Integrative and Biomedical Physiology IGDP
Faculty Program Handbook

2021-2022

Introduction: We seek to maintain a strong and viable Integrative and Biomedical Physiology (IBMP) Intercollege Graduate Degree Program, which is dependent on continued participation of interested and motivated faculty. The value of inter-disciplinary graduate training programs is reflected in the success of our alumni and faculty, and we foresee many new opportunities for the program in the future with your help. The purpose of the faculty handbook is to define expectations for faculty of the IBMP, as well as provide guidance on facilitating the progression of IBMP students to degree completion. Specific program and policy details regarding IBMP requirements and expectations such as rotations, coursework, and major milestones (qualifying exam, committee meetings, comprehensive exam and thesis defense) can be found in the IBMP student handbook (https://www.huck.psu.edu/graduate-programs/integrative-and-biomedical-physiology/degree-requirements/ph-d-requirements). Recommendations for conflict resolution are also addressed. The faculty handbook provides the necessary information for faculty to understand IBMP expectations and opportunities. Where possible, alignment with specific Graduate School policies is also provided.

I. Responsibilities for New and Continued Membership in the Physiology IGDP

A. Criteria for Membership to the IBMP

1. Active research and/or pedagogy in an area of physiology
2. *Experience as a research mentor with primary responsibility for the training of undergraduates, graduate students, or post-doctoral fellows
3. *Senior authorship of publications
4. Designated research space
5. Member of the Graduate Faculty (once a faculty applicant is approved by the IBMP Steering Committee, the program chair will notify the Graduate School to request IBMP affiliation)

**special consideration will be made for newly hired junior faculty who have not secured external funding but who will be mentoring students with guaranteed funding.*

**special consideration is made for 'affiliate' members as defined in the bylaws.*

B. Responsibilities for Continued Membership in the IBMP

In accordance with the IBMP Bylaws, IBMP faculty participation will be reviewed every 5 years by the Steering Committee, and faculty will be asked to confirm their desire to retain membership in the IBMP. Individuals who have not been active during the prior 5-year period will be asked to provide a specific commitment for continued participation. Faculty who persistently fail to meet their stated commitment will be discontinued from membership in the Program Faculty of the IBMP. Specific examples of program participation are as follows:

1. Advising PhD candidates on Physiology-related projects, which includes
    a. Following Graduate School and IBMP Policies on degree milestones and thesis committee composition and meetings (GCAC-602, GCAC-603, GCAC-604; IBMP Student Handbook)

   b. Completing the **Annual Graduate Student Activity Report** (GSAR), which will originate from the Huck Institutes Graduate Office to be completed in June of each academic year (https://grad-activity.science.psu.edu/).
   c. Providing information on IBMP student accomplishments (i.e. publications, presentations, awards, etc.) and post-degree accomplishments and placement when requested in a timely manner.
   d. Completing mentor training
2. Participating in IBMP student recruitment activities
3. Hosting IBMP rotating students
4. Participating in IBMP student committees (comprehensive, thesis) when asked
5. Participating in IBMP Qualifying Examinations when asked (writing and grading questions; participate in serving on Qualifying Exam Committee)
6. Attending IBMP student seminars on a regular basis
7. Attending IBMP faculty meetings at least once per year and attend the annual retreat
8. Willingness to serve on an IBMP standing committee (see section II) when requested by the IBMP Program Chair. Ad hoc committees may be formed at the discretion of the program director and will be credited similarly.
9. Teaching in IBMP core courses/electives or serving as the course coordinator for PHSIO 571, 572 or 590 (see section VII for course objectives)

C. Removal of Program Faculty for Unsatisfactory Performance

Removal of a faculty member for cause, including but not limited to, failure to meet agreed program expectations (for example, completing mentor training, failure to facilitate mentoring milestones, teaching assignments, etc) shall be determined as described in accordance with Section IV(B).

II. IBMP Standing Committees

A detailed description of IBMP standing committees can be found in the IBMP Bylaws. For the vibrancy of the program, examples of expected service would include serving on 1 committee every 3 years. Ad hoc committees may be formed at the discretion of the IBMP Program Chair.

A. **STEERING COMMITTEE**. Function as the IBMP program advisory and oversight committee and make recommendations to the program director on key policy and procedural information related to program administration.

B. **QUALIFYING AND ENGLISH PROFICIENCY EXAM COMMITTEE**. Administer and evaluate first year doctoral students who sit for the IBMP Qualifying Examination.

C**. ADMISSIONS AND RECRUITMENT COMMITTEE**. Review student applicants to the IDGP in Physiology and recommend applicants to be invited for interview.

