INTEGRATIVE AND BIOMEDICAL PHYSIOLOGY

Graduate Program Head	Gregory Shearer
Program Code	PHSIO
Campus(es)	University Park (Ph.D., M.S.)
Degrees Conferred	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-title Ph.D. in Integrative and Biomedical Physiology and Clinical and Translational Sciences
The Graduate Faculty	View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=PHSIO)

The Intercollege Graduate Degree Program (IGDP) in Integrative and Biomedical Physiology will enable students to obtain interdisciplinary training encompassing both the fundamentals of biomedical physiology and advanced training in a specialized area, in preparation for varied biomedical careers in academia or industry. This IGDP is uniquely focused on the study of integrative mechanisms of mammalian body systems at the molecular, cellular, tissue, and organ levels, and the application of that knowledge to study a number of human diseases and conditions. A broad range of research is conducted by faculty, all of whom are widely regarded in their respective fields. Subspecialization areas include aging, exercise and muscle biology, biophysics, cancer, cardiovascular regulation and disease, energy and nutrient regulation, immunology and inflammation, obesity and diabetes, and reproductive biology. The master's program, including courses, laboratory experience, and original research, is designed for completion in approximately two years, while the doctoral degree requires approximately five years.

Graduate instruction in integrative and biomedical physiology is under the direction of graduate faculty from multiple colleges and departments at University Park—including animal science, biochemistry, biology, bioengineering, biomedical engineering, kinesiology, and nutrition, as well as veterinary and biomedical sciences.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (https://gradschool.psu.edu/graduate-admissions/how-to-apply/). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (https://gradschool.psu.edu/graduate-education-policies/).

Students with a 3.00 junior/senior average (on a 4.00 scale) and with appropriate course backgrounds will be considered for admission. The best-qualified applicants will be accepted up to the number of spaces that are available for new students. Exceptions to the minimum 3.00 grade-point average may be made at the discretion of the program for students with special backgrounds, abilities, and interests. Deficiencies in chemistry, biological science, mathematics (through a second course in calculus), and physics must be made up early in the student's graduate program. The majority of students are admitted directly into the Ph.D. program. GRE scores are not required for admission.

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (https://gradschool.psu.edu/graduate-education-policies/)

M.S. degree students must complete a minimum of 30 credits for the degree, including 21 core credits in:

Code	Title	Credits
Required Courses		
PHSIO 571	Integrative and Cellular Mammalian Physiology I	3
PHSIO 572	Integrative and Cellular Mammalian Physiology II Endocrine Physiology	3
NUTR 501	Regulation of Nutrient Metabolism I	4
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	2
STAT 500	Applied Statistics	3
3 credit course in immunology		3
3-credit course in molecular biology		3
Total Credits		**21**

At least 6 credits in thesis research (PHSIO 600 or PHSIO 610) must be taken in conjunction with the thesis. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense which includes a public presentation. Students in the non-thesis option must write a satisfactory scholarly paper, while enrolled in PHSIO 596.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (https://gradschool.psu.edu/graduate-education-policies/)

All candidates must complete rotations in physiology laboratories before choosing an area of specialization. Possible areas of specialization include cellular, molecular, animal or human aspects of the following:

- cardiovascular and respiratory physiology
- comparative physiology
- environmental physiology
- exercise physiology
- muscle physiology
- physiology of nutrition and metabolism
- immunology
- neurophysiology
- reproductive physiology

Students in the Ph.D. program must successfully pass the qualifying, comprehensive, and final oral examination (the dissertation defense) required by Graduate Council. To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School. The Ph.D. committee shall be appropriately represented by members of the Integrative and Biomedical Physiology faculty and those of the area of specialization who shall have the responsibility and jurisdiction for determining the course program and research acceptable in satisfying degree requirements.

The doctoral degree in Integrative and Biomedical Physiology requires a minimum of 30 credits, including:

Code	Title	Credits
Required Courses		
PHSIO 571	Integrative and Cellular Mammalian Physiology I	3
PHSIO 572	Integrative and Cellular Mammalian Physiology II Endocrine Physiology	3
NUTR 501	Regulation of Nutrient Metabolism I	4
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	2
PHSIO 590	Colloquium	2
STAT 501	Regression Methods	3
STAT 502	Analysis of Variance and Design of Experiments	3
3-credit course in immunology		3
3-credit course in molecular biology		3
Other Seminars		4
Electives		
The remaining 5 credits may be chosen from 500-level Physiology courses or other relevant 400- or 500-level course. For a list of suggested courses, contact the graduate program.		5
Total Credits		**35**

Students must earn a grade of B or better in each course and maintain an overall average of 3.00.

Dual-Titles

Dual-title Ph.D. in Integrative and Biomedical Physiology and Clinical and Translational Sciences

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/).

