

THE IU SCHOOL OF MEDICINE PH.D. PROGRAMS

Anatomy and Cell Biology

Focuses on three main research areas: bone biology (study of fragility and repair, cellular and tissue responses to mechanical loading, and the regulation of bone gene transcription), renal biology (kidney stone disease and shock wave lithotripsy, polycystic kidney disease, and AIDS nephropathy), and neuroscience (electrophysiology and correlative microscopy of neurons injured by stroke, and study of neuroadaptation in substance abuse and degenerative disorders). Additional areas include topics as diverse as the molecular basis of heart development and strength training. Curriculum includes basic levels of human anatomical sciences, a background which can enhance future employability in academic settings, and laboratory techniques include electron microscopy, micro computed tomography, histology, molecular biology, and transgenic models.

Biochemistry and Molecular Biology

Offers outstanding training opportunities to investigate the molecular basis of fundamental biological processes and of human diseases including cancer, diabetes, alcoholism, cardiovascular and neurological malfunctions. Faculty are actively engaged in research of signal transduction mechanisms, gene regulation, molecular genetics, cell and developmental biology, regulation of metabolic processes, macromolecular structure/function, enzyme catalysis, chemical biology, structural biology, proteomics/genomics, and bioinformatics. The program strives to help students develop the biochemical and molecular skills necessary to drive the current revolution in the biomedical sciences. Academic requirements are normally completed within two years, at which point the student devotes full time to an original investigation culminating in the Ph.D. thesis.

Medical Biophysics and Biomolecular Imaging

Covers both biomedical science and the physical basis of imaging methods, including microscopy and x-ray methods. Designed to prepare students for

research in the application and development of imaging to study biological processes at the molecular, cellular or tissue/organism level. Faculty are based in clinical and basic science departments in the medical school, and in the IUPUI schools of Science and Engineering. Faculty research includes macromolecular structure determination, microscopy development, image processing and analysis, and application of these techniques to basic biomedical science and diseases, including cardiovascular disease, diabetes and cancer. In addition to research and completion of the dissertation, students follow a biomedical science core curriculum, followed by specialized courses covering the fundamental theory and application of imaging techniques.

Cellular and Integrative Physiology

Offers a comprehensive yet flexible program of courses and outstanding research opportunities. Provides students with diverse research training and interdisciplinary approaches ranging from the study of molecules and their functions in cells and animal models to physiological processes in health and disease. Students engage in research areas including diabetes, aging, cardiovascular disease, mechanotransduction in bone, neurophysiology, respiratory, renal and endocrine dysfunction, and developmental physiology. The program of study is tailored to the individual background and career goals of students to prepare them for research careers in academia and industry.

Medical and Molecular Genetics

One of the first programs in the country to train students for careers in human genetics research. For over 40 years, the department has been involved with the dramatic advancements in the field. Program divisions include Clinical Genetics, providing accredited training to clinical residents and genetic counselors; Molecular Genetics, ranging from developmental genetics to gene therapy; Hereditary Genomics, combining bioinformatics and clinical databases to search for genes important in

a variety of complex disorders; and Cytogenetics, with research ranging from cancer to artificial chromosomes. Our training program is broad based with students taking core courses in each division, including the Clinical Genetics Division involved in accredited training of clinical residents and genetic counselors.

Medical Neuroscience

Provides training to prepare students for research and teaching careers in academic, institute, industrial, or hospital settings. Focuses on a range of neuroscience research, including animal models of anxiety disorders, neurobiology and genetics of alcoholism and addictive behaviors, molecular mechanisms underlying pain syndromes, genetics of degenerative disorders, signal transduction and receptor pharmacology, advanced brain imaging in animal models and humans, molecular genetics of psychiatric disorders, neuronal stem cell biology, neurobiology of motor and autonomic function, and autism and neuroimmune disorders. The curriculum includes eight modular mini-courses, such as Translational Neuroscience, Neuroanatomy, Behavioral Neuroscience, Effective Grant Writing, and Principles of Experimental Design.

Microbiology and Immunology

Emphasizes an interdisciplinary approach of molecular, cellular, and biochemical techniques as a means to solve current problems in molecular and cellular immunology, microbial pathogenesis, virology, and cancer biology. The primary goal of the department is to prepare students for a career in basic research. Faculty research areas include cancer (cancer cell biology, DNA repair, gene therapy, hematopoiesis, stem cell transplantation, tumor immunity, viral oncogenesis), immunology (autoimmunity, innate immunity development and differentiation of immune cell function, transplantation biology), and pathogenesis (gene therapy and viral vectors, viral gene regulation, mechanisms of host-cell invasion, viral and bacterial pathogenesis).

Pathology and Laboratory Medicine

Offers research opportunities in a board range of specialty areas included in experimental and diagnostic pathology. The department includes major research programs in pathobiology of *Pneumocystis carinii* infections, Alzheimer's disease and neuropathology of aging, prion disease and dementias, *Streptococcus mutans* surface and heat shock proteins, molecular genetic evolution of tumors of the prostate, kidney, and bladder, flow cytometric evaluation of leukemia markers using four-color staining, amyloid storage disease, role of prostaglandin E2 receptors in skin and breast cancer, proteins of polycystic kidney disease, and development and application of molecular probes for diagnosis of infectious diseases.

Pharmacology

Emphasizes studying the mechanisms by which drugs affect biological systems with the goal of ameliorating disease. A multidisciplinary approach focuses on molecular, cellular, and systems methods. Graduate students develop individually tailored programs of study that include a balance of courses and research rotations followed by in-depth dissertation research in diverse areas including cancer biology, neurobiology, and cell signaling. The overall goal of the program is to prepare students for careers in basic science in academics or in industry. Members of the graduate faculty have strong interactions with the IU Cancer Center, the Stark Neurosciences Research Institute, and the Center for Environmental Health.

Toxicology

Focuses on understanding the cellular and molecular mechanisms involved in toxic responses elicited by pharmaceutical and environmental agents, exposure to chemical agents and how they lead to chronic diseases such as cancer, and how genetic and environmental factors affect individual susceptibility to human disease. Faculty members maintain close interactions with the IU Cancer Center, the Center for Environmental Health, and research groups in industrial settings.