D. **CURRICULAR AFFAIRS COMMITTEE**. Recommend changes and/or courses or other action to be taken in the academic program of the IDGP in Physiology.

III. Time to Degree Completion, Time Lines and Student Funding

A. **Degree Milestones and Coursework** are specifically outlined in the IBMP Student Handbook (https://www.huck.psu.edu/graduate-programs/integrative-and-biomedical-physiology/degree-requirements/ph-d-requirements). Briefly, all students shall complete rotations and core coursework during year 1, and declare a mentor at the time of the Qualifying Exam (May of each academic year). In accordance with GCAC-602, the doctoral committee should be formed no later than one year following the date of passing the Qualifying Examination, unless an alternative timing is approved through the Graduate Council's curricular review process. The IBMP Program Assistant should be notified of all committee meetings, and IBMP students are required to meet with the thesis committee at least once annually. A **committee progress form** documenting student progress should be submitted to the IBMP Program Assistant following each committee meeting. Dissertation committees should meet no fewer than once annually, (GCAC-603) and twice yearly is recommended. The comprehensive exam should be completed by year 3, and the defense thereafter. The IBMP Program Assistant submits all paperwork to the Graduate School related to milestone completion. Finally, students and faculty will complete the **Annual Graduate Student Activity Report** (GSAR), which originates from the Huck Institutes Graduate Office in June of each academic year (https://grad-activity.science.psu.edu/**)**. These evaluations are integral parts of the student's professional development and provide a formal mechanism for students and their advisors to broadly review the student's progress and discuss current and future goals. The IBMP Program Chair reviews and approves the annual GSAR. Status of degree milestones will be communicated to the trainee at this time.

B. **Student Funding, Assistantships and Student Status**. Funding for year 1 (12 mo) is provided by the Huck Institutes of the Life Sciences or a Graduate School Fellowship. It is the responsibility of the faculty mentor to secure funding after the 1st year for individual students that is commensurate with grade levels established by the Huck Institutes of the Life Sciences. Financial support may come in the form of an external grant, T32 fellowship, individual fellowship, or a home departmental assistantship negotiated by the mentor. Students with teaching or research graduate assistantships must be registered as full-time students to maintain stipend eligibility. Full time status is considered either a minimum of nine credits each fall and spring semester (pre-comprehensive exam) or PHSIO 601 (post-comprehensive exam). Students funded through training grants cannot have teaching or other University responsibilities during the period of their appointment.

The assistantship appointments typically originate with the department of the faculty advisor. Questions regarding student registration status can be directed to the IBMP Program Assistant. Summer stipends and associated appointments are also the responsibility of the faculty mentor through the home department.

Limited out year student support may be available at the discretion of the IBMP Program Chair in consultation with the IBMP Steering Committee. IBMP out year support can be used during the fall/spring semester, and occasionally during summer. The IBMP Program Chair will evaluate each individual request, and agreements between the IBMP Program Chair and faculty members will be individualized to best support the mentor/trainee pair. Examples of IBMP support include:

- Matching TA Program with the Department of Biology: Biology and IBMP have a long-standing collaboration whereby stipend and tuition support for a given fall/spring semester is split equally between IBMP and Biology, and the student provides TA support to the Department of Biology (~20 hrs per week, fall/spring semesters). The faculty mentor is required to provide a minimum of 5 contact hours in a PHSIO core course such as PHSIO 571, 572 or 590, and in alignment with stated course objectives (section VII), and/or committee service in consultation with the IBMP Chair. Failure to honor program commitments will result in loss of program support for the student.
- IBMP Matching RA Program: stipend and tuition is split equally between IBMP and the faculty mentor. The faculty mentor is required to provide a minimum of 5 to 8 lectures in a PHSIO core course such as PHSIO 571, 572 or 590, and/or committee service in consultation with the IBMP Chair. Failure to honor program commitments will result in loss of program support for the student.
- IBMP Tuition Support Program: IBMP may be able to provide tuition support for an external grant award or home department funding. The faculty member is expected to provide program/committee service in consultation with the IBMP Chair. Failure to honor program commitments will result in loss of program support for the student.
- Occasionally additional funds may become available for summer/academic year support and will be allocated at the discretion of the IBMP Program Chair.

IV. Conflict Resolution

Conflicts may arise in any aspect of a student or faculty member's professional life. The purpose of conflict resolution is to provide voice to all parties in a collaborative process that solves problems. Often conflicts can be resolved with clear and open communication. In more challenging instances, conflict resolution procedures assure that due process is afforded to all parties so that the matter can be properly adjudicated**.** This section describes the general conflict resolution procedures for faculty and students. Great detail relative to students can be found the IBMP Student Handbook. These are broad guidelines that may be tailored as individual circumstances dictate.