IBMP doctoral students interested in having a degree that reflects advanced training in the design, analysis, interpretation, implementation, and dissemination of physiological research aimed at improving human health may apply to pursue a dual-title Ph.D. in IBMP and Clinical and Translational Sciences. The CTS program encourages interdisciplinary scholarly work at the interface between basic sciences, clinical sciences and human health. This program is applicable for students pursuing academic careers in the area of basic research focused on processes that can be targeted through intervention practice; the development or improvement of therapeutics, devices, and/or intervention programs; clinical trials in the academic, public, or private sector; and/or the science of translation and dissemination. The program is well-suited for students pursuing non-academic careers related to drug discovery and implementation of new diagnostics, treatments or devices. The CTS dual-title complements the expertise that students in IBMP acquire in basic mechanisms underlying disease.

Admission Requirements

Students must apply and be admitted to the graduate program in IBMP and the Graduate School before they can be admitted to a dual-title degree program. Applicants interested in the dual-title degree program may note their interest in their applications to IBMP. After admission to IBMP, students must apply for admission to and meet the admissions requirements of the CTS dual-title program. Refer to the Admission Requirements section of the CTS Bulletin page (https://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/). Students admitted to the IBMP program will be admitted to the dual-title program in Clinical and Translational Sciences upon the recommendation of a faculty member affiliated with the dual-title. Students must be admitted apply to CTS prior to taking their qualifying exam.

Degree Requirements

To qualify for the dual-title degree, students must satisfy the requirements of the Ph.D. in IBMP, listed on the Degree Requirements tab. In addition, students pursuing the dual-title Ph.D. in IBMP and Clinical and Translational Sciences must complete the degree requirements for the dual-title Clinical and Translational Sciences Ph.D., listed on the Clinical and Translational Sciences Bulletin page (https://bulletins.psu.edu/graduate/programs/majors/clinical-translational-sciences/).

Students' Qualifying Examination committee for the dual-title degree must fulfill composition requirements for IBMP, and at least one of the committee members must hold Graduate Faculty status in Clinical and Translational Sciences. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both IBMP and Clinical & Translational Sciences. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

Similarly, the Ph.D. Committee (https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/) of a dual-title doctoral degree student must either be chaired by a faculty member holding appointments in both IBMP and Clinical Translational Sciences, or be co-chaired by two faculty members who each represent one discipline. The Ph.D. Committee will oversee the Comprehensive Exam, which must meet the requirements established in the IBMP Program, as well as demonstrate expertise in an area deemed relevant to Clinical Translational Sciences by the Committee chair or co-chair.

Ph.D. candidates must complete a dissertation on a topic that reflects their original research on a topic approved by IBMP and the CTS program; specifically, one that translates biomedical discovery into applications with the goal of improving human health. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Minor

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (https://gradschool.psu.edu/graduate-education-policies/) and GCAC-700 Professional Degree Policies (https://gradschool.psu.edu/graduate-education-policies/).

The objective of the doctoral minor in Integrative and Biomedical Physiology is to augment the training of doctoral students with a coordinated group of courses that provide an integrated perspective of physiology from the molecular to the organismal level. It is expected that most students pursuing the minor will be graduate degree candidates in basic biological sciences, health sciences, or bioengineering.

The doctoral minor in Integrative and Biomedical Physiology requires the following:

- BIOL 472 (https://bulletins.psu.edu/search/?P=BIOL%20472) - If the student took a one-semester, upper-level undergraduate mammalian physiology course as an undergraduate, then this requirement may be

waived with approval by the chair of the Integrative and Biomedical Physiology program.

- PHSIO 571 (https://bulletins.psu.edu/search/?P=PHSIO%20571) and PHSIO 572 (https://bulletins.psu.edu/search/?P=PHSIO%20572) - If these courses are required for the major, then substitute an equal number of credits in 500-level Integrative and Biomedical Physiology elective courses.
- A 3-credit, 500-level Integrative and Biomedical Physiology elective course.
- Select additional credits from 500-level Integrative and Biomedical Physiology courses or a relevant 400- or 500-level course so that the total course credits for the minor is 15. These 15 credits cannot include course work that is used to fulfill requirements in the student's major.
- Elective courses for the minor must be approved by the chair of the Integrative and Biomedical Physiology program. For a list of suggested courses, contact the graduate program.
- Students must earn a grade of C or better in each course in the minor and maintain an overall average of 3.00 in the minor.
- One member of the Ph.D. committee must be a faculty member in the Intercollege Graduate Degree Program in Integrative and Biomedical Physiology.
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Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (https://gradschool.psu.edu/graduate-funding/) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/) set by The Graduate School.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Physiology (PHSIO) Course List (https://bulletins.psu.edu/university-course-descriptions/graduate/phsio/)

Contact

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Program Contact	Freya Heryla 101 Life Sciences Building University Park PA 16802 fqh5144@psu.edu (814) 863-3273
Program Website	View (https://www.huck.psu.edu/graduate-programs/integrative-and-biomedical-physiology/)