Twin Cities Campus

Integrative Biology and Physiology Ph.D.

Integrative Biology and Physiology
Medical School

Link to a list of faculty for this program.

Contact Information:
Department of Integrative Biology and Physiology, Jackson Hall 6-125, 321 Church Street SE, Minneapolis, MN 55455 (612-625-5902; fax: 612-301-1543)
Email: ibpdept@umn.edu
Website: http://z.umn.edu/ibpgradprog

- Program Type: Doctorate
- Requirements for this program are current for Fall 2018
- Length of program in credits: 60
- This program does not require summer semesters for timely completion.
- Degree: Doctor of Philosophy

Along with the program-specific requirements listed below, please read the General Information section of the catalog website for requirements that apply to all major fields.

Physiology may be defined as the application of mathematics, physics, and chemistry to the study of structure and function in living systems. As such, physiology is a "hybrid" field in which expertise from many other disciplines is ordinarily required and combined.

The program emphasizes a quantitative approach to understanding the functions of cells, organs, and systems in living animals. PhD students take a core concentration that provides a broad background in the physiology of membranes, cells, transport, and organ systems. Individualized programs are structured to build on the student's strengths and to fill in gaps that would otherwise be an impediment to specific problem solving. Teaching experience is also available to all students.

The graduate program in the Twin Cities has cardiovascular, hypertension and metabolism emphases, although many other areas of specialization are represented.

Students can enter the PhD program from the Twin Cities or Duluth campus. Highly qualified individuals with solid quantitative backgrounds are encouraged to apply. In the Twin Cities, prospective students also include people with previous medical training who are already at the University of Minnesota or are considering the University of Minnesota Medical School for residency or fellowship training.

Entering PhD students are expected to take a series of laboratory rotations to familiarize themselves with active areas of research within the degree program. The program includes faculty and corresponding research laboratories from the Department of Integrative Biology and Physiology and also the Departments of Medicine; Surgery; Neuroscience; Neurosurgery; Biochemistry, Molecular Biology, and Biophysics; Pharmacology; Physical Medicine and Rehabilitation; Kinesiology; and Animal Science.

Program Delivery

This program is available:
- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission

Other requirements to be completed before admission:
An undergraduate degree with at least one year (three quarters or two semesters) of calculus, one year of physics, one year of biology, and two years of chemistry is required. For the minor, a background in mathematics, physics, chemistry and biology acceptable to the graduate faculty is required.

Special Application Requirements:
For the Ph.D., applicants must take the General Test of the GRE. There is no minimum GPA or GRE score requirements to apply. In addition, all applicants need three letters of recommendation. Admission to the program begins in the Fall semester.

International applicants must submit score(s) from one of the following tests:
- TOEFL
  - Internet Based - Total Score: 107

- Internet Based - Writing Score: 21
- Internet Based - Reading Score: 19
- Paper Based - Total Score: 625

• IELTS
- Total Score: 6.5

Key to test abbreviations(TOEFL, IELTS).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements

24 credits are required in the major.
12 credits are required outside the major.
24 thesis credits are required.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

At least 3 semesters must be completed before filing a Degree Program Form.

The PhD program requires courses in cellular physiology and medical physiology. Coursework is tailored to the student's interests with input from the director of graduate studies and the student's advisor. During the first year, students rotate through three to four laboratories, attend weekly seminars, choose an advisor, and begin a research project. A preliminary written exam in physiology is given after the first year and examines the ability of the student to apply concepts learned in core courses. By the end of the second year, students have completed their coursework including a grant-writing class, and selected a laboratory for their thesis research. A preliminary oral exam is given at the end of the second year and tests the student's ability to apply principles of both physiology and the minor or supporting program to a proposed research-based thesis. A minimum of 12 credits must be completed in the minor field or supporting program.

Required Coursework

Take all of the following coursework. Take 2-8 credits of PHSL 8294, and at least 4 credits of PHSL 5096. Take PHSL 8232 (Journal Club) in conjunction with PHSL 5101 (Medical Physiology).

ANSC 5702 - Cell Physiology (4.0 cr)
PHSL 8294 - Research in Physiology (1.0 - 18.0 cr)
PHSL 5096 - Integrative Biology and Physiology Research Advances (1.0 cr)
PHSL 5101 - Human Physiology (5.0 cr)
PHSL 8232 - Critical Reading of Journal Articles in Physiology (2.0 cr)
BIOC 8401 - Ethics, Public Policy, and Careers in Molecular and Cellular Biology (1.0 cr)
PHSL 8242 - Professional Skills Development for Biomedical Scientists (2.0 cr)
PHSL 5701 - Physiology Laboratory (1.0 - 2.0 cr)
PHSL 5197 - Stress Physiology (1.0 - 3.0 cr)

Molecular Biology/Genetics Options

Take at least 3 credits of molecular biology/genetics coursework, chosen in consultation with the advisor.
BIOL 4003 - Genetics (3.0 cr)
or BIOL 4004 - Cell Biology (3.0 cr)
or BIOC 4331 - Biochemistry I: Structure, Catalysis, and Metabolism in Biological Systems (4.0 cr)
or BIOC 4332 - Biochemistry II: Molecular Mechanisms of Signal Transduction and Gene Expression (4.0 cr)
or BIOC 6021 - Biochemistry (3.0 cr)

Biostatistics Options

Take at least 3 credits of biostatistics coursework, chosen in consultation with the advisor.
STAT 5021 - Statistical Analysis (4.0 cr)
or PUBH 6450 - Biostatistics I (4.0 cr)
or PUBH 6451 - Biostatistics II (4.0 cr)

Outside Coursework

Take at least 12 credits of coursework outside the major, in consultation with the advisor.
BMEN 5001 - Advanced Biomaterials (3.0 cr)
or BMEN 5041 - Tissue Engineering (3.0 cr)

or BMEN 5101 - Advanced Bioelectricity and Instrumentation (3.0 cr)
or BMEN 5351 - Cell Engineering (3.0 cr)
or CMB 8344 - Mechanisms of Hormone Action (2.0 cr)
or GCD 4134 *{Inactive}*(3.0 cr)
or NSC 5540 - Survey of Biomedical Neuroscience (2.0 cr)
or BIOL 8100 - Improvisation for Scientists (1.0 cr)
or NUTR 8620 - Advances in Nutrition (2.0 cr)

Supporting Major Optional Coursework
PHSL 4021 - Advanced Physiology and Bioengineering: Bionic Human (3.0 cr)
PHSL 5095 - Problems in Physiology (1.0 - 5.0 cr)
PHSL 5444 - Muscle (3.0 cr)
PHSL 5510 - Advanced Cardiac Physiology and Anatomy (2.0 - 3.0 cr)
PHSL 5525 - Anatomy and Physiology of the Pelvis and Urinary System (1.0 - 2.0 cr)
PHSL 8222 - Central Regulation of Autonomic Function (3.0 cr)

Thesis Credits
Take 24 credits of doctoral thesis credits.
PHSL 8888 - Thesis Credit: Doctoral (1.0 - 24.0 cr)