A. Problem/Conflict Resolution with Students. Graduate students occasionally have difficulties with their advisors, their programs or an academic matter associated with their programs. The first step in problem resolution is for the student to speak directly with the mentor or the involved party. If the problem is unresolved, the IBMP Program Chair should be contacted, who will arbitrate further discussions between the parties. If satisfactory resolution remains elusive, the next step would be to work with the Graduate Education Associate Director of the Huck Institutes of the Life Sciences and/or with the Dissertation Committee (if post-qualifying). The Huck Associate Director for Graduate Education can assist with arbitration through the leadership of the Huck Institutes of the Life Sciences. The Associate Dean for Graduate Student Affairs of the Graduate School is also available to provide guidance and maintain neutrality if issues remain unresolved. Issues discussed during meetings will remain confidential if requested by the student. Please see http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-800/gcac-802-procedures-for-resolution-of-problems/ for additional Graduate School policy details.

B. Problem/Conflict Resolution with IBMP Faculty. Should a conflict arise between IBMP faculty, the first step would be to seek problem resolution with the IBMP Program Chair, who may consult with the IBMP Steering Committee. If the problem between faculty remains unresolved, the next step would be for the involved parties to contact the Senior Associate Dean of the Graduate School to facilitate resolution. If the issue involves the IBMP Program Chair and an individual IBMP faculty member, the immediate first step would be to engage the Senior Associate Dean of the Graduate School, who may consult with the IBMP Steering Committee, to facilitate mediation and grievance resolution. Any action to suspend or remove IBMP faculty or the IBMP Program Chair will ultimately be determined by the Senior Associate Dean of the Graduate School. The Senior Associate Dean of the Graduate School may consult with the Steering Committee to facilitate due process, and an appeal process if deemed necessary.

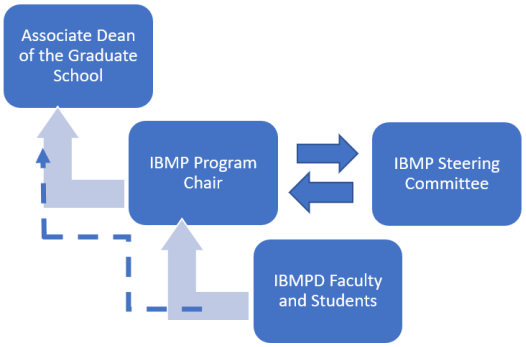

Figure 1. *Process for IBMP Conflict Resolution.*

V. Mentor Training - TBD

VI. STUDENT Vacation Policy. Arrangements for leave must be done in consultation with the student's faculty advisor or the IBMP Program Chair and should not compromise fulfillment of any obligations regarding coursework or research activities required of the student. The Penn State Graduate School has established policies and should be followed (see GSAD 900/901/see GSAD-906). For summer sessions please see GSAD-905. Any period of vacation without prior approval of the Program Chair or advisor is considered a violation of policy and nullifies all previous funding arrangements. In some instances, it will be appropriate for a student to spend time away from the PSU campus in other laboratories or in acquiring advanced training. Such experiences should be planned in consultation with the student's advisor. It is expected that all ramifications of such an experience, including legal and financial liabilities, will be discussed with the advisor, the IBMP Program Chair and/or other relevant administrative parties. Time spent in such activities does not count as vacation.

VII. Core Course Participation

The IBMP core courses approved by Graduate Council are provided here.

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A. PHSIO 571 (Course Description): This course in Cellular and Integrative Mammalian Physiology covers all major aspects of physiology. A special emphasis will be placed on how cellular aspects of physiology are integrated with organ and systems physiology. It is designed for students that either major in Physiology or are interested in integrating physiology concepts into their education. An in-depth presentation of membrane biophysics, muscle dynamics, cardiovascular and circulatory regulation, respiratory and renal function, as well as acid base balance are addressed.

