

INTEGRATIVE BIOLOGY • biological chemistry • cancer biology •
cell regulation • genetics and development • immunology • molecular
biophysics • molecular microbiology • neuroscience



INTEGRATIVE BIOLOGY■ **CHAIR, GRADUATE PROGRAM**

Yi Liu, Ph.D.

■ **DEGREE OFFERED**

Doctor of Philosophy

FACULTY AND RESEARCH INTERESTS**Ilya B. Bezprozvanny, Professor**

Ph.D., Institute of Cytology Russian Academy of Sciences, 1992

Neuronal calcium signaling and neurodegeneration; molecular mechanisms of Huntington's and Alzheimer's diseases; calcium channels and synaptic transmissions.

Kamal Bharucha, Assistant Professor

Ph.D., University of California, Berkeley, 1992; M.D., Yale University School of Medicine, 1998
Drosophila as a model organism to study endocrinology and metabolism.

Rolf A. Brekken, Associate Professor

Ph.D., UT Southwestern Medical Center, 1999
Tumor-host interactions in the context of tumor-cell metastasis; interplay between neoplastic genetic alterations, changes in the extracellular matrix, and angiogenesis in the development and progression of pancreatic cancer.

Michael S. Brown, Professor

M.D., University of Pennsylvania School of Medicine, 1966
Unraveling the mechanism by which the SREBP pathway regulates cholesterol metabolism at the molecular, cellular and whole-body levels.

Stephen C. Cannon, Professor

M.D., Ph.D., Johns Hopkins University, 1986
Ion channel biophysics; neuromuscular disorders; mathematical modeling.

Benjamin Chen, Assistant Professor

Ph.D., Ohio State University, 1996
DNA damage response and DNA double-strand break repair.

Roberto Coppari, Assistant Professor

Ph.D., University of Marche, Italy, 2002
Unraveling the physiological roles of Sirtuin family members (e.g., SIRT1 and SIRT6) in the brain on whole-body energy and glucose homeostasis.

George N. DeMartino, Professor

Ph.D., University of Rochester, 1976
Cell physiology; regulation of growth and atrophy; protein degradation; intracellular proteases; ubiquitin/proteasome pathway of protein degradation.

J. Michael DiMaio, Associate Professor

M.D., University of Miami, 1987
New measures to reduce death and disability from arteriosclerotic heart disease.

Amelia J. Eisch, Assistant Professor

Ph.D., University of California, Irvine, 1997
Adult mammalian neurogenesis and growth factors; cell-cycle analysis of adult neural stem cells in vivo; regulation of endogenous cell-cycle proteins (specifically in psychiatric disorders such as addiction, depression and Alzheimer's disease); transgenic manipulation of adult mammalian neurogenesis.

Carol F. Elias, Assistant Professor

Ph.D., University of Sao Paulo, Brazil, 1997
Hypothalamic pathways linking energy balance and reproduction using systems neuroscience combined with genetic and molecular approaches.

Joel K. Elmquist, Professor

D.V.M., Ph.D., Iowa State University, 1992, 1993
Mouse genetics and systems neuroscience approaches to studying the pathways in the brain that control homeostasis, including the hypothalamic control of food intake, body weight and glucose homeostasis.

Errol C. Friedberg, Professor

M.D., University of Witwatersrand, South Africa, 1961
Cellular responses to DNA damage and their relationship to neoplasia.

Christine Kim Garcia, Assistant Professor

M.D., Ph.D., UT Southwestern Medical Center, 1996
Genetic approaches to identify primary determinants of lung disease.

Joseph A. Garcia, Associate Professor

M.D., Ph.D., University of California, Los Angeles, 1993
Integrative biological studies of hypoxia-inducible transcription factors; identification of genetic factors controlling the cardiovascular-respiratory response to hypoxia.

William T. Garrard, Professor

Ph.D., University of California, Los Angeles, 1971
Regulation of the terminal stages of apoptosis in the nucleus; regulation of gene expression, chromatin structure and V(D)J recombination of antibody genes.

Dwight C. German, Professor

Ph.D., University of Oklahoma Health Sciences Center, 1972

Mechanisms of neurodegeneration in neurological and psychiatric disorders, using human postmortem tissue and animal models.

