovery, the process of government approval for clinical trials, design of clinical trials, and new genetic-based technologies to foster drug development.