A listing of the **major topics** to be covered with an approximate length of time allotted for their discussion: Membrane Biophysics and Action Potentials (10%) Autonomic Nervous System (15%) Skeletal Muscle Regulation (10%) Cardiovascular and Circulatory Regulation (25%) Respiratory Function (20%) Renal Function (20%)

Instructional, Educational, and Course Objectives: The learning objectives associated with this course are derived from standards established by the American Physiological Society and the Medical Physiology Learning Objectives Project. After successfully completing this course, a student will be able to:

- Describe concepts of electrochemical equilibrium, calculate resting membrane potential and understand transport across biological membranes.
- Define ion channel properties including: gating, activation, inactivation, conduction of an action potential, and saltatory conduction;
- Contrast the cell to cell spread of depolarization at a chemical synapse with that at a gap junction and propagation along both nonmyelinated and myelinated axons.
- Understand the principle of the voltage clamp and how it is used to identify the ionic selectivity of channels and ion contributions to each phase of the action potential.
- Understand general principles for structure and function of skeletal, cardiac, and smooth muscle, at all anatomical levels, from the whole muscle to molecular components of the sarcomere.
- Understand the cross bridge cycle, length-force and force-velocity relationships; understand energy sources of muscle contraction, thick and thin myofilaments, constituent proteins, and multiple sources and localization of calcium for contraction of skeletal, cardiac and smooth muscle.
- Understand excitation-contraction coupling and neuromuscular transmission including sequence of steps involved in neuromuscular transmission, force generation and energetics for each muscle type; define a motor unit and order of recruitment during contraction of varying strengths.
- Understand cardiac electrophysiology and the ionic basis for the cardiac action potential, the cardiac cycle, pressure volume loops and principles underlying regulating cardiac output and venous return.
- Contrast intrinsic and extrinsic control (sympathetic and parasympathetic nervous system) influence on cardiac and vascular function, with an emphasis on regulation of ventricular force development and contractility and cell membrane receptors and second messenger systems mediating changes in cardiac performance and vascular function.
- Understand hemodynamics and the relationship between pressure, flow, and resistance in the vasculature; contrast the relative contribution of neural and renal mechanisms in blood pressure and blood volume regulation including afferent and efferent arms of the baroreflex.
- Apply concepts from neural, musculoskeletal and cardiovascular sections to regulatory mechanisms associated with pulmonary mechanics, alveolar ventilation, pulmonary circulation, pulmonary gas exchange, oxygen and carbon dioxide transport, respiratory control; in depth understanding of partial pressures and the oxyhemoglobin dissociation curve (hemoglobin oxygen equilibrium curve).
- Apply concepts from neural, musculoskeletal and cardiovascular sections to regulatory mechanisms associated with maintenance of body fluids, structure of the kidney and

nephrons, renal clearance, glomerular filtration rate and renal hemodynamics, transport properties of nephron segments, urine concentration and dilution, Na+ balance and regulation of extracellular fluid volume, K+, Ca2+ and phosphate balance, and acid-base balance. Human and animal models of health and disease are emphasized.

Evaluation Methods: Evaluation is primarily achieved through 3 to 4 written examination on a given section (90%). Examination of the primary literature is also utilized (both classic and contemporary research papers) and class participation is evaluated from these assignments (10%).

B. PHSIO 572 (Course Description): The course in Cellular and Integrative Mammalian Physiology II covers all major aspects of endocrine physiology. A special emphasis will be placed on how cellular aspects of physiology are integrated with organ and systems physiology. This course is designed for graduate students in the Physiology or Animal Science graduate programs, or students who are interested in integrating physiology concepts into their work in another program. Although there are no prerequisites for the course, prior courses in physiology, endocrinology, and/or biochemistry are beneficial. The course will include the following topics: gastrointestinal physiology, pancreatic hormones and integrated metabolism, hypothalamic pituitary function, thyroid, parathyroid and bone, as well as physiology of growth and lactation. Additional topics will encompass adrenal function, sexual differentiation, male and female reproduction, embryo and adult derived stem cells, aging, obesity, and metabolic syndrome.

A listing of the **major topics** to be covered with an approximate length of time allotted for their discussion: Gastrointestinal physiology (1 week) Pancreatic hormones and integrated metabolism (2 weeks) Hypothalamic pituitary function, thyroid, parathyroid and bone, as well as physiology of growth and lactation (4 weeks) Adrenal function (2 weeks) Sexual differentiation, male and female reproduction (4 weeks) Embryo and adult derived stem cells, aging, obesity, and metabolic syndrome (2 weeks)

Instructional, Educational, and Course Objectives: The learning objectives for this course are derived from The Medical Physiology Learning Objectives Project established by the American Physiological Society (APS) for the Endocrine and Metabolism section, and Gastrointestinal sections, respectively (http://www.the-aps.org/mm/Education/Publications/Education-Reports/HigherEd/MedPhysObj/Endocrinology-and-Metabolism#General Principles). After successfully completing this course, a student will be able to:

- Differentiate between human, animal and cellular experimental endocrine models to critically evaluate and translate application of physiological regulation within each model system.
- Evaluate, analyze and critique classic and contemporary papers in endocrinology, and formulate testable hypotheses to further a given topical area.
- Compare and contrast hormone actions that are exerted through changes in gene expression with those exerted through changes in protein activity.
- Discriminate between and employ different methodological approaches to implement effective endocrine experimental study design in human vs animal models.

