Department of Molecular and Integrative Physiology

Research programs in the Department of Molecular and Integrative Physiology cover the range from analysis of genes to analysis of whole organisms and fall into three broad categories:

- Cellular & Integrative Physiology (https://www.kumc.edu/school-of-medicine/academics/departments/molecular-and-integrative-physiology/research.html)
  - This area includes the investigation of physiology and pathophysiology in experimental models ranging from cellular preparations to intact animals and humans. Current research is directed at studies of the microvascular system, cardiac system, hypoxia and oxygen transport in the respiratory system, metabolism within adipose, muscle and liver, and plasma membrane and fluid transport within the renal system. Research also encompasses various aspects of cancer biology including both *in vitro* and *in vivo* approaches.
- Neuroscience (http://www.kumc.edu/school-of-medicine/molecular-and-integrative-physiology/about-us/neuroscience.html)
  - This area includes the investigation of neural function in normal and disease states, and addresses problems at different levels ranging from the regulation of nervous system genes to central nervous system mechanisms controlling arm movement in the intact animal. Current research includes the study of development, transplantation, demyelinating diseases, recovery of function following peripheral and central nervous system injury and stroke, motor and cognitive defects associated with HIV, neurophysiological, behavioral and molecular measures of early development, central mechanisms of hearing, neurotransmitters and plasticity.
- Reproduction & Development (http://www.kumc.edu/school-of-medicine/molecular-and-integrative-physiology/about-us/reproduction-and-development.html)
  - This area includes the investigation of the hypothalamic-pituitary-gonadal axis, as well as uterine and placental function. Current studies are directed at mechanisms of hormone action, cell motility, cell-cell communication, cell and tissue differentiation and growth, cytokines and growth factors, gene expression and control of enzyme regulation in ovary, testis, sperm, hypothalamic-pituitary axis, preimplantation embryo, trophoblast/placenta and uterus. Mammalian and invertebrate reproductive models including transgenic and gene knockout mice provide fundamental information related to cell biology, endocrinology, and developmental biology.

The common thread is that all programs endeavor to understand biological function in health and disease. Nearly all faculty members have served on national advisory committees to major funding agencies such as the National Institutes of Health and as reviewers and editors to major scientific publications. The program provides outstanding didactic instruction and laboratory experiences that enable students to become effective teachers and independent investigators. The department offers the Ph.D. degree, and the combined M.D./Ph.D.degrees in conjunction with the School of Medicine. An M.S. degree may be granted in appropriate circumstances.

Courses

PHSL 784. Faculty Research Programs. 1 Credits.
The new student will be introduced to the faculty research programs. Each faculty member will present his/her research interests using one or more of the following formats: laboratory demonstrations, computer simulations and lectures. The objectives are to assist the new student in selecting his/her area of dissertation research and acquainting the new student with the department research resources.

PHSL 834. Reproductive Physiology. 5 Credits.
All aspects of reproductive physiology including an in depth study of ovarian and testicular development/function, neuroendocrine development/function, implantation, placentation, puberty, pregnancy and fertility regulation are covered. Historical and current scientific literature will be used to support a graduate level text and didactic lectures. Prerequisite: a general endocrinology/physiology course, an equivalent course and/or consent of instructor.

PHSL 835. Integrative Physiology of Exercise. 3 Credits.
To understand how the major physiological systems of the body respond to exercise with an emphasis on integration and function. Historical and current scientific literature will be used to generate discussion and support didactic material. Fundamentals of exercise physiology will be covered, but a background in exercise physiology is not required. Prerequisite: a general physiology course, an equivalent course and/or consent of instructor.

PHSL 838. Advanced Topics. 1-3 Credits.
Special studies designed and arranged on an individual basis to allow a student to pursue a particular subject through reading, special laboratory work, and conferences with a senior staff member.

PHSL 840. Advanced Genetic Analysis. 3 Credits.
This course will focus on principles that underlie genetic analysis, including mutation, complementation, recombination, segregation, and regulation. The genetics of commonly used model organisms such as yeast, flies, worms and mice will be examined, classic genetic screens performed to study phage assembly, cell cycle regulation, sex determination and X-chromosome inactivation will be discussed and modern-day techniques used to study inheritance and gene function in various systems will be analyzed. Human genetic analysis will also be covered, including population genetics, techniques for gene mapping, inherited diseases, genetic testing and gene therapy. Through reading and discussion of scientific literature and problem-based homework and exams, students will learn how to evaluate and interpret genetic data as well as develop and design genetic strategies to solve current biological problems. Prerequisite: Completion of IGPBS Core Curriculum or equivalent, or permission of Course Director.

