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Integrative Biology and Physiology (IBP)
Graduate Program Overview

Message from the IBP Director of Graduate Studies (DGS):

Welcome! 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. Areas of specialization include a growing cardiovascular core and other areas as well. We are glad you are in the IBP Graduate Program and wish you success in your endeavors!

John Osborn, DGS

The IBP Graduate Program handbook provides information on requirements, policies and logistics in the IBP department, the University and the Graduate School. The information provided in this handbook should be used as a supplement to the University’s Graduate Student Handbook.

IBP Graduate Students should become familiar with the following University guidelines and resources:

- Graduate School
- University Catalogs – Graduate Education
- Prospective Students: Graduate School Admissions
- Current Students: Graduate Student Services
- One Stop Student Services
- Graduate Assistant Employment Services
- Counsel of Graduate Students
- Course Registration

For any questions that are not addressed in this handbook, students should contact Financial information: Randi Lundell, 612-626-4925 or email rlunde@umn.edu.
Academic Information: John Osborn or Stephen Katz
Other questions: Jane Barnard 612-624-8151 or mayhe001@umn.edu
Goals and Objectives of the Master’s and PhD Programs in IBP

Dedicated to an integrative systems biology approach to biomedical discovery.
We partner with colleagues across disciplines to investigate questions ranging from the gene/molecule to the whole animal, striving for excellence in research and dissemination of new knowledge with local, national, and global impact.

Committed to mentoring and training graduate students.
We empower students to develop a deep understanding of the complexity of physiological systems to enable them to pursue unique career pathways spanning from academia to bio-industry.

Devoted to excellence, innovation, and scholarship in education.
We educate students in the integration of structure and function of cells, organ-systems, and living animals, providing a strong foundation for knowledge discovery in basic science and human health fields.

Graduate Studies in IBP

Success in research demands creativity, the ability to think critically and the mastery of technical skills. Although it is often said that one “cannot teach creativity,” it certainly can be encouraged and rewarded. As for critical thinking and technical skills, these are acquired through a carefully structured curriculum that emphasizes learning from original research papers and hands-on laboratory experience rather than summaries usually found in textbooks. In all cases, the IBP Graduate Program at the University of Minnesota is highly individualized so that each student has the freedom to pursue their own scientific interests with respect to their unique academic background.

There is, however, a fundamental base of knowledge in the Life Sciences (Cell Biology, Biochemistry, Systems Physiology and Neuroscience) that provides a strong foundation for advanced study. Course work in these areas constitutes the core curriculum and demonstrated understanding of this material is required of all students. These courses are usually taken within the first two years of study. Beyond the core requirements, individualized programs are structured to address advanced work in the student’s chosen area of specialization.

Each student is encouraged to participate in laboratory rotations with faculty whose research interests are similar to that of the student. These rotations provide hands-on experience with state-of-the-art techniques and give the student an opportunity to explore a variety of specialization options available within the program.

Graduate Program and Graduate School Commitment to Diversity

The IBP Graduate Program embraces the University of Minnesota’s position that promoting and supporting diversity among the student body is central to the academic mission of the University. A diverse student body enriches graduate education by providing a multiplicity of views and perspectives that enhance research, teaching and the development of new knowledge. Higher education trains the next generation of leaders of academia and society in general, and such opportunities for leadership should be accessible to all members of society. The IBP Graduate Program is, therefore, committed to providing equal access to educational opportunities through recruitment, admission, support of programs that promote diversity and foster successful academic experiences that in turn help to cultivate the leaders of the next generation.
IBP Department History

The Department of Integrative Biology and Physiology (formerly the Department of Physiology) has a long and distinguished tradition for excellence in research and graduate education. The department was founded in 1889 and achieved national and international prominence in large part through the efforts of Dr. Maurice Visscher during his tenure as Chairman from 1936 to 1968. Dr. Visscher received both his MD and PhD degrees from the University of Minnesota. His pioneering research on cardiac energy metabolism began in Starling’s laboratory in Cambridge and eventually provided a foundation for the development of open heart surgery techniques at the University of Minnesota. He was a member of the National Academy of Sciences, served as president of the American Physiological Society and as president of the International Union of Physiological Scientists. In recognition of his scientific contributions and his service to the University of Minnesota, an endowed professorship was established in his honor.

Dr. Visscher also began another tradition at Minnesota: A tradition of collaboration between the departments of Physiology, Surgery and Medicine that emphasized the importance of understanding basic physiologic mechanisms and applying this knowledge to the development of new approaches in clinical medicine.

This tradition continues today through an interdepartmental graduate program in Integrative Biology & Physiology, which draws upon the expertise of physiologists in both basic science and clinical departments. This program provides a greater range of opportunities and experiences for graduate student training than could otherwise be provided through a single department. It also increases access to state-of-the-art research facilities and equipment in each of these departments to support graduate student and faculty research activities within the program.

In 1999, the Physiology Department moved into its new space in the completely renovated Jackson Hall. Its current location is between Nils Hasselmo Hall and the new Molecular and Cellular Biology Building, which opened in 2002. In 2008, Dr. Joseph Metzger became the new department head and shortly thereafter, the Physiology Department changed its name to Integrative Biology & Physiology (IBP) to better reflect its focus on research of Integrative Biology & Physiology.
IBP Department Location and Staff Contact Information

Mailing Address:
Department of Integrative Biology & Physiology
University of Minnesota
6-125 Jackson Hall
321 Church Street SE
Minneapolis, MN 55455-0250
Phone: (612) 625-5902
Fax: (612) 625-5149
http://physiology.med.umn.edu

Joseph Metzger, Department Head
6-125 Jackson Hall, (612) 625-8296,
metzgerj@umn.edu

John Osborn, Director of Graduate Studies
2-153 Jackson Hall, (612) 624-3074,
osbor003@umn.edu

Stephen Katz, Associate Director of Graduate Studies
3-144 Jackson Hall, (612) 626-6899,
katzx001@umn.edu

Randi Lundell, Department Administrator/MNPI Center Grants Manager
6-129A Jackson Hall, (612) 626-4925,
rmlunde@umn.edu

Deb Fergus, Executive Assistant to the Head of the Department
6-125 Jackson Hall, (612) 625-9137,
fergu226@umn.edu

Yang Chong, Accountant II
6-129 Jackson Hall, (612) 625-2970,
chong001@umn.edu

Lynn Katz, Accountant II
6-129 Jackson Hall, (612) 625-7113,
kaatz003@umn.edu

Jane Barnard, Grad program Assistant and Education Administrative Specialist
6-125 Jackson Hall, (612) 624-8151,
mayhe001@umn.edu

Penny Busch, Personnel Specialist
6-120 Jackson Hall, (612) 625-3687,
pbusch@umn.edu

Graduate Student Mailboxes
6-125 Jackson Hall, Department work room

After-Hours Building Access
Students who have an advisor with lab space in Jackson Hall or Nils Hasselmo Hall (NHH) will be authorized for after-hours access to the relevant building. After-hours access to Jackson Hall and NHH is granted through use of the U-Card, your University of Minnesota identification card. Please contact Randi Lundell for building access questions.
Program Contents

Graduate Student Orientation (GSO)

All newly admitted Graduate School students are given an orientation by the DGS and associate DGS before classes begin. A course schedule and first rotation is worked out and upcoming milestones are pointed out. New students can also attend an orientation event specifically aimed for new students beginning their graduate work in the life sciences programs.

Advisor Selection

The Director of Graduates Studies (DGS) is the default Faculty Advisor for all new graduate students during the first year, (with the exception of students admitted to the graduate program with a research assistantship provided by a specific faculty member). The DGS can assist students with developing a program of study, selecting a Thesis Advisor, Graduate School paperwork and course permission numbers.