- Define and evaluate the interactions between hormones, target cells, and receptors pertaining to the anterior and posterior pituitary, thyroid gland, pancreas, adrenal gland and bone.
- Predict and interpret hormonal response for a variety of pathological or adaptive physiological states. Identify hormones that promote the influx and efflux of glucose, fat, and protein into and out of energy storage pools and their impact on the uptake of glucose by tissues.
- Draw conclusions on target organ damage and predict phenotypic consequences of the metabolic syndrome.
- Describe changes in metabolic fuel utilization that occur in long- and short-term fasting and in acute and sustained exercise.
- Understand how increases or decreases in hormone secretion produce these changes. Identify disease states caused by: a) over secretion, b) under secretion of insulin, or c) decreased sensitivity to insulin, and describe the principal symptoms of each.
- Describe the physiological functions and molecular basis of the major components of the male and female reproductive tracts, and understand aging- related changes in the hypothalamo-pituitary-gonadal axis that lead to puberty, reproductive maturity, pregnancy, birth, and reproductive senescence. Understand the integrated regulation (neural, endocrine, luminal) that drives digestion and absorption of nutrients after a meal and the temporal sequence of regulatory events during digestion with particular emphasis on the stomach, small and large intestines.
- Identify the cell types and anatomical location of the endocrine cells secreting major GI hormones. List the target organs and cell types for parathyroid hormone and describe its effects on each.
- Discuss the functions of the osteoblasts and the osteoclasts in bone remodeling and the factors that regulate their activities.
- Demonstrate sources of vitamin D and diagram the biosynthetic pathway and calcium homeostasis.

Evaluation Methods: Evaluation is primarily achieved through written examinations accounting for 90% of the total grade. Essay and short answer exams are administered after each major section, with a minimum of 3 and up to 5 exams during a given semester offering. Examination of the primary literature is also utilized (both classic and contemporary research papers are utilized) and verbal class participation and presenting sections of assigned papers accounts for 10% of the total letter grade.

C. PHSIO 590 (Course Description): PHSIO 590 was designed to facilitate science communication skills for graduate trainees in the IBMP program. Emphasis is placed on oral communication skills. Students are charged with developing a 30 to 40 min oral scientific research presentation, and receive feedback from course instructors. Doctoral students are required to enroll in PHSIO 590 during their 2nd and 3rd years, while M.S. candidates are required to complete PHSIO 590 in their 2nd year.

Instruction and Educational Course Goals: 1) To develop effective oral communication and science presentation skills related to their research activities, and 2) to develop effective seminar

question-asking techniques in a public presentation venue. Skills are developed through lecture**,** oral research presentations**,** poster presentations, and through discussant responsibilities.

EXPECTATIONS:

- Evaluations will be expected from non-presenting students for each talk. Non-presenters will submit their evaluative feedback forms immediately following a given seminar. Students should arrive prior to the start time of the class to get full attendance credit. The feedback will be summarized by the instructor and provided to the presenter (anonymously).
- Each student will be responsible for uploading to Canvas a key review or original scientific article which pertains to the subject matter of their research focus **one week prior to their scheduled presentation** (preferably in PDF format). All students are responsible for reading the assigned article prior to each presentation.
- Each student's thesis/academic advisor (and lab mates) will be invited to attend the scheduled seminar presentations and will be informed of the assignment and presentation date. Students are required to seek input from their research supervisors; for more junior students, data used for a given presentation may have been collected by other members of their laboratory. Whenever possible, students should utilize in their presentations data that were self-generated.
- Discussant Responsibilities: The discussant for each presentation will be responsible for introducing the speaker, managing the Q & A period, and generating 1 to 2 thoughtful/ stimulating questions following the speaker's presentation. *Information should be obtained in advance from the presenter for introduction purposes.*
- Revisions to content may be required. If requested, the student will submit a revised power point presentation file according to feedback from the class and supervising instructor.
- Students naïve to PHSIO 590 will be required to complete the HUCK Student Assessment (https://www.huck.psu.edu/resources/students/graduate-students/professional-development/professional-development-overview) at some point during the semester. This activity is meant to compliment your 30-40 min presentation.
- Student attendance and discussion will constitute the participation grade.

Evaluation Methods: Research Presentation (55% (1st time), 70% (2nd time))**,** HUCK Assessment Center Inventory (15%; 2nd year students only)**,** Discussant Responsibilities (14%), Seminar Evaluations (11%)**,** Participation/Attendance (5%)