

Molecular and Cellular Pharmacology (HBH)

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Degree awarded: Ph.D. in Molecular and Cellular Pharmacology

The faculty of the Department of Pharmacological Sciences, in conjunction with faculty in other departments at Stony Brook, offers the graduate program in Molecular and Cellular Pharmacology leading to the Ph.D. degree. Because the program emphasizes early research experience and provides a broad curriculum, students lay the foundation for subsequent independent research. Graduate research opportunities are provided in a broad range of areas including biochemical and molecular pharmacology, chemical pharmacology and toxicology, and cellular and physiological pharmacology. Students, in consultation with faculty advisors, pursue basic and elective courses and begin thesis research during the first two years of training. During this time, they participate in several research projects directed by faculty members associated with the program. Students then select a research advisor from the faculty and, upon completion of the qualifying exam, devote full effort to dissertation research. Students have the opportunity to perform research rotations and/or thesis research in any of 52 associated laboratories in Department of Pharmacological Sciences or other University departments or at Brookhaven National Laboratory and Cold Spring Harbor Laboratory. Further details may be obtained from the graduate program director.

Facilities

The Department of Pharmacological Sciences is the primary training facility for graduate studies in Molecular and Cellular Pharmacology. The Department occupies 32,000 square feet in the University's Basic Sciences Tower and 5,000 square feet in the Graduate Chemistry Building. Faculty laboratories, including those faculty located in the recently opened Center for Molecular Medicine, are equipped for all types of modern molecular and cell biological, biochemical, neurochemical, chemical, biophysical, and toxicological research. Specialized facilities are provided for tissue culture, recombinant DNA work,

ultracentrifugation, scintillation and gamma spectrometry, transgenic mouse research, electron microscopy, confocal microscopy, molecular modeling, gas and high-performance liquid chromatography, proteomics, nuclear magnetic resonance, X-ray crystallography, and mass spectrometry. Research activities are supported by various shops, University computing facilities, animal-care facilities, and media services. Excellent library facilities include the Health Sciences Library, the Pharmacological Sciences Library, and online resources, comprising of databases, e-books, and e-journals. Program faculty members currently receive more than \$19 million in annual research support from federal and private agencies.

Admission

Admission to the Ph.D. Program in Molecular and Cellular Pharmacology

For admission to the graduate program in Molecular and Cellular Pharmacology, the following, in addition to the minimum Graduate School requirements, are normally required:

A. A bachelor's degree in an appropriate field (biology, chemistry, biochemistry, microbiology, physics) with evidence of superior performance in science courses. Coursework in biochemistry, physical chemistry, and physiology is desirable;

B. Three letters of reference are required;

C. Graduate Record Examination (GRE) General Test scores are required, as is the TOEFL for foreign students. An advanced test in biochemistry, biology, chemistry, computer science, physics, or mathematics is desirable;

D. Students must be accepted by both the Department of Pharmacological Sciences and the Graduate School;

E. Students accepted into the graduate program receive stipend support and full tuition scholarships. The current stipend level (2008-2009) is \$26,000 and includes health insurance coverage.

Faculty

Distinguished Professors

Grollman, Arthur P.,¹ M.D., 1959, Johns Hopkins University: Chemical carcinogenesis and mutagenesis.

Malbon, Craig C., Ph.D., 1976, Case Western Reserve University: Wnt-frizzled signaling via G-proteins in development; analysis of signaling complexes.

Reich, Edward, M.D., 1956, Johns Hopkins University; Ph.D., 1962, Rockefeller University: Autocrine regulation; parasite biochemistry; design of new therapeutic systems.

Professors

Bliska, James, Ph.D.,¹⁰ 1988, University of California, Berkeley: Molecular and cellular basis of bacterial-host cell interactions.

Bogenhagen, Daniel, M.D., 1977, Stanford University School of Medicine: Replication, transcription, and repair of mammalian mitochondrial DNA; mitochondrial proteomics.

Cohen, Ira S.,¹⁴ M.D., Ph.D., 1974, New York University: Electrophysiology of the heart.

Eisenberg, Moises, Ph.D., 1972, California Institute of Technology: Application of bioinformatics tools to study comparative gene organization.

Fisher, Paul A., M.D., Ph.D., 1980, Stanford University: Structure and function of the cell nucleus; DNA metabolism and mutagenesis; human neurodegenerative diseases.