Joseph L. Goldstein, Professor

M.D., UT Southwestern Medical Center, 1966
Unraveling the mechanism by which the SREBP pathway regulates cholesterol metabolism at the molecular, cellular and whole-body levels.

Frederick Grinnell, Professor

Ph.D., Tufts University School of Medicine, 1970
Cell migration and extracellular matrix organization; tissue engineering and biomaterials; wound repair.

Lisa Halvorson, Associate Professor

M.D., Johns Hopkins University, 1987
Anterior pituitary gland function; regulation of gonadotropin gene expression; reproductive aging.

Joachim Herz, Professor

M.D., University of Heidelberg, Germany, 1983
Genetic manipulation of neuronal apoE receptors in mice; mechanisms of brain development, neurogenesis and Alzheimer's disease.

Joseph A. Hill, Associate Professor

M.D., Ph.D., Duke University, 1987
Molecular signaling processes in cardiac hypertrophy and failure; mechanisms of structural, functional and electrophysiological remodeling.

Sandra Lee Hofmann, Professor

M.D., Ph.D., Washington University, St. Louis, 1983
Role of lipid-metabolizing enzymes in cell metabolism and signal transduction; covalent modification of proteins by the fatty-acid palmitate; enzymes that transfer the palmitate on and off modified proteins.

Jay D. Horton, Professor

M.D., University of Iowa College of Medicine, 1988
Elucidating the molecular mediators of hepatic steatosis; proteins that regulate plasma lipid levels.

Chou-Long Huang, Professor

M.D., Taipei Medical University, Taiwan, 1981;
Ph.D., University of California, San Francisco, 1988

Ion channels and human diseases caused by dysregulation of ion channels, including hypertension, polycystic kidney disease, kidney stone disease, and genetic diseases of K⁺ and Mg²⁺ disorders.

Peter Igarashi, Professor

M.D., University of California, Los Angeles, 1981
Transcriptional control of tissue-specific gene expression and organogenesis; polycystic kidney disease.

Leighton R. James, Assistant Professor

M.D., University of Toronto, 1994
Understanding interaction of glucose disposal pathways and cytokines in the pathogenesis of diabetic kidney disease using gene-targeted mice models and cells to study in vivo and in vitro mechanisms of progressive kidney disease.

Kristine E. Kamm, Professor

Ph.D., University of Missouri, 1977
Muscle physiology; regulation of contractility in smooth, skeletal and cardiac muscle and motility in nonmuscle cells.

Steven G. Kernie, Associate Professor

M.D., University of Washington School of Medicine, 1992
Role of stem cells in brain remodeling following traumatic injury, using both an in vivo injury model and in vitro techniques of culturing neural stem cells from wildtype and genetically altered mice.

Makoto Kuro-o, Associate Professor

M.D., Ph.D., University of Tokyo, 1985, 1991
Understanding molecular mechanisms of aging in mammals through elucidating the function of the anti-aging hormone Klotho.

Lu Q. Le, Assistant Professor

Ph.D., M.D., University of California, Los Angeles, 2002, 2003
Tumor cell of origin; roles of tumor microenvironment in cancer development; cellular and molecular mechanisms of neurofibromatosis; stem cell and cancer biology.

Guosheng Liang, Assistant Professor

Ph.D., Ohio State University, 1997
Dyslipidemia in pathogenesis of diabetes and obesity; transcriptional regulation of lipid metabolism.

Yi Liu, Professor

Ph.D., Vanderbilt University, 1995
Molecular mechanisms of circadian clocks, photo receptors, protein degradation and gene silencing.

Michael Lutter, Assistant Professor

Ph.D., M.D., UT Southwestern Medical Center, 2001, 2003
Mechanisms of food reward; metabolic consequences of psychiatric disorders; gut-brain regulation of mood and motivation.

Mala Mahendroo, Associate Professor

Ph.D., UT Southwestern Medical Center, 1992
Parturition; cervical ripening; male and female reproductive biology.

David J. Mangelsdorf, Professor

Ph.D., University of Arizona, 1987
Mechanism of action of nuclear hormone receptors; transcriptional regulation of lipid metabolism; role of retinoids and cancer.