All students are expected to select a Thesis Advisor, who then also becomes their Faculty Advisor, by the end of their first year. Students are encouraged to speak with different faculty members about their interests and possible research topics. There are several mechanisms to facilitate the process of identifying the student’s top choices for a thesis advisor including:

1) A web site lists potential advisors and research interests. IBP Grad Faculty. See Appendix A

2) The initial Faculty Advisor (the DGS) can brief students on appropriate choices for a Thesis Advisor.

3) Departmental seminars presented by potential faculty advisors are given throughout Fall and Spring semesters.

4) It is also helpful if students take the initiative to arrange individual meetings with faculty of interest.

5) Students should also meet with current graduate student advisees of faculty and explore the infrastructure that exists at the University for research projects of interest.

Once selected, the Thesis Advisor guides students in choosing remaining coursework and thesis research. The Thesis Advisor also provides financial support for their students from their research grants.

Students with traineeships should check with the stipulations of the training grant regarding the timing of advisor selection.

Remember that the advisor-advisee relationship is mutual; faculty members must agree to become a student’s advisor. Upon selection of a faculty member and the faculty member’s acceptance of advising responsibilities, students should inform the DGS.

Class Registration

Registration for each semester begins approximately one month prior to the end of the previous term. For example, registration for fall semester begins in April. All graduate students must register for both fall and spring semesters throughout the term of their appointments as Graduate Assistants, or lose employment and health benefits.

The deadline for fall registration is usually somewhere around September 1st. Fall semester begins the Tuesday after the Labor Day Holiday. A late registration fee will be charged for students enrolling in classes during the first 14 days of the semester.

Please see the ONE STOP registration website for complete information about fall semester
Class Registration (cont.)

registration. Printable publications for each semester may be found at:
http://onestop.umn.edu/registration/printable_p_and_p/index.html

All new graduate students should meet with the DGS to review their initial course selections and registration. Thereafter, continuing graduate students should register with the approval of their assigned Faculty Advisor. Some courses require prior approval from the department offering the course before students can register. For questions or registration approvals, contact a DGS or assistant DGS.

To register via the University of Minnesota One Stop website, you will need your student ID number or social security number and your password to log on. Your initial password is your date of birth; once logged into the system, you can choose a different password. If you are unable to login initially with your date of birth, contact the Student Services Center, 200 Williamson Hall, 612-625-5333.

You must clear all registration holds before you will be permitted to register. A new student who has the hold “BACH DEGREE” on record must submit a transcript or other evidence of graduation from the undergraduate institution to the Registrar’s Office, 200 Fraser Hall. For more information on holds and hold clearance, go to the One Stop website.

A student who holds a graduate assistantship must register for a minimum of 6 credits for each of the fall and spring semesters. However, the graduate assistant tuition benefit is capped at 14 credits per semester; if you register for more than 14 credits, you will be responsible for paying the additional tuition. A PhD candidate (i.e., a PhD student who has successfully completed the preliminary examinations and has completed 24 thesis credits) need only register for a minimum of 1 graded thesis credit per semester to maintain the graduate assistantship.

Your advisor must approve your enrollment in summer session classes.

A student who has completed all of their coursework and thesis credits and who needs to maintain a minimum number of credits to satisfy non-Graduate School requirements, such as receiving or deferring repayment of loans, keeping assistantships, or maintaining visa status, may register for Full Time Equivalent (FTE) credit - FTE: Master’s; FTE: Doctoral; or FTE: Doctoral Pre-Thesis Credits. These courses are intended only for advanced MS and PhD students who have completed all their program coursework and required thesis credits, but still are working full-time on the research or writing of their thesis, papers, capstone project or dissertation. These credits cannot be used to meet specific program course or credit requirements, nor can they be used to meet the 24 doctoral thesis credit requirement.

Students are required to register every fall and spring semester to maintain active status in the Graduate School. Requests to schedule final oral examinations, for example, will not be honored if a student is considered inactive. If your student status has become inactive, you will need to reapply for admission to the Graduate School.

- The University of Minnesota uses a four-digit course numbering system. Graduate students typically fulfill their course requirements by registering in courses at the 5xxx and 8xxx levels. In some cases, such as coursework necessary for the research which is outside the student’s prior major and graduate coursework to date, 4xxx level courses can be used towards degree course requirements with pre-approval of the advisor and DGS. DGS pre-approval may be granted occasionally for a course at the 6xxx or 7xxx levels.

MS and PhD candidates who believe they have taken courses for undergraduate credit that are the equivalent of required Physiology (PHSL) graduate core courses should consult their advisor.
Degree Requirements

IBP Master’s Degree Requirements

Twin Cities Campus

A Master’s Degree for individuals is sometimes available, but only for special circumstances. A total of 20 graduate credits, 14 graduate credits in physiology, 6 graduate credits outside of physiology plus at least 10 thesis research credits, are required. The degree is based on laboratory research, and requires a written thesis or written project and an oral presentation of the work for the final exam.

The Master’s Degree is Plan A, unless there are special circumstances requiring a Plan B. For Plan B, the final exam is oral.

The Plan A option for a Master’s Degree requires the completion of a thesis/project to be submitted to The Graduate School. The formatting requirements for the thesis/project are outlined in the “Preparation of the Master’s Thesis/Project,” available outside 310 Johnston Hall and at http://www.grad.umn.edu/current_students/forms/masters.html.

The Plan B option for a Master’s Degree requires the completion of at least one Plan B project. The graduate faculty in each major may require as many as three such projects. More information regarding the Plan B option is available in the Graduate School Catalog and at http://www.grad.umn.edu/current_students/forms/masters.html.

Master’s candidates. The Graduate School requires final exams for both Plan A and B master’s degrees. The exams may be written, oral, or both, depending upon the major field.

IBP PhD Degree Requirements

Graduate level course work in cell & molecular physiology and medical physiology provide a foundation for PhD Program students.

In the first year of the PhD program, students are required to take courses in Cell and Medical Physiology, as well as three laboratory rotations and some seminar courses (see below). The coursework is tailored to the student’s interests with input from the director of graduate studies and the advisor. During the first year, students rotate through three laboratories, pick an advisor, and begin a research project.

A preliminary written exam (PWE) in physiology is taken after the first two semesters of classes (before the preliminary oral exam) and is based on the Cell Physiology, Medical Physiology & related seminar coursework. The preliminary oral exam (POE), usually at the end of the second year, is given to test the student’s ability to apply principles of both physiology and the minor or supporting program to a proposed research based thesis. A doctoral student must write a thesis project proposal and must successfully defend it in a preliminary oral exam. This exam must be scheduled with The Graduate School and cannot be held until all work on the official course program has been completed and the written preliminary exam has been passed.

A minimum of 12 credits must be completed in the minor field or supporting program (Non-PHSL graduate credits).

After the successful completion of the preliminary oral exam, the student is expected to do primarily thesis research. At the completion of the thesis research, the student must write their thesis and then orally defend it (thesis defense).
A completion checklist of ALL requirements is found on Appendix D.

The listing of forms you will need as you progress to degree completion are downloadable at the Graduate School site: Forms for Doctoral Students (http://www.umn.edu/grad/education/doctoral/index.html)

The policy that governs the application of graduate credit to satisfy the requirements for the PhD can be found at: Application of Graduate Credits to Degree Requirements (http://policy.umn.edu/Policies/Education/Education/GRADCREDITDEGREE.html)
**You must register for 6-14 credits for fall and spring.** The Medical Physiology course PHSL 5101 and PHSL 8232 start in early January because it is taken with the Medical school students.