PHSL 842. Comprehensive Human Physiology. 5 Credits.
Advanced course on modern human physiology. The course focuses on organ systems of the human body including nervous, cardiovascular, endocrine, digestive, respiratory, reproductive and urinary systems. This course emphasizes the use of modern experimental approaches that take advantage of cellular and molecular technologies. Prerequisite: NONE

PHSL 843. Physiology of Disease. 3 Credits.
This course will cover physiological changes associated with representative diseases of major organ systems (endocrine, muscle, cardiovascular, respiratory, renal, gastrointestinal, immune, nervous, and reproductive). Example diseases to be covered include: diabetes, pituitary disorders, osteoporosis, obesity, non-alcoholic fatty liver disease,

muscular dystrophy, hypertension, chronic obstructive pulmonary disease, asthma, glomerulonephritis, polycystic kidney disease, gastroesophageal reflux disease, inflammatory bowel diseases, rheumatoid arthritis, multiple sclerosis, infertility, endometriosis, and pregnancy complications. Class will include lectures, faculty-mentored student presentations, evaluations of research papers, and discussions. LEC Prerequisite: Comprehensive Human Physiology (PHSL 842), an equivalent course, or consent of Course Director.

PHSL 844. Neurophysiology. 3 Credits.
Somatosensory, motor and cognitive function of the brain will be discussed using a combination of lecture and student presentation formats. Current issues and evidence underlying accepted concepts and mechanisms will be emphasized. (Same as NEUS 844 and NURO 844.) Prerequisite: PHSL 846 or equivalent and consent of instructor.

PHSL 846. Advanced Neuroscience. 5 Credits.
Team-taught, in-depth neuroscience course focusing on normal and diseased brain function at the molecular, cellular and systems levels. Lectures and discussions will emphasize current issues in neuroscience research. (Same as ANAT 846, PHCL 846, NURO 846 and NEUS 846.) Prerequisite: Permission of the course director.

PHSL 847. Developmental Neurobiology. 2 Credits.
Development of the nervous system from early induction to the development of learning and memory. Topics include: Induction; Cellular Differentiation; Axon Growth and Guidance; Target Selection; Cell Survival and Growth; Synapse Formation; Synapse Elimination; and Development of Behavior. (Same as ANAT 847, NURO 847, and NEUS 847.) Prerequisite: Advanced Neuroscience (ANAT 846; NURO 846; PHSL 846) or consent of instructor.

PHSL 848. Molecular Mechanisms of Neurological Disorders. 3 Credits.
An in-depth coverage of pathogenic mechanisms in neurological diseases; cellular and molecular responses to brain injury and disease, neuroinflammatory diseases (e.g., multiple sclerosis), neurodegenerative diseases (e.g., Alzheimer's, Parkinson's, Huntington's, amyotrophic lateral sclerosis, and prion diseases), neurogenetic diseases (e.g., lysosomal and peroxisomal disorders, Down's syndrome and fragile X), trauma, stroke, and viral diseases (e.g., HIV encephalitis). (Same as ANAT 848, NURO 848, PHCL 848, and NEUS 848.) Prerequisite: Advanced Neuroscience (ANAT 846, PHCL 846 or PHSL 846) or an equivalent course and consent of instructor.

PHSL 850. Research. 1-10 Credits.
Original laboratory investigation conducted under the supervision of a senior staff member.

PHSL 851. Seminar. 1 Credits.
Student participation (attendance and presentation) in weekly Departmental seminar series. The topics examined in these seminars are dictated by the interests of students and staff. Prerequisite: student must have passed their oral comprehensive exam.

PHSL 899. Master's Thesis. 1-5 Credits.
Preparation of the formal thesis based on library research or independent research and in partial fulfillment of the requirements for the master's degree. Credits will be given only after the thesis has been accepted by the student's thesis committee.

PHSL 999. Doctoral Dissertation. 1-10 Credits.
Preparation of the Dissertation based on original research and in partial fulfillment of the requirements for the Ph.D. degree. Credits will be given only after the dissertation has been accepted by the student's dissertation committee.