Steven L. McKnight, Professor

Ph.D., University of Virginia, 1977
Subset of transcription factors that are gene-specific; regulation of transcription-factor function at a biochemical level with keen attention to biological relevance.

Carole R. Mendelson, Professor

Ph.D., Rutgers University, 1970
Molecular mechanisms in tissue-specific, developmental and hormonal regulation of eukaryotic gene expression.

Orson W. Moe, Professor

M.D., University of Toronto Faculty of Medicine, 1982
Regulation of mammalian water and electrolyte homeostasis, including sodium, calcium and acid-base metabolism and epithelial transport.

Lisa M. Monteggia, Associate Professor

Ph.D., Chicago Medical School, 1998
Development of animal models for psychiatric diseases; growth factors and depression; role of MeCP2 in mediating autistic-like behavior; transcriptional repression in neurons.

Shmuel Muallem, Professor

Ph.D., Weizmann Institute of Science, Israel, 1981
Ca²⁺ signaling and ion transport in secretory cells.

Eric N. Olson, Professor

Ph.D., Wake Forest University, 1981
Transcriptional control of cell differentiation; muscle development.

Juan M. Pascual, Assistant Professor

M.D., Universidad de Granada, Spain, 1990;
Ph.D., Baylor College of Medicine, 1995
Animal and cellular models of neurogenetic disorders; synaptic transmission in experimental epilepsies; disorders of brain-energy metabolism; developmental neurobiology; genotype/phenotype correlations in novel childhood encephalopathies.

Joyce R. Repa, Associate Professor

Ph.D., University of Wisconsin, Madison, 1996
How nuclear hormone receptors control the expression of ABC transport proteins; the consequences of this regulation on lipid balance with respect to atherosclerosis, diabetes and brain physiology.

Charles R. Rosenfeld, Professor

M.D., Emory University, 1966
Cardiovascular adaptation during development and pregnancy; maturation and ontogeny of visceral and vascular smooth-muscle protein expression and function; regulation and function of angiotensin II receptor subtypes during development and pregnancy; mechanisms related to estrogen-induced vasodilation and modulation of uteroplacental blood flow in pregnancy.

Beverly A. Rothmel, Assistant Professor

Ph.D., Yale University, 1991
Control of muscle remodeling during development and disease; circadian control of cardiac function and the role of RCAN1, a regulator of the calcium-dependent phosphatase calcineurin.

Rashmin C. Savani, Professor

M.B., Ch.B., University of Sheffield School of Medicine, England, 1982
Using cell and mouse models to investigate the mechanisms of extracellular matrix regulation of lung development and injury; the interaction of hyaluronan with specific receptors to regulate cell migration in pulmonary vascular development; innate immunity and inflammatory responses to injury.

Philipp E. Scherer, Professor

Ph.D., University of Basel, Switzerland, 1992
Identification and physiological characterization of novel secretory protein that serve as potential links

between the adipocyte and the processes of whole-body energy homeostasis, inflammation and cancer, thereby identifying novel targets for pharmacological intervention and further defining the role of adipose tissue as an endocrine organ.

Margaret A. Schwarz, Associate Professor

M.D., University of Missouri-Kansas City, 1987
Developmental pulmonary vascular biology interactions with distal lung morphogenesis and extracellular matrix deposition; contradictory proliferative/anti-angiogenic roles of endogenous negative vascular regulators during development.