Frohman, Michael A., *Interim Chair*, M.D., Ph.D., 1985, University of Pennsylvania: Neural differentiation and signal transduction.

Ghebrehwet, Berhane,⁹ D.V.M., D.Sc., 1974, University of Paris VII: C1q receptor mediated cellular responses with particular emphasis on inflammation and microbial infection.

Haltiwanger, Robert,⁷ Ph.D., 1986, Duke University: Regulation of signal transduction by glycoproteins.

Hearing, Patrick,¹⁰ Ph.D., 1980, Northwestern University: Adenovirus regulation of cellular proliferation and gene expression; adenovirus vectors for human gene therapy.

Iden, Charles R., Ph.D., 1971, Johns Hopkins University: Biomedical applications of mass spectrometry; proteomics; characterization of DNA adducts and DNA repair mechanisms; synthesis of modified oligodeoxynucleotides.

Johnson, Francis, Ph.D., 1954, University of Glasgow, Scotland: Synthesis of natural products; DoM reactions; antiviral agents; mechanism of action of carcinogens and mutagens; site-specific mutagenesis; DNA damage and mechanisms of action of DNA-repair enzymes.

Levine, Joel,¹¹ Ph.D., 1980, Washington University: Glial cells; proteoglycans, and the regulation of axonal growth.

McKinnon, David,¹¹ Ph.D., 1987, Australian National University, Australia: Molecular physiology of neurons and cardiac muscle.

Miller, W. Todd,¹⁴ Ph.D., 1987, Rockefeller University: Signal transduction by tyrosine kinases.

Moll, Ute M.,⁵ M.D., 1985, Ulm, Germany: Function/regulation of the p53 gene family in apoptosis and cancer.

Prives, Joav M., Ph.D., 1968, McGill University, Canada: Regulation of surface receptors in muscle cells.

Reich, Nancy C.,¹⁰ Ph.D., 1983, Stony Brook University: Signal transduction and gene expression induced by cytokines and viral infection.

Rigas, Basil,¹ M.D., 1972; D.Sc. 1975, Athens University Medical School, Greece: NSAIDs in the prevention of colon cancer.

Said, Sami I.,⁹ M.D., 1951, Cairo University, Egypt: Physiology and pharmacology of VIP and related neuropeptides, with special reference to their modulation of cell injury, inflammation, and cell death, and their potential as therapeutic agents.

Sampson, Nicole,² Ph.D., 1990, University of California, Berkeley: Integrin receptor interactions in mammalian fertilization/enzymology of cholesterol oxidase.

Schechter, Nisson,¹⁵ Ph.D., 1971, Western Michigan University: Structure, function, and regulation of intermediate filament proteins and homeobox proteins during zebrafish neurogenesis.

Steigbigel, Roy,¹ M.D., 1966, University of Rochester: HIV treatment and immunoreconstitution.

Tonge, Peter,² Ph.D., 1986, University of Birmingham, England: Biological chemistry and enzyme mechanisms; quantitating substrate strain in enzyme-substrate complexes using vibrational spectroscopy; rational drug design.

Tsirka, Styliani-Anna (Stella) E.,¹⁶ *Graduate Program Director*, Ph.D., 1989, University of Thessaloniki, Greece: Neuronal-microglial interactions in the physiology and pathology of the central nervous system.

Van Nostrand, William,⁹ Ph.D., 1985, University of California: Cerebrovascular pathology in Alzheimer's disease and related disorders.

Volkow, Nora D.,^{15, 16} M.D., 1981, National University, Mexico: Imaging studies of neuropharmacological agents; positron emission (PET) scanning.

Associate Professors

De los Santos, Carlos, Ph.D., 1987, University of Buenos Aires, Argentina: NMR solution structures of damaged nucleic acids and repair proteins.

Dewey, Stephen L.,¹⁶ Ph.D., 1985, University of Iowa: Imaging neurotransmitter interactions with PET and fMRI.

Evinger, Marian J.,¹³ Ph.D., 1978, University of Washington: Transcriptional regulation of PNM1 gene expression; gene expression in neuronal tumors.

Enikolopov, Grigori N.,¹⁷ Ph.D., 1978, Institute of Molecular Biology, USSR Academy of Science: Stem cells; neurogenesis; development; signal transduction

Karzai, Wali A.,⁷ Ph.D., 1995, Johns Hopkins University: Biochemistry and structural biology of RNA-protein interactions, translational control of gene expression, and drug discovery.