**Rotations**
Lab rotations should be taken very seriously since by the end of summer of Year 1, students must choose a laboratory for thesis work. Hence, in the Fall of year 1 students need to acquaint themselves of all possible lab rotation possibilities. When a student is not in class, IT ALWAYS A GOOD IDEA TO BE IN LAB! Use rotations to make sure the lab is right for you, acquire new skill sets, and ensure that your potential mentor is favorably impressed.
MD/PHD Sample Curriculum

### Year 1

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Details</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td><strong>ANSC 5700 - Cell Physiology</strong></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Biostatistics (options below)</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td><strong>PHSL 5096 - Integrative Bio &amp; Phys Advances (Seminar)</strong></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>PHSL 8888 - Thesis Research</strong></td>
<td>fill in*</td>
</tr>
<tr>
<td></td>
<td>*semester credits not to exceed 14</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td><strong>PHSL 8232 - Critical Journal Reading</strong></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>PHSL 5096 - Integrative Bio &amp; Phys Advances (Seminar)</strong></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>PHSL 8242 - Prof Skills Devel for Bio-1 medical scientists (grant writing)</strong></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>PHSL 8888 - Thesis Research</strong></td>
<td>fill in*</td>
</tr>
<tr>
<td></td>
<td>*semester credits not to exceed 14</td>
<td></td>
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</tbody>
</table>

Written Preliminary Exam – Essay format test taken within 2 weeks of completion of Spring Semester.

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Details</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td><strong>PHSL 8888</strong></td>
<td>**</td>
</tr>
</tbody>
</table>

**Total PHSL 8888 = 24 credits after summer

### Year 2

<table>
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<tr>
<th>Semester</th>
<th>Course Details</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>Fall</td>
<td><strong>PHSL 5096 - Integrative Bio &amp; Phys Advances (Seminar)</strong></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>PHSL 5701 - Phsl Lab teaching Asst.</strong></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Preliminary Oral Exam taken no later than end of Fall Semester Year 2</td>
<td></td>
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### Spr Yr 2 and Beyond

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<tr>
<th>Semester</th>
<th>Course Details</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td><strong>PHSL 8444 - Thesis Credits</strong></td>
<td>1</td>
</tr>
<tr>
<td>Summer</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Give Seminar</td>
<td></td>
</tr>
</tbody>
</table>
Curriculum Notes

**Summer:** Students do not typically register during the summer but must finish all rotations and select a thesis lab and advisor in order to receive their stipend. No summer registration results in a ~$75.00 drop in pay per paycheck.

* Beginning with the summer semester of the second year and then on, students are also expected to give a seminar each year.

Two critical issues:

1) Doctoral degrees must consist of a minimum of 48 credits: a **minimum of 24 graduate-level course credits** AND a minimum of 24 **thesis credits** (PHSL 8888). Course credits are intended to provide doctoral students the necessary intellectual and professional foundation for their thesis projects, future career and professional activities.

2) Thesis credits may be taken at any time after admission to a doctoral program; programs have the discretion to determine when it is academically appropriate for students to take these credits.

This policy is online at [http://www.policy.umn.edu/Policies/Education/Education/MAPHDDEGREEREQ.html](http://www.policy.umn.edu/Policies/Education/Education/MAPHDDEGREEREQ.html)
Degree Progress, Forms, and Exams

Information for Master’s Degree
Go to: http://www.grad.umn.edu/current_students/masters/index.html for the latest information on all Master's Degree related procedures. Click on the appropriate Master’s Degree Plan: Master's Plan A (with thesis), Master's Plan B/C (without thesis) to obtain degree completion steps and needed forms.

Change of Status / Readmission Application

• Students admitted as a Master’s Degree candidate, must file a “Change of Status/Readmission” application to indicate a change of degree objective, after passing the Preliminary Written Examination (PWE), in order to become a PhD candidate.
• DO NOT CHOOSE AN EFFECTIVE TERM OF SUMMER – students are REQUIRED to register for the effective term of the change. If you have an effective term of summer, you have to register for that term (otherwise you’ll become inactive from the Graduate School).
• You can register for GRAD 999, if the effective term for your Change of Status Application is summer.
• Submit Change of Status / Readmission application online with the Graduate School (http://www.grad.umn.edu/admissions/registration/readmission/index.html).

Information for Doctoral Degree
Go to: http://www.grad.umn.edu/current_students/doctoral/index.html for the latest information on all PhD Degree related procedures. Click on “PhD/EdD Degree” to obtain access to all needed forms.

IBP Department Graduate Program Policy: In an effort to ensure students are making timely progress on their degrees, a hold will be placed on your record preventing you from registering if this form is not submitted after completing 20 credits. This hold will remain there until the Degree Program Form has been submitted or until you have spoken with the Director of Graduate Studies.

Information for both Master’s and Doctoral Degrees

Graduate Degree Plan

The Graduate Degree Plan is where the courses that the student has taken and those that will be taken to complete the requirements for the degree are indicated. **Do not list thesis credits (PHSL 8888 or PHSL 8444) in your list of classes taken.** The form must be signed by the student’s thesis advisor, and the DGS.

For Doctoral Students:
The Graduate Degree Plan should be filed after 4 semesters have been completed (as soon as the coursework for the PhD is known, usually during Spring Semester of the second year).

• **This form is also used to assign the committee for the Preliminary Oral Examination (POE).**

Doctoral Degree Completion Steps:
Information on the forms and the order in which they should be submitted for a successful and timely completion of the doctoral degree program.
Examinations

There are 3 examinations for the PhD degree:

- Written Preliminary Examination (WPE)
- Preliminary Oral Examination (POE)
- Final Oral Examination with Thesis Defense

Preliminary Written Examination (PWE) Specifics

Overview and Purpose

THE PWE EXAM WILL BE GIVEN WITHIN 4 WEEKS OF COMPLETION OF THE SPRING SEMESTER OF THE FIRST YEAR. It will be essay style format, testing the student’s ability to apply concepts learned in the core courses and integrate these concepts into the ‘big picture.’ Courses covered in the written preliminary exam include: PHSL 5700 Cell Physiology (or ANSC 5700), PHSL 5101 Medical Physiology, and the additional seminar based on reading the literature related to the Med Physiology class in the Spring of year 1. By studying for and taking the PWE, students are afforded an opportunity to integrate their primary knowledge base. Unsatisfactory performance on the PWE may result in the student leaving the PhD program, or modification of the student’s PhD program, including a re-take of the PWE.

Process

Exam questions in short and long essay format covering PHSL 5700 Cell Physiology (or ANSC 5700), PHSL 5101 Medical Physiology, and the additional seminar based on reading the literature related to the Med Physiology class in the Spring of year 1 will take place in the early summer (within 2-4 weeks of completion of the Spring Semester). The PWE takes place over 2-4 days and usually has both a morning and afternoon session. Students are given the specific PWE format and general question areas as well as exam timing about a month before the PWE.

All PWE questions are graded by the graduate faculty member that wrote the question, and often by one or two other faculty members as well. Students can fail individual questions but cannot fail the exam as a whole, as judged by the DGS and assistant DGS. For each section (specific area) students will often be asked to answer X out of Y questions, where Y is greater than X.

Preliminary Oral Examination (POE) Specifics

- Before the POE can be scheduled, students must have the PhD Graduate Degree Plan and the Preliminary Written Exam Report on file at Graduate School. Allow 6-8 weeks for the PhD Degree Program Form and the Preliminary Written Exam Report to be approved.
- To schedule the POE, submit the Scheduling Form found on the Graduate School’s website at: [http://www.grad.umn.edu/current_students/forms/doctoral.html](http://www.grad.umn.edu/current_students/forms/doctoral.html)

Purpose

The Preliminary Oral Examination (POE) must be passed before a student achieves candidacy for the PhD degree. Students usually take the exam at the end of the summer after the second year or in the beginning the Fall semester of their third year. There are four objectives of the POE in IBP:

- To evaluate a student’s knowledge of physiology in their general area of interest and to test the student’s ability to integrate this knowledge with other areas of physiology;
- To evaluate the student’s capacity to think creatively and communicate effectively in both oral and written presentations;
- To provide students with a unique learning experience in written and oral communication and to foster development and expression of scientific creativity.
- To ensure that students have thesis committee and thesis proposal, and that the thesis committee agrees to the thesis proposal.
before the student commits to their thesis research.

Process

The DGS and the student’s advisor will help the student to familiarize themselves with guidelines of the Preliminary Examination. Briefly, the process is as follows:

Prelim Committee. The student establishes a Prelim Committee consisting of a minimum of five faculty members (at least four from the IBP Department and one cognate member from outside the IBP Department). The Chair of the Prelim Committee must be a member of the Graduate Committee. A graduate student representative, selected by the student, is present at all functions as a non-voting participant. To avoid conflict of interest, the student’s Thesis Advisor cannot be a member of the Prelim Committee.

Research Proposal. The student writes a research proposal according to the guidelines of an National Institutes of Health (NIH) pre-doctoral fellowship (see: http://grants1.nih.gov/grants/guide/pa-files/PA-09-207.html ). The student, in consultation with their advisor, selects a topic and develops the proposal. Its scope and area should be suitable for a PhD thesis. The selected topic may represent the student’s planned PhD thesis research. The proposal should contain a hypothesis, specific aims, sufficient background and preliminary data to justify the work, and a general outline of the experimental plan to accomplish the aims. The proposal should be distributed to the Thesis Committee at least two weeks before the meeting to allow time for committee members to digest the information.

Input from advisors

The Graduate Committee is aware that there may be some confusion regarding how much input students may receive from advisors and/or other faculty in developing the research proposal. The primary objective of the advisor is to foster the development of scientific creativity and expression and to provide a unique learning experience in written and oral communication. Other objectives are to evaluate a student’s knowledge in their area of interest, to assess the student’s ability to integrate this knowledge to other areas of physiology, and to judge the student’s capacity to think creatively and communicate effectively.

Students should exercise originality and independence in preparing their research proposal. Although proposed experiments and designs should originate with the student, each student is encouraged to seek critical input from their advisor, committee members, other faculty and students. It is acceptable for others to comment on the rationale and justification of the hypothesis, the clarity of the writing, as well as the feasibility of the proposed experimental design, techniques and interpretation of the results. It is not appropriate for a student to copy or include specific aims and experiments that are part of a grant proposal developed previously by the advisor.

Oral Seminar. The student presents a thesis proposal seminar based on the written research proposal. The seminar is open to all members of the IBP Department, the Prelim Committee and other interested individuals. The presentation generally lasts 40-45 minutes and is followed by a discussion in which all present may participate. Afterwards, the public is excused, and the student’s POE committee further questions the student, and then the student is excused and the POE committee votes to Pass the student or pursue other courses of action.

The student’s POE Committee typically serves as the Doctoral Thesis Committee. It is the student’s responsibility to schedule the exam with the POE Committee members and the Graduate School.

Thesis Proposal Form

- This form should be filed soon after the student passes the Preliminary Oral Examination (POE).

The following regulations apply to the Preliminary Oral Exam:

- The POE determines whether the student has
mastered the material in their major and minor/supporting fields at a level the committee deems appropriate for advancement to doctoral candidacy. Thus, the examination is not restricted to a discussion of the research proposal, but will include questions related to coursework in the major and minor/supporting fields.

The Chair of the POE Committee is responsible for the conduct of the exam, ensuring that the line of questioning is appropriate as well as observing Graduate School procedures. Following the seminar, the Prelim Committee meets with the student for further questioning. In addition to addressing issues related to the written research proposal and seminar, questioning will also address the student’s general knowledge of physiology, including both molecular and integrative aspects, using the research proposal as a point of reference. The POE Committee then determines the outcome: Pass, Conditional Pass (which will require remedial action), or Fail.

Passing the Preliminary Oral Examination constitutes official candidacy for a PhD degree. There are no further examinations until the final oral defense of the dissertation.

Failing the Preliminary Oral Examination may result in either a recommendation to repeat the exam, or to terminate graduate studies with or without completion of the MS degree.

The Thesis Defense

Thesis Preparation, Deadlines and Resources
The final step in obtaining the PhD is writing the thesis, defending it in front of the Thesis Committee, and revising it as specified by the committee. Students must adhere to specified formats and timelines in preparing and defending their thesis. Details are provided in the Graduate Student Handbook at:

Upon written completion of the thesis, the PhD candidate takes the final oral examination in defense of their thesis. The final oral exam may take place only after the written thesis has been judged ready for defense by the thesis committee readers. This exam consists of a public seminar in which the candidate presents their thesis and to which the scholarly community is invited. Students must notify IBP staff at least two weeks prior to their thesis defense and provide them with the title, abstract, date, time and location of their thesis defense so appropriate IBP announcements can be prepared. Final Examination Information, assigning committee and scheduling exam is found on the Grad School site:
http://www.grad.umn.edu/students/forms/doctoral/index.html

A closed meeting between the candidate and the thesis Committee immediately follows the thesis presentation. The candidate is then excused and a vote is taken. The final oral exam is limited to the thesis and relevant subject areas.

The Thesis Advisor is responsible for ensuring the inclusion of appropriate modifications and required revisions, if any, in the final thesis. The final oral exam report form will not be signed and submitted to the Graduate school until all revisions have been made.
Determination of Student’s Progress

Academic Performance Policy

1. IBP PhD grad students must achieve a B grade or better in both ANSC 5700 (or PHSL 5700), and PHSL 5101. Failure to achieve a B or better in either class results in academic probation and possible dismissal.

2. IBP PhD grad students must also achieve an overall GPA of 3.0 or better. Failure to achieve a GPA of 3.0 for one semester would result in academic probation. Failure to achieve an overall GPA of 3.0 or better for two or more semesters could result in dismissal.

A PhD student is deemed to be making satisfactory progress by completing most or all of their coursework, submitting the PWE and successful completing the Preliminary Oral Examination (POE) within the first two academic years.

After the second academic year, satisfactory progress is determined by the student's Thesis Advisor. The Thesis Advisor will inform both the student and the DGS if there are problems. A PhD student in the IBP Graduate Program is expected to earn their degree within four-to-six years from the date of the initial registration in the Graduate School. A PhD student is required to meet with their Thesis Committee at least once each year, beginning with the POE.

Meeting with the committee for the POE and final defense constitutes two of the required meetings. During each intervening year, the student must schedule a meeting with the Thesis Committee. The student’s Thesis Advisor must provide the DGS with a summary of the committee’s opinion regarding the student’s progress. The summary must also indicate the date the meeting occurred and the committee members in attendance. The lack of satisfactory progress as defined above is due cause for termination from the IBP Graduate Program.

Thesis Research

The thesis research should make an original and significant contribution to the student’s chosen field of research. The overall scope of the work will vary depending on the research area, but it should be of sufficient quality, depth and originality to be published in peer reviewed scientific journals. The Thesis Committee, together with the student and Thesis Advisor, determine when the research is of sufficient quality and quantity to be appropriate for the PhD thesis defense.

Selection of a Thesis Advisor.

By the end of their first year, each student should have selected a Thesis Advisor from the IBP faculty to guide their thesis research. This selection would have been based on common research interests, and the faculty mentoring style and overall atmosphere of the laboratory. The Thesis Advisor must have a graduate faculty appointment in IBP and must agree to the mentoring relationship.

Thesis Committee.

It is the responsibility of the student to select a thesis committee in conjunction with their advisor and the DGS and to organize annual thesis committee meetings.

This committee is intended to monitor progress and help the student in several ways:
1) Help and evaluate the student’s POE
2) Develop a research program suitable for obtaining the PhD degree
3) Provide guidance during the course of the research and offer suggestions for future directions
4) Ensure that the quality and quantity of research is suitable for obtaining the PhD
5) Help the student and Thesis Advisor determine when sufficient research has been completed to prepare the dissertation.
Ideally, the Thesis Committee is formed soon after the student passes the Preliminary Exam. The first meeting should be held when the research is still in its early stages. Although the length of committee meetings can vary greatly, it is recommended that approximately 2 hours be set aside for each committee meeting.

**Role of the Thesis Advisor and the Thesis Committee.** Although mentoring styles vary tremendously amongst faculty and depending on the student, a few general comments may be helpful. The PhD research may be considered a collaboration between the student and Thesis Advisor. It is appropriate for the Thesis Advisor to provide substantial input and advice regarding development of the research plan, interpretation of results, and determination of next steps. Although this is a collaborative effort, the student should be the driving force. The committee should provide oversight and feedback, and should help the student and Thesis Advisor in development and subsequent modification of the overall research plan. The committee should not require the student and Thesis Advisor to conduct specific experiments; rather, it should serve in an advisory capacity, and ultimately pass judgment as to whether the research and written thesis are sufficient for obtaining a PhD degree. The student is encouraged to seek input from individual committee members outside the scheduled committee meetings.

**Forming the Thesis Committee.** The committee must be formally established with the DGS prior to the first meeting. The IBP Graduate Program Assistant is available to help students fill out the necessary forms. The Graduate School policy states that the Thesis Committee must have at least four members, three of which are regular members of the IBP graduate faculty and one member who has a graduate faculty appointment outside IBP. Students are strongly encouraged to include a fifth committee member so that the committee will be sufficient in number in the event that one member cannot attend the thesis defense. The committee must have a chair (student’s Thesis Advisor, except for the thesis defense).

**Subsequent Committee Meetings.** Subsequent committee meetings should be held at least once a year or more frequently if considered desirable by the student, Thesis Advisor, or Thesis Committee. The goal of these meetings is for the student to present recent progress and for the committee to provide input to the student and Thesis Advisor as to whether satisfactory progress is being made, if the student is on course, and ultimately to help the student and Thesis Advisor decide when sufficient research has been conducted for writing the PhD dissertation.

One week prior to the meeting, the student should distribute to the committee a progress report that includes the hypothesis, specific aims (updated as needed from the original proposal) and research findings obtained since the last meeting. In this progress report, student should include any publications, abstracts or presentations they produced/submitted that are relevant to their thesis research. The student should begin with an oral presentation (PowerPoint recommended) reviewing the material in the progress report. This should be followed by a discussion and suggestions from the committee. The meeting should end by discussing next steps, goals and setting an approximate date for the next meeting.

**Reports of Committee Meeting.** The chair of the Thesis Committee can submit a written report to the DGS within two weeks after the meeting. This report should be signed by both the Thesis Advisor and the student and should be distributed to all committee members. The report should indicate the date of the meeting, committee members in attendance (and absent), and a written narrative describing the events that took place at the meeting. For the first meeting, this report should be sufficiently detailed as to indicate what has been proposed and whether it is feasible and sufficient as thesis research. For subsequent meetings, it should specify progress and if this is sufficient relative to the goals set at
the last meeting. It should include any deficits that were identified and recommendations of the committee. This report should also include goals to be accomplished prior to the next meeting and the approximate date of the next meeting.

Roles and Responsibilities of the Thesis/Dissertation Advisor

Faculty and graduate students share complementary responsibilities in the maintenance of academic standards and the development of high quality graduate programs.

These are basic roles and responsibilities guidelines that advisors follow:

- Provide clear direction for the requirements each student must meet and policies of the graduate program.
- Advise graduate students as to how to develop a program plan, including appropriate course work, research or project activity, and available resources.
- Ensure that each graduate student initiates thesis or dissertation research in a timely fashion.
- Provide training and oversight in creative activities, research rigor, theoretical and technical aspects of the thesis or dissertation research, and professional integrity.
- Create supervisory relations with students that stimulate and encourage students to learn creatively and independently, and respect the academic freedom for students to express options that may differ from those of faculty.
- Encourage graduate students to stay abreast of the literature and cutting-edge ideas in the field.
- Help graduate students to develop professional skills in writing reports, papers, grant proposals and evaluating manuscripts and papers; encourage participation in professional meetings; help establish professional networks/professional contacts for the benefit of students; to develop interviewing skills.
- Provide regular feedback on the progress of graduate students toward degree completion, including feedback on research or creative activities, coursework, teaching, and provide constructive criticism if the progress does not meet expectations.
- Acknowledge student contributions in research presented at conferences, in professional publications, or in applications for copyrights and patents.
- Help graduate students develop into successful professionals and colleagues, including encouraging students to participate and disseminate results of research or creative activities in the appropriate scholarly or public forums.
- Facilitate career development, including advising graduate students on appropriate job and career options, as well as on the preparation of application materials for appropriate fellowship, scholarship, and other relevant opportunities.
- Write letters of reference for appropriate fellowship, scholarship, award, and job opportunities.
- Provide for supervision and advising of graduate students when the Faculty Advisor is on leave or extended absence.
Roles and Responsibilities of the Student

These are some basic roles and responsibilities guidelines that students should follow:

- Adhere to and take responsibility for learning university and academic unit rules, procedures, and policies applicable to graduate study, research or creative activities.
- Meet university and academic unit requirements for degree completion.
- Recognize that in many disciplines, the Faculty Advisor provides the intellectual and instructional environment in which the student conducts research, and may, through access to teaching and research funds, also provide the student with financial support.
- Respect faculty member’s need to allocate their time and other resources in ways that are academically and personally productive.
- Devote an appropriate amount of time and energy toward achieving academic excellence and earning an advanced degree in a timely fashion.
- Acknowledge the contributions of the Faculty Advisor and other members of the research team to the student’s work in all publications and conference presentations.
- Follow disciplinary and scholarly codes of ethics in course work, thesis or dissertation research, and in creative activities.
- Practice uncompromising honesty and integrity according to university and federal guidelines in collecting and maintaining data.
- Seek regulatory approval for research in the early stages of thesis or dissertation work where applicable.
- Take initiative to communicate regularly with Faculty Advisor(s) on progress toward completion of the thesis or dissertation.

- Work cooperatively with supervising faculty and Teaching Assistants (TA) to accomplish the tasks set out in TA assignments.
- Give adequate attention to the teaching role by conscientious efforts in planning, preparation, and implementation of TA assignments.
- Achieve an appropriate balance between teaching responsibilities and other essential activities.

Professionalism and Ethics Related Links:

- Professional Ethics and Conduct of Research
- Educational Requirements for Grad Students and Postdocs
- Teaching Ethics for Research, Scholarship, & Practice (University of Minnesota, State & Federal Policies and Procedures)
- On Being A Scientist: Responsible Conduct In Research

an online book (local copy)
Graduation Information

Graduation Application Deadlines

Graduate School degrees are awarded monthly. To graduate at the end of any given month students must:

☐ Submit your Graduate School Application for Degree form to a One Stop Student Services Center on or before the first workday of the month. For more information, see the graduate student graduation checklist at onestop.umn.edu/degree_planning/graduation/graduate_checklist.html.

☐ Complete all other requirements by the last work day of the month.

☐ Graduating before the end of the term may affect your eligibility for financial aid (work-study, student loans), housing, and other benefits conferred by your student status. Check with the appropriate office, if you have questions on eligibility.

☐ The Application for Degree form and detailed graduation instructions are available from 316 Johnston Hall. (map online at http://www.umn.edu/twincities/maps/JohnH/)

The award of the degree should appear on the transcript within two to three weeks following graduation. The diploma will be mailed from the Registrar’s office four to six weeks after graduation.

Commencement Information

Graduate School commencement ceremonies are held in the fall and spring terms. If you wish to participate in commencement, contact the Graduate School, 316 Johnston Hall, one term in advance of the ceremony. http://www.grad.umn.edu/current_students/degree_completion/commencement/

Attending a ceremony does not imply that you have officially graduated.

Prior to the Ceremony

Deadline for participation: Graduate students interested in participating in the commencement ceremony must submit their Commencement Attendance Approval Form to the Graduate Student Services and Progress Office, 316 Johnston Hall.

Check http://www.grad.umn.edu/current_students/degree_completion/commencement/ for current deadline dates.

Ordering academic regalia: Students can order academic regalia in person or by phone through the Bookstore in Coffman Memorial Union (625-6000) or Books Underground on the St. Paul Campus (625-3138); or via the Bookstore’s website. Check http://www.grad.umn.edu/current_students/degree_completion/commencement/ for current deadline dates.

Students can also order regalia during Grad Fest which will be held in the Great Hall in Coffman Memorial Union. See http://www.grad.umn.edu/current_students/degree_completion/commencement/ for current dates.

Guest Accommodations:

While every attempt will be made to provide requested accommodations, please be advised that handicap and wheelchair seating is very limited.
(Check hotels for special U of MN rates.)

University Hotel (Radisson)
615 Washington Avenue SE
(612) 379-8888

Holiday Inn Metrodome
1500 Washington Avenue S
(612) 333-4646

Minneapolis Days Inn-U of MN
2407 University Avenue SE
(612) 623-3999

Econo Lodge
2500 University Avenue SE
(612) 331-6000

Change in plans? If your plans change and you decide not to attend the ceremony, please notify the Graduate School.

Master’s students: gsmast@umn.edu
Doctoral students: gsdoc@umn.edu
Faculty: starry@umn.edu.

5 Miscellaneous

List of IBP Grad Program Student Tuition and Fees:

All numbers are approximate:

$U \text{ of } M \text{ Grad Tuition Benefit: } \sim$7285.00
$AHC \text{ Student Health Plan } \sim$1340.00

<table>
<thead>
<tr>
<th>Students are responsible for the following fees (estimates):</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Enhancement Fee</td>
<td>$75.00</td>
</tr>
<tr>
<td>GA Health Plan Base Premium</td>
<td>$96.90</td>
</tr>
</tbody>
</table>

| Transportation Fee                                          | $19.00     |
| Student Services Fee                                        | $368.29    |
| Grad & Prof Student Assembly Fee                            | $12.08     |
| Stadium fee                                                 | $12.50     |
| Total approximate amount paid by Graduate student each semester | \sim$566.00 |

No summer registration will mean a \sim$75.00 drop in pay per pay period.

**Health Insurance for Graduate Assistants**

All new and continuing students holding a fellowship or at least a 25% graduate assistantship will need to complete an application for coverage by the graduate assistant medical plan. See Penny Busch, IBP Human Resource Specialist, 6-120 Jackson Hall for an Application Packet. Submit the Enrollment Form as soon as possible to the Graduate Assistant Insurance Office, N323 Boynton Health Service, 625-6936. Students who hold at least a 50% graduate assistantship during both semesters of the academic year, will be covered by the health insurance plan during the following summer, as well. When you register, students must provide the name of their health insurance provider and their policy number on their registration form, or they will automatically be charged for a University-sponsored hospitalization plan, which is not the same as the plan for graduate assistants. Read the Class Schedule and the graduate assistant health insurance Application Packet for more information. Should a student suffer an injury while fulfilling their duties as a graduate assistant,
they must complete an Employee Incident Report form to report the injury and file for worker’s compensation. This must be done as soon as physically possible following the injury. Further information on the policy go to www.fpd.finop.umn.edu/groups/ppd/documents/policy/workers_comp.cfm, or see Penny Busch, IBP Human Resource Specialist, 6-120 Jackson Hall for a copy of the form.

Serving as a Graduate Assistant and Related Financial Matters

Until the date student-advisor pairings are announced, students without their own external or internal fellowships will be paid with fellowship funds provided by the IBP Department. Students do not incur any obligation other than to be enrolled, take a full course load (13-14 course credits or as advised by the DGS) and identify top choices for the advisor.

After a student joins a thesis research lab with a thesis advisor, the student will be paid entirely from their Thesis Advisor’s research grant(s). Students continue taking courses and performing research related to the project funded by the grant.

Paychecks are issued every other Wednesday. To have your pay deposited directly into your bank account, please complete a Direct Deposit Authorization Form. Students who opt for direct deposit can view their pay statements on line at http://hrss.umn.edu/. For students who do not opt for direct deposit, paychecks will be put in their mailbox. All payroll, health and tuition benefit questions should be directed to Molly Rochford, IBP Human Resource Specialist, 6-120 Jackson Hall, (612) 625-3687.

Laboratory Safety Training

New graduate students in the IBP Graduate Program must complete two-hours of lab safety training. This training will be offered twice at the start of each fall semester.

Anyone not attending a training session will not be allowed access to the Nils Hasselmo Hall labs or the Shepherd Laboratories.

Dates for training sessions can be found at: http://www.dehs.umn.edu/training.htm

Responsible Conduct of Research

The Graduate School mandates that all graduate students receive the equivalent of 8 hours of instruction in Responsible Conduct of Research (RCR). Dates for RCR workshop sessions can be found at the link below: http://cflegacy.research.umn.edu/first/CourseSchedReg.htm.

New graduate students should visit http://www.grad.umn.edu/ethics/ethics_brochure.html. This site is intended to introduce beginning graduate students to RCR concepts; to institutional expectations regarding intellectual honesty and integrity; and to our commitment to provide educational opportunities and resources for students to learn about these topics. Graduate students in IBP must take at least a formal ethics course related to biomedical research.

Frequently Asked Questions (FAQ)

Highlights from The Graduate School - Frequently Asked Questions (FAQ) http://www.grad.umn.edu/current_students/faq.html

What is the Graduate School’s registration requirement?

As a Graduate School student you are required to register every fall and spring term to maintain active status up through and including the term in which you will officially complete your degree. Failure to maintain your active status will result in
the discontinuation of your student status and require applying for readmission.

What is full time status?
Full time status is 6 or more credits. Some University benefits are reliant upon the registration of at least 6 credits. Students should contact the office providing the benefit to inquire about minimum registration requirements.

What is active status?
Graduate School students maintain active status by registering in the Graduate School every fall and spring term (for any credit amount or course type).

What happens if I don’t maintain active status?
Graduate School students who do not maintain active status are considered to have withdrawn, and their student status is deactivated. Inactive students may not take examinations, submit degree progress paperwork, apply for graduation, or complete their degrees. Inactive students who wish to resume graduate work must apply for readmission to the Graduate School.

I am done with my coursework and thesis credits (if applicable) and need to maintain full time status. What should I do?
You have the option to register as an advanced status student by applying for the full time equivalent (FTE) credit (xxxx 8333 (masters) or xxxx 8444 (doctoral)). You must apply for this status each term you wish to hold this benefit. More information is available at [http://www.grad.umn.edu/current_students/registration/FTE_procedures.html](http://www.grad.umn.edu/current_students/registration/FTE_procedures.html).

What is the maximum credit load the Graduate School allows?
The Graduate School allows registration for up to 18 credits. However, most offices providing tuition benefits will not pay for more than 14 credits. Students should check with the office providing the tuition benefit to determine the number of credits that will be covered.

I didn’t register last term and now my status is inactive. What should I do?
You must apply for re-admission through the Graduate Office of Admissions by completing a Change of Status/Readmission Application at [http://www.grad.umn.edu/current_students/registration/readmission.html](http://www.grad.umn.edu/current_students/registration/readmission.html).
Appendix A

Graduate Faculty in the Department of Integrative Biology & Physiology

The following Graduate Faculty can serve as Thesis Advisors for PhD students. Please note that this list will change over time. Consult the DGS or the IBP Grad web site for the most up-to-date list.

<table>
<thead>
<tr>
<th>Name</th>
<th>Research Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atsushi Asakura, Ph.D.</td>
<td>Molecular mechanisms controlling muscle stem cells</td>
</tr>
<tr>
<td>Robert Bache, MD</td>
<td>Coronary circulation</td>
</tr>
<tr>
<td>Alessandro Bartolomucci, PhD</td>
<td>Stress pathophysiology; Obesity; Vgf gene-derived peptides</td>
</tr>
<tr>
<td>David Bernlohr, PhD</td>
<td>Adipose biology</td>
</tr>
<tr>
<td>Peter Bitterman, MD</td>
<td>Respiratory medicine</td>
</tr>
<tr>
<td>William C. Engeland, PhD</td>
<td>Adrenal gland physiology</td>
</tr>
<tr>
<td>Ervasti, James M.</td>
<td>Molecular basis of Muscular Dystrophy; Role of actin in cell polarity</td>
</tr>
<tr>
<td>Daniel Garry, MD, PhD</td>
<td>Regenerative medicine; Cardiogenesis; Stem cell biology</td>
</tr>
<tr>
<td>Mary G. Garry, PhD</td>
<td>Determining the role of TRPv1 dysregulation in cardiovascular responses to exercise in heart failure, determining factors that dysregulate the TRPv1 in heart failure, and determining factors that mark the group III afferent neuron.</td>
</tr>
<tr>
<td>Jennifer Hall</td>
<td>Translational genomics</td>
</tr>
<tr>
<td>Robert Hebbel, MD</td>
<td>Vascular Biology</td>
</tr>
<tr>
<td>Paul Iaizzo, PhD</td>
<td>Muscle cell pathophysiology</td>
</tr>
<tr>
<td>David H. Ingbar, MD</td>
<td>Alveolar epithelial repair and clearance of alveolar edema fluid</td>
</tr>
<tr>
<td>Catherine M. Kotz, PhD</td>
<td>Neuropeptidergic regulation of energy balance</td>
</tr>
<tr>
<td>Walter Low, PhD</td>
<td>Nerve cell transplantation and gene therapy</td>
</tr>
<tr>
<td>Dawn Lowe, PhD</td>
<td>Muscle Physiology</td>
</tr>
<tr>
<td>Doug G. Mashek, Ph.D,</td>
<td>role and regulation of fatty acids in energy metabolism</td>
</tr>
<tr>
<td>Joseph Metzger, PhD</td>
<td>Integrative systems biology of cardiovascular function; Cardiac genetic engineering and experimental cardiac gene therapy; Transgenic models of heart disease; Molecular mechanisms of sarcomere function</td>
</tr>
<tr>
<td>Scott O’Grady, PhD</td>
<td>Electrolyte transport in epithelia</td>
</tr>
<tr>
<td>John W. Osborn, PhD</td>
<td>Pathophysiology of hypertension</td>
</tr>
<tr>
<td>Angela Panoskaltsis-Mortari, PhD</td>
<td>Idiopathic pneumonia syndrome; biology of graft-versus-host disease</td>
</tr>
<tr>
<td>Steer, Clifford, MD</td>
<td>Liver, bone marrow and brain disorders; bile acids as potent antiapoptotic agents; role of microRNAs in gene regulation.</td>
</tr>
<tr>
<td>Name</td>
<td>Institution</td>
</tr>
<tr>
<td>-------------------------------------------</td>
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<tr>
<td>Alena Talkachova, PhD</td>
<td></td>
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<tr>
<td>David Thomas, PhD</td>
<td></td>
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<tr>
<td>DeWayne Townsend, DVM, PhD,</td>
<td></td>
</tr>
<tr>
<td>Cardiac Gene Transfer; Dystrophic Cardiomyopathy; Regulation of Coronary Blood Flow</td>
<td></td>
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<tr>
<td>LaDora Thompson, PhD</td>
<td></td>
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<tr>
<td>Demetris Yannopoulos</td>
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<tr>
<td>Robert Tranquillo</td>
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<tr>
<td>Jianyi Zhang, MD, PhD</td>
<td></td>
</tr>
</tbody>
</table>

The following Graduate Faculty can serve on Thesis Committees.

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mustafa N. al'Absi, PhD</td>
<td>Duluth Campus</td>
<td>Neurobiological mechanisms of stress and risk for heart disease; Biological and psychosocial predictors of addiction and relapse; Pain perception and endogenous opioid system functions</td>
</tr>
<tr>
<td>David Levitt, MD, PhD</td>
<td></td>
<td>X-ray crystallography of protein structure</td>
</tr>
<tr>
<td>Lisa Carney Anderson, PhD</td>
<td>Duluth Campus</td>
<td>Muscle cardiovascular</td>
</tr>
<tr>
<td>Edward K. Stauffer, PhD, Duluth Campus</td>
<td></td>
<td>Spinal mechanisms of motor control; Intrinsic electrophysiological properties of spinal neurons</td>
</tr>
<tr>
<td>Janet L. Fitzakerley, PhD</td>
<td>Duluth Campus</td>
<td>Sensory physiology; Hearing science; Central nervous system development; Information processing in the brainstem and inner ear.</td>
</tr>
<tr>
<td>O. Douglas Wangensteen, PhD</td>
<td>Duluth Campus</td>
<td>Respiratory physiology; Bronchial epithelium</td>
</tr>
<tr>
<td>Göran B. Hellekant, PhD</td>
<td>Duluth Campus</td>
<td>Anatomy</td>
</tr>
<tr>
<td>Anthony J. Weinhaus, PhD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lois J. Heller, PhD</td>
<td>Duluth Campus</td>
<td>Influences of various pathophysiological conditions upon cardiac function</td>
</tr>
<tr>
<td>Lorentz Wittmers, Jr., MD, PhD</td>
<td>Duluth Campus</td>
<td>Temperature regulation and metabolism with special emphasis on cold exposure and hypothermia; Pain perception and addiction with special emphasis on smoking and smoking cessation.</td>
</tr>
<tr>
<td>Stephen A. Katz, PhD</td>
<td></td>
<td>Renin Angiotensin system Adipocyte endocrinology</td>
</tr>
</tbody>
</table>
Appendix B

Graduate Course Options

Statistics Options

**STAT 5021 - Statistical Analysis**
(4.0 cr; = [ANSC 2211, ESPM 3012, STAT 3011]; Prereq=: 3011; College algebra or #; Stat course recommended; fall, spring, every year) Intensive introduction to statistical methods for graduate students needing statistics as a research technique. Warning: This has not been the favorite stats class according to our student survey.

**PUBH 6414 - Biostatistical Methods I**
(3.0 cr; = [PUBH 6450]; Prereq=Public Health [MPH or certificate] student or [environmental health [MS or PhD] or health journalism MA or health informatics [MS or PhD]] major or #; A-F only, fall, spring, summer, offered when feasible) Descriptive statistics, graphical methods. Use of Excel. Proportions, relative risk, odds ratios. Random sampling. Estimates of mean, medians, measures of variability. Normal distribution, t-/chi-square tests. Confidence intervals. Correlation/regression. Inference/causality.

**PUBH 6450 – Biostatistics I**
4.0 cr; Gaussian probability models, point/interval estimation for means/proportions. Hypothesis testing, including t, chi-square, and nonparametric tests. Simple regression/correlation. ANOVA. Health science applications using output from statistical packages.

**PUBH 6451 - Biostatistics II**
(4.0 cr; Prereq=[[6420, 6450] or [6414, 6415]] with grade of at least B, health sciences grad student] or #; spring, every year). Two-way ANOVA, interactions, repeated measures, general linear models. Logistic regression for cohort and case-control studies. Loglinear models, contingency tables, Poisson regression, survival data, 

Molecular / Cellular Biology Options

**BIOL 4003 - Genetics**
(3.0 cr; = [GCD 3022]; Prereq=[[BIOC 3021 or BIOC 4331], [any CBS major or major in [animal science or applied plant science or BA biology or BA microbiology or nutrition or physiology or biology/society/environment]]] or #; fall, spring, summer, every year) Introduction to the nature of genetic information, its transmission from parents to offspring, its expression in cells/organisms, and its course in populations.
Graduate Course Options (Cont.)

**Molecular / Cellular Biology Options (cont.)**

**BIOL 4004 - Cell Biology**
(3.0 cr; Prereq-[3021 or BIOC 3021 or BIOC 4331], [4003 or BIOC 4332]; fall, spring, summer, every year) Processes fundamental to cells. Emphasizes eukaryotic cells. Assembly/function of membranes/organelles. Cell division, cell form/movement, intercellular communication, transport, secretion pathways. Cancer cells, differentiated cells.

**BIOC 4331 - Biochemistry I: Structure, Catalysis, and Metabolism in Biological Systems**
(4.0 cr; Prereq-[[BIOL 1002 or BIOL 1009 or BIOL 2003 or equiv], [CHEM 2302 or equiv]] or #; fall, spring, every year) Advanced survey of structure/catalysis, metabolism/bioenergetics.

**BIOC 4332 - Biochemistry II: Molecular Mechanisms of Signal Transduction and Gene Expression**
(4.0 cr; Prereq-4331 or #; spring, every year) Advanced survey of molecular biology, mechanisms of gene action, and biological regulation.

* 4000 level courses above only by permission of DGS and advisor.

**BIOC 6021 - Biochemistry**
(3.0 cr; =[BIOC 3021]; Prereq-general biology, organic chemistry, #; intended for MBS students; fall, spring, summer, every year) Fundamentals of biochemistry. Structure/function of proteins, nucleic acids, lipids and carbohydrates. Metabolism, regulation of metabolism. Quantitative treatments of chemical equilibria, enzyme catalysis, and bioenergetics. Chemical basis of genetic information flow.
Biomedical Engineering

**BMEN 5001 - Advanced Biomaterials**  
(3.0 cr; Prereq-3301 or MatS 3011 or grad student or #; A-F or Aud, fall, every year)  
Commonly used biomaterials. Chemical/physical aspects. Practical examples from such areas as cardiovascular/orthopedic applications, drug delivery, and cell encapsulation. Methods used for chemical analysis and for physical characterization of biomaterials. Effect of additives, stabilizers, processing conditions, and sterilization methods.

**BMEN 5041 - Tissue Engineering**  
(3.0 cr; Prereq-IT upper div or grad student or med student or #; fall, spring, every year)  
Fundamentals of wound healing and tissue repair; characterization of cell-matrix interactions; case study of engineered tissues, including skin, bone marrow, liver, vessel, and cartilage; regulation of biomaterials and engineered tissues.

**BMEN 5101 - Advanced Bioelectricity and Instrumentation**  
(3.0 cr; Prereq-[IT upper div, grad student] or #; spring, offered when feasible)  
Instrumentation, computer systems, and processing requirements for clinical physiological signals. Electrode characteristics, signal processing, and interpretation of physiological events by ECG, EEG, and EMG. Measurement of respiration and blood volume/flow.

**BMEN 5102 - Bioelectric Measurements and Therapeutic Devices II**  
(3.0 cr; Prereq-5101 or #; spring, every year)  
Theory/application of electrical stimulation in areas of therapeutic/functional neuromuscular stimulation and pain control, cardiac pacing, defibrillation, tissue healing, and electrotherapy. Safety of electric fields. Electrical tissue impedance measurements.

**BMEN 5351 - Cell Engineering**  
(3.0 cr; Prereq-[2501 or 5501], CSCI 1107, [Math 2243 or Math 2373], [IT upper div or grad student or #]; fall, spring, offered when feasible)  
Engineering approaches to cell-related phenomena important to cell/tissue engineering. Receptor/ligand binding. Trafficking/signaling processes. Applications to cell proliferation, adhesion, and motility. Cell-matrix interactions.

**Physiology Courses**

**PHSL 4021 - Advanced Physiology and Bioengineering: Bionic Human**  
(3.0 cr; Prereq-3061 or 3063 or 5061 or #; A-F only, spring, every year)  

**PHSL 5095 - Problems in Physiology**  
(1.0 - 5.0 cr [max 20.0 cr]; Prereq-#; fall, spring, summer, every year)  
Individualized study in physiology. Students address selected problem through library or lab research, supervised by physiology faculty.
PHSL 5444 - Muscle  
(3.0 cr; = [BIOC 5444]; Prereq-3061 or 3071 or 5061 or BioC 3021 or BioC 4331 or #; spring, every year) Muscle membranes: structures, mechanisms, and physiological roles of channels/pumps. Muscle contraction: force generation by actin/myosin.

PHSL 5510 - Advanced Cardiac Physiology and Anatomy (Short Course)  
(2.0 - 3.0 cr [max 2.0 cr]; Prereq-#; spring, every year) Fundamental concepts, advanced topics related to clinical/biomedical cardiac physiology. Lectures, laboratories, workshops, anatomical dissections. Intense, one week course, in early January.

PHSL 5525 - Anatomy and Physiology of the Pelvis and Urinary System (Short Course)  
(1.0 - 2.0 cr [max 2.0 cr]; Prereq-#; spring, every year) Fundamental concepts and advanced topics related to Pelvic Physiology. Lectures, laboratories, workshops, anatomical dissections. Intense, 3-day course, in early January.

PHSL 8222 - Central Regulation of Autonomic Function  
(3.0 cr; = [NSC 8222]; Prereq-NSC 5561 or #; A-F or Aud) Neural/hormonal sensory pathways affecting central autonomic nuclei involved in maintenance of homeostasis. Current research on physiological control systems at cellular, organ, and integrative levels. Offered fall of odd-numbered years. This class is not offered every year.
Appendix C

PHD Program
Year 1 Checklist

August

☐ Enroll in classes for Fall Semester (Assistant to the DGS will help you with this)

☐ Meet with DGS to choose mentor for 1st lab rotation

Fall Semester

☐ Coursework:
  o Phsl/Ansc 5700 (Cell Physiology, Scott O’Grady, St. Paul campus)
  o Phsl 5096 (seminar)
  o Phsl 8294 (lab rotation)
  o Bioc 6021 or GCD 5036 (Molecular Cell Biology or Biochemistry)

☐ lab rotation – 10-20 hrs/week

☐ Meet with DGS to choose 2nd lab rotation (mid to end of 1st semester)

Spring Semester

☐ Coursework:
  o Phsl 5101 (Medical Physiology) - begins in early January
  o Phsl 8232 (Journal course - Critical reading in Phys) – in conjunction with Phsl 5101
  o Bioc 8401 (Ethics)
  o PUBH 6450 or Stat 5021 (Stats) - disregard if already taken
  o Phsl 5096 (Seminar)
  o Phsl 8294 (lab rotation) – if needed

☐ lab rotation – 10-20 hrs/week

End of Spring Semester

☐ Take Preliminary Written Exam (PWE)

Summer

☐ lab rotation if needed

☐ Select a Thesis Advisor (faculty advisor)
Year 2 Checklist

Fall Semester

☐ Coursework:
  - Phsl 5701 (Phsl lab TA)
  - Phsl 5096 (seminar)
  - Phsl 8888 (fill in thesis credits)
  - Stats course (if still needed)

Spring Semester

☐ Coursework:
  