Philip W. Shaul, Professor

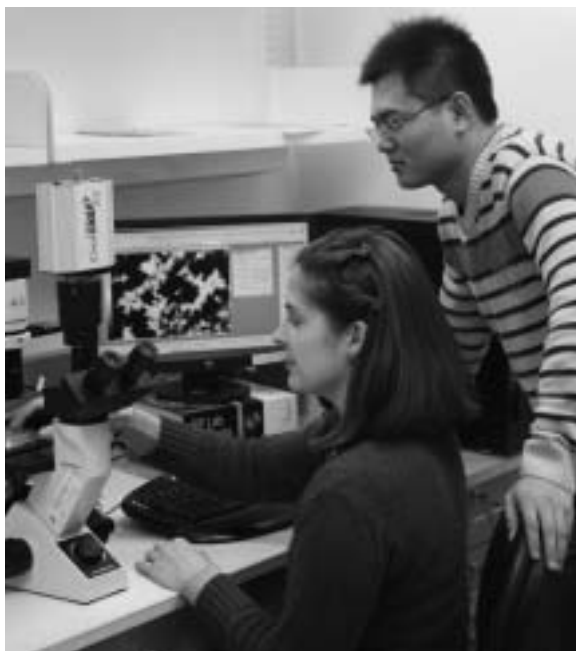
M.D., University of Cincinnati, 1981
Developmental biology of the pulmonary circulation and airways; molecular mechanisms underlying pulmonary hypertension.

Jerry W. Shay, Professor

Ph.D., University of Kansas, 1972
Defining the molecular interrelationships between aging and cancer.

William J. Snell, Professor

Ph.D., Yale University, 1975
Understanding the mechanisms of cell-cell adhesion-induced signaling and cell-cell fusion during fertilization.



Rhonda F. Souza, Associate Professor

M.D., Howard University, 1991
Molecular mechanisms involved in the development and neoplastic progression of Barrett's esophagus, focusing on the intracellular signaling mechanisms and biologic relevance of acid and/or bile acid exposure, using animal models, cell culture and human biopsy tissues.

James T. Stull, Professor

Ph.D., Emory University, 1971
Molecular and biochemical regulation of contractile protein phosphorylation; responses and adaptations of cardiac, skeletal and smooth muscles.

Philip J. Thomas, Professor

Ph.D., University of South Dakota, 1988
Function and structural development of ATP-dependent membrane proteins, including CFTR.

Benjamin Tu, Assistant Professor

Ph.D., University of California, San Francisco, 2003
Metabolic cycles; mechanisms by which fundamental processes (e.g., cell growth and division, transcription, mitochondria homeostasis) are coupled to cellular metabolic state; yeast.

Roger H. Unger, Professor

M.D., Columbia University, 1947
Diabetes; obesity; lipotoxicity; internal medicine; islet physiology and pathophysiology.

Steven Vernino, Associate Professor

M.D., Ph.D., Baylor College of Medicine, 1994
Autoimmune disorders of the nervous system; animal models of autonomic failure; synaptic transmission in autonomic ganglia; nicotinic acetylcholine receptors.

Yihong Wan, Assistant Professor

Ph.D., University of Colorado Health Sciences Center, 2001
Transcriptional regulation of development, metabolism and cancer by nuclear receptors using the skeleton and the mammary gland as model systems.

Xiaodong Wang, Professor

Ph.D., UT Southwestern Medical Center, 1991
Biomedical studies of apoptosis.

Thomas M. Wilkie, Associate Professor

Ph.D., University of Washington, Seattle, 1986
G-protein signaling during mouse development; energy homeostasis and feeding behavior.

Hiromi Yanagisawa, Assistant Professor

M.D., Ph.D., University of Tsukuba, Japan, 1986, 1993

Molecular components of the vascular wall during development and disease.

Masashi Yanagisawa, Professor

M.D., Ph.D., University of Tsukuba, Japan, 1985, 1988

Identification and characterization of new signaling molecules that regulate vital functions such as sleep, appetite and blood pressure.

Jin Ye, Assistant Professor

Ph.D., UT Southwestern Medical Center, 2000

Replication of hepatitis C virus; cellular lipids that affect viral replication.

Helen L. Yin, Professor

Ph.D., Harvard University, 1976

Actin cytoskeletons of nonmuscle cells, including reorganization in response to extracellular signals; structure/function relationships of the gelsolin family of actin regulatory proteins.

Chengcheng “Alec” Zhang, Assistant Professor

Ph.D., University of Illinois at Urbana-Champaign, 1999

Mechanisms by which the cell fates of adult stem cells are regulated; the interaction of adult stem cells and their in vivo microenvironment; ex vivo expansion of HSCs for cell therapy and gene therapy; the interplay between stem cells and cancer.

Chun-Li Zhang, Assistant Professor

Ph.D., UT Southwestern Medical Center, 2002

Nuclear hormone receptor and epigenetic signaling in adult neural stem cells and central nervous system.

Jeffrey M. Zigman, Assistant Professor

Ph.D., M.D., University of Chicago, 1994, 1997

Identification of CNS targets of ghrelin action; ghrelin cell physiology; functional neuroanatomy of the mammalian hypothalamus.

Andrew R. Zinn, Associate Professor

M.D., Ph.D., UT Southwestern Medical Center, 1988

Human genetic diseases; infertility, obesity and sex chromosome abnormalities.

DESCRIPTION OF THE DISCIPLINE

The Integrative Biology Graduate Program fosters training in scientific investigations that relate biological processes to normal or pathological organismal functions. Principles and techniques used to study multicellular biological preparations are applied to investigate and verify hypotheses arising from knowledge of molecular and cellular biology. Multicellular preparations may include co-cultures of different cell types, isolated tissues, organ systems or whole animals. Thus, cells and tissues are studied in their “social” context. This program promotes effective cross-disciplinary research involving faculty in basic science and clinical departments with the goal of training a student for a career as an independent investigator.

Some areas of interest in this program include response and adaptation to physiological (exercise, microgravity and pregnancy) and pathological (ischemia, hypertension, cancer, diabetes, sepsis, and inflammatory and immune diseases) stresses. Specific subjects of investigation involve cell-cell signaling, including the basis of fertilization; exocrine secretion; renal tubular transport; gene regulation in development and differentiation; regulation of cardiovascular function and metabolism; regulation of muscle contraction and protein turnover; sensory regulation of behavior; carbohydrate and lipid metabolism; and tumor biology.

OBJECTIVES

The Integrative Biology Graduate Program offers doctoral training in a multidisciplinary, integrative discipline that seeks to understand the complexity of interacting organismal systems and the molecular basis of involved processes. This approach provides insights into derangements caused by disease and thereby provides biomedical advances for treatment of humans through molecular medicine. Students in this program have the opportunity to master scientific principles through classroom, seminar and discussion experiences and have the opportunity to perform original and innovative

research in this new area. The goal of this program is to prepare students for biomedical research in academia, industry or government. The dissertation project should combine studies on multicellular culture preparations, isolated tissue or organs, organ systems, or whole animals with aspects of cell or molecular biology. The program encourages the recruitment of two mentors if this requirement is not met in a single laboratory. The two-mentor system is intended to promote ongoing or newly initiated cross-disciplinary studies providing a broad-based education for the student.

SPECIAL REQUIREMENTS FOR ADMISSION

Students wishing to join the Integrative Biology Graduate Program must be enrolled in the Division of Basic Science and be in good standing academically. Usually students seek enrollment in the program toward the end of the first year of study following completion of the set of research rotations and selection of a mentor.

CURRICULUM

All students in the Integrative Biology Graduate Program must have satisfactorily completed the first-year core curriculum and three laboratory rotations. In the second year, students complete at least nine credit hours of advanced course work. Three hours must include Human Biology and Disease, and three hours are selected from the following list of courses. Additional courses may be selected from courses listed

in the Division of Basic Science section and from the Biomedical Engineering and Radiological Sciences graduate programs.

Students are strongly encouraged to develop, in collaboration with the graduate student adviser and appropriate faculty, special topic courses dealing with the physiological systems related to future dissertation research. These tutorial-type courses may cover fundamental knowledge as well as methodological approaches and recent primary literature. Students will participate in a seminar-journal club each term. At the end of the second year, students take a qualifying examination, which consists of an oral defense of an original, written proposal.

Admission to candidacy for the Ph.D. requires satisfactory performance in the core and advanced courses and on the qualifying exam.

■ INTEGRATIVE BIOLOGY COURSES

Advanced Genetics I: Genetics of Unicellular Organisms
 Advanced Genetics II: Human Genetics
 Cancer Biology I
 Cancer Biology II
 Experimental Approaches to Complex Genetic Disease and Therapy
 Fundamentals of Neuroscience
 Human Biology and Disease
 Molecular Basis of Metabolic Regulation
 Responses to Stress
 Signal Transduction I
 Topics in Developmental Biology