Kurland, Irwin,¹ M.D., 1984, University of Southern California; Ph.D. 1992, Vanderbilt University: Regulation of insulin action and glucose metabolism.

Morrison, Sidonie A.,¹ D.Phil., 1973, University of Oxford, England: Mechanisms of infection and pathogenesis in HIV-1 disease, especially host-cell factors; restoration of immune function during highly active antiretroviral therapy.

Simmerling, Carlos,² Ph.D., 1994, University of Illinois, Chicago: Computational chemistry and structural biology; molecular dynamics of biological macromolecules.

Schärer, Orlando, Ph.D., 1996, Harvard University: Chemical biology of mammalian DNA repair.

Talmage, David,¹⁰ Ph.D., 1981, University of Minnesota: Interactions between retinoids and receptor tyrosine kinase signaling pathways.

Thomsen, Gerald H.,⁷ Ph.D., 1988, Rockefeller University: Vertebrate embryonic development.

Wollmuth, Lonnie,¹¹ Ph.D., 1992, University of Washington: Molecular mechanisms of synaptic transmission.

Assistant Professors

Bowen, Mark,¹⁴ Ph.D., 1998, University of Illinois at Chicago: Single molecule spectroscopy; coordination of post-synaptic glutamate receptor signaling by the MAGUK family of scaffolds.

Chen, Emily, Ph.D., 2002, University of California, San Diego: Proteome signature of organ-specific metastasis.

Cognato, Holly, Ph.D., 1999, Rutgers University: Extracellular matrix in the brain: roles during development and during neurodegeneration.

Crawford, Howard, Ph.D., 1993, University of Texas Southwestern Medical Center at Dallas: Pancreatic cancer.

Fu, Dax,⁶ Ph.D., 1995, Mayo Graduate School of Medicine: Biochemical and X-ray crystallographic studies of transmembrane active processes via membrane channels and transporters.

Garcia-Diaz, Miguel, Ph.D., 2003, University of Madrid, Spain: Structural enzymology of DNA/RNA transactions.

Maletic-Savatic, Mirjana,^{18, 5} M.D., Ph.D., 1996, University of Belgrade, Serbia and Montenegro: Mechanisms of differentiation of neural progenitor cells; identification of neuron progenitor cell biomarkers.

Nassar, Nicolas,¹⁴ Ph.D., 1992, European Molecular Biology Laboratory, Grenoble, France: Regulation of signaling proteins.

Rizzo, Robert,¹⁹ Ph.D., 2001, Yale University: Computational research projects in cancer, HIV/AIDS, influenza, and method development.

Takemaru, Ken-Ichi, Ph.D., 1997, Graduate University for Advanced Studies, Japan: Wnt signaling in development and disease.

Wei-Xing Zong,¹⁰ Ph.D., 1999, UMDNJ-Robert Wood Johnson Medical School, New Jersey: Molecular regulation of apoptotic and necrotic cell death.

Research Faculty

Berrios, Miguel, *Associate Professor*, Ph.D., 1983, Rockefeller University: Polypeptide structure of the cell nucleus; nuclear assembly and disassembly; mapping genomic DNA damage and repair assembly and disassembly; fertilization and pronuclear formation.

Du, Guangwei, *Assistant Professor*, Ph.D., 1999, Peking Union Medical College and Chinese Academy of Medical Sciences, China: Cellular morphogenesis and membrane trafficking

Li, Feng-Qian, *Assistant Professor*, Ph.D., 1994, University of Advanced Studies/National Institute of Genetics, Japan: Function of signaling regulators involved in cell growth regulation, cancer biology and adipogenesis.

Moriya, Masaaki, *Professor*, Ph.D., 1981, Nagoya University, Japan: Cellular response to DNA damage.

Rosenquist, Thomas, *Assistant Professor*, Ph.D., 1989, University of Wisconsin-Madison: Genetic analysis of mammalian oxidative DNA damage repair.

Shibutani, Shinya, *Professor*, Ph.D., 1983, Toyama Medical and Pharmaceutical University, Japan: Mechanisms of translesional DNA synthesis.

Number of teaching, graduate, and research assistants, Fall 2008: 34

1) Joint appointment, Department of Medicine

2) Joint appointment, Department of Chemistry

3) Joint appointment, Department of Neurobiology and Behavior

4) Joint appointment, Department of Physiology and Biophysics

5) Joint appointment, Cold Spring Harbor Laboratory

6) Joint appointment, Brookhaven National Laboratory

7) Primary appointment with Department of Biochemistry and Cell Biology

- 8) Primary appointment with Department of Chemistry
 9) Primary appointment with Department of Medicine
 10) Primary appointment with Department of Molecular Genetics and Microbiology
 11) Primary appointment with Department of Neurobiology and Behavior
 12) Primary appointment with Department of Pathology
 13) Primary appointment with Department of Pediatrics
 14) Primary appointment with Department of Physiology and Biophysics
 15) Primary appointment with Department of Psychiatry
 16) Primary appointment with Brookhaven National Laboratory
 17) Primary appointment with Cold Spring Harbor Laboratory
 18) Primary appointment with Department of Neurology
 19) Primary appointment with Department of Applied Mathematics

Degree Requirements

Requirements for the Ph.D. Degree in Molecular and Cellular Pharmacology

In addition to the minimum Graduate School requirements, the following are required:

A. Course Requirements

1. Graduate Biochemistry (MCB 520)
2. Molecular Genetics (MCB/HBM 503)
3. Biochemical Laboratory Techniques (HBH 545, HBH 546)
4. Computational Methods in Biochemistry and Structural Biology (BSB 515)
5. Cell Biology (MCB 656)
6. Biomembranes (MCB 517)
7. Six one-credit special topics in the series Principles of Pharmacology (HBH 631-636)
8. Integrity in Science (GRD 500)
9. Proposal Preparation in Regulatory Biology (HBH 560)
10. One elective
11. Practicum in Teaching Pharmacology (HBH 601)

Depending on prior course work, students may adjust these requirements with the consent of the Steering Committee of the graduate program.

B. Research Rotations

Students are required to complete three rotations in laboratories affiliated with the program during the first two semesters and the following summer.

The host laboratory for thesis research is typically selected from one of these three rotations.

C. Qualifying Exam

In the second year, students are required to write and orally defend a research proposal on a topic unrelated to their thesis research.

D. Thesis Proposal Examination

In the fall semester of the third year, students select a thesis committee including three program faculty and one extramural faculty member to evaluate their written thesis proposal and their oral defense of the proposal.

E. Advancement to Candidacy

Following completion of coursework, and satisfactory performance on the qualifying examination and research proposal examination, students will be recommended to the Graduate School for advancement to Ph.D. degree candidacy.

F. Ph.D. Dissertation

The research for the Ph.D. dissertation is conducted under the supervision of the thesis committee. Upon approval of the completed dissertation by this committee, a dissertation examining committee is appointed by the dean of the Graduate School. A formal public oral defense of the dissertation is scheduled, at which the student presents his or her findings and is questioned by members of the examining committee and by other members of the audience.

G. Teaching Requirement

It is expected that each graduate student completing a doctoral degree will have functioned as a teaching assistant during at least one semester of his or her graduate career (HBH 601).

H. Residence Requirement

The University requires at least two consecutive semesters of full-time graduate study. The demands of the program necessitate a longer period of residence.

Courses

HBH 501 Principles of Pharmacology

Basic principles and mechanism of drug distribution, absorption, metabolism, and elimination. Principles of chemical carcinogenesis and tumor promotion. Autonomic, Smooth Muscle and CNS Pharmacology. Pharmacology of specific drugs of historical interest including alcohol, antibiotics, aspirin, nicotine, and morphine.

Review of anticoagulants and thrombolytic agents, antiparasitic, and drugs for the treatment of allergic conditions and gout. Includes discussion of specific cases taken from clinical practice and a presentation based on a set of selected readings. Crosslisted with BCP 401.
Fall, every year, 4 credits, ABCF grading

HBH 502 Advanced Principles of Pharmacology

Advanced concepts of drug metabolism, pharmacokinetics, biochemical and molecular mechanisms of drug action and drug resistance in human disease states. Toxicological agents and environmental pollutants. The pharmacology of autocoids, anti-inflammatories, immunosuppressants, and anti-asthmatics. Rational drug design and drug receptor interactions using computer molecular modeling techniques. Includes discussion of specific cases taken from clinical practice and a presentation based on a set of selected readings. Crosslisted with BCP 402.
Spring, every year, 4 credits, ABCF grading

HBH 510 Pharmacology: Principles and Practice

Introduces the basic principles of pharmacology and covers drugs with action in the autonomic and central nervous systems. Includes the discussion of specific cases taken from the clinical practice.
Fall, every year, 2 credits, ABCF grading

HBH 511 Pharmacology: Principles and Practice

Continuation of HBH 510. Covers the action of drugs acting in the cardiovascular, respiratory, gastrointestinal, renal, and endocrine systems, as well as anticoagulant, anti-inflammatory, anti-microbial, and anticancer agents. Includes the discussion of specific cases taken from the clinical practice.
Prerequisite: HBH 510; open only to students enrolled in the Physician Assistant Graduate Program
4 credits, ABCF grading

HBH 531 Principles of Medical Pharmacology

Basic principles that underlie actions of drugs on physiological processes with particular reference to their therapeutic and toxic actions. For medical and dental students.
Prerequisites: Physiology, biochemistry, permission of instructor, admission to graduate Health Sciences Center program
Modules 4-6, 5 credits, ABCF grading

HBH 545 Biochemical Laboratory Techniques

Introduces theoretical principles and experimental techniques used in modern biochemical research. Lectures and homework assignments explore topics in basic molecular and cellular techniques.
Prerequisites: Admission to graduate Health Sciences Center program
Fall, 1 credits, ABCF grading
May be repeated once for credit

HBH 546 Biochemical Laboratory Techniques

Continuation of HBH 545. Lectures and demonstrations present topics in chromatog-

raphy, mass spectrometry, protein sequencing, sedimentation, electrophoresis, ligand binding, basic pharmacological methods, and statistical analysis of data. Includes procedures for the safe handling of toxic chemicals and radioisotopes.

Prerequisites: Permission of instructor; admission to graduate Health Sciences Center program.

*Spring, 1 credit, ABCF grading
May be repeated once for credit*

HBH 553 Signal Transduction

The course will emphasize fundamental concepts in signal transduction (e.g., membrane-protein and protein-protein interactions, amplification of signals), and individual lectures will apply these concepts at each stage of cell signalling from the cell surface to the nucleus, where signal transduction leads to specific gene expression. Crosslisted as HBH 553 or HBH 553.

Prerequisites: Admission to graduate Health Sciences Center program

Spring odd years, 3 credits, ABCF grading

HBH 560 Proposal Preparation in Regulatory Biology

A literature-based course focusing on major research areas in molecular and biochemical pharmacology. The first part of the course will expose students to a series of examples of recent grant proposals. The second part of the course will feature student presentations of their research proposals. Due to the coordination of this course with the Qualifying Exam, registration is limited to Pharmacology graduate students.

*Fall and spring, 2 credits, ABCF grading
May be repeated once for credit*

HBH 580 Selected Topics in Pharmacology

Student seminars and readings on topics arranged through consultation with staff.

Prerequisites: Full-time pharmacology graduate status

*Fall and spring, 0 to 1 credit, ABCF grading
May be repeated for credit*

HBH 590 Pharmacology Seminars

Advanced research seminars by staff and visiting lecturers.

Prerequisites: Full-time pharmacology graduate status

*Fall and spring, 0 to 1 credit, S/U grading
May be repeated for credit*

HBH 599 Graduate Research in Pharmacological Sciences

Original research projects under faculty supervision.

Prerequisites: Full-time pharmacology graduate status

Fall, spring, and summer, 0-12 credits, ABCF grading

May be repeated up to nine times for credit

HBH 601 Practicum in Teaching Pharmacology

Practical experience and instruction in the teaching of pharmacology carried out under faculty orientation and supervision.

Prerequisites: Full-time pharmacology

graduate status

*Fall and spring, 0 to 1 credit, ABCF grading
May be repeated up to five times for credit*

HBH 631 Principles of Drug Action

This course is designed to provide a quantitative understanding of the basic principles by which drugs interact with living systems at the cellular and organismal levels. Topics include the mechanisms of drug transport through membranes, interaction of drugs with receptors and binding proteins, drug distribution, biotransformation of drugs, enzymes of stage I and stage II metabolism, cytochrome p450 gene families and regulation of p450 gene expression, mechanisms of renal excretion of drugs and metabolites, pharmacokinetics of constant drug infusions and intermittent dosing regimens, and applications of pharmacokinetic principles to protein and mRNA induction and turnover. Students apply pharmacological principles in a series of problem-solving exercises.

Prerequisites: Admission to a graduate Health Sciences Center program

Fall or spring, 1 credit, ABCF grading

HBH 632 Molecular Interactions of Drug Structures

The course provides an overview of the most current approaches to analyze and understand the interactions between a drug and its target and how this information is used for the design and development of new drugs. The detailed structural analysis of drug target interactions by X-ray crystallography and NMR spectroscopy as a basis for the design of new drugs will be discussed on the basis of very recent examples. Advanced computer simulation techniques will be discussed and will include the use of molecular mechanics energy functions to optimize biomolecular structures, predict ligand binding modes and energetics.

Prerequisites: Admission to a graduate Health Sciences Center program

Fall or spring, 1 credit, ABCF grading

HBH 633 Physiological Action of Drugs

Selected applications of drugs used in clinical medicine, illustrating current concepts and problems at the intersection of pharmacological basic science and therapeutic treatment. Settings to include the management of diabetes, metabolic diseases, and cardiac disease.

Prerequisites: Admission to a graduate Health Sciences Center program

Fall or spring, 1 credit, ABCF grading

HBH 634 Organ Physiology and Pharmacology

The goals of this class are to provide a general introduction to the normal physiology of the cardiovascular/blood, respiratory, gastrointestinal, and muscle systems at the cellular, tissue, organ, and organ systems levels. Additionally students learn how normal function may be changed by disease and pharmacology.

Prerequisites: Permission of instructor 1 credit, ABCF grading

HBH 635 New Concepts in Chemotherapy

This course compares mechanisms of action of drugs used for antibacterial and anti-

cancer chemotherapy. The lecture material stresses how selective toxicity is achieved in each case with either cell death or inhibition of cell growth as the ultimate mechanism. Original research papers are discussed on mechanisms whereby cells develop resistance to chemotherapy and novel strategies to overcome this resistance.

Prerequisites: Admission to graduate Health Sciences Center program

Fall, 1 credit, ABCF grading

HBH 636 Drug Discovery and Drug Interactions

An advanced series of lectures and student presentations will develop a basic understanding of modern methods of drug discovery and drug receptor interactions. Topics include the structural and physiological factors essential for drug action, quantitative structure activity relationships, and unintended toxicities produced by drug substances.

Prerequisites: Admission to graduate Health Sciences Center program

Fall, 1 credit, ABCF grading

HBH 655 Neuropharmacology

An advanced course for graduate students interested in developing an understanding of neuropharmacology and research on this topic. Following a general introduction to the nerve cell structure, synaptic and chemical transmission, three themes receptors, receptors as channels, and G-protein-coupled receptors are developed. Recent advances in cell and molecular biology provide the framework for instruction and discussion. This course is offered as both HBH 655 and BNB 655.

Prerequisites: Admission to graduate Health Sciences Center program

Spring, even years, 3 credits, ABCF grading

HBH 699 Dissertation Research On Campus

Original investigation undertaken as part of the Ph.D. program under supervision of thesis adviser and committee.

Prerequisite: Advancement to candidacy (G5); permission of thesis advisor; major portion of research must take place on

SB campus, at Cold Spring Harbor, or at Brookhaven National Lab; full-time pharmacology graduate status

Fall, spring, and summer, 1-9 credits, S/U grading

May be repeated for credit

HBH 700 Dissertation Research Off Campus-Domestic

Prerequisite: Must be advanced to candidacy (G5). Major portion of research will

take place off-campus, but in the United States and/or U.S. provinces. Please note, Brookhaven National Labs and the Cold Spring Harbor Lab are considered on-campus. All international students must enroll in one of the graduate student insurance plans and should be advised by an International Advisor; full-time pharmacology graduate status

Fall, spring, and summer, 1-9 credits, S/U grading

May be repeated for credit

HBH 701 Dissertation Research Off Campus-International

Prerequisite: Must be advanced to candidacy (G5). Major portion of research will take place outside of the United States and/or U.S. provinces. Domestic students have the option of the health plan and may also enroll in MEDEX. International students who are in their home country are not covered by mandatory health plan and must contact the Insurance Office for the insurance charge to be removed. International students who are not in their home country are charged for the mandatory health insurance. If they are to be covered by another insurance plan they must file a waiver by second week of classes. The charge will only be removed if other plan is deemed comparable. All international students must receive clearance from an International Advisor; full-time pharmacology graduate status

*Fall, spring, and summer, 1-9 credits, S/U grading
May be repeated for credit*

HBH 800 Full-Time Summer Research

Full-time laboratory research projects supervised by staff members.

Prerequisites: Full-time pharmacology graduate status

*Summer, 0 credit, S/U grading
May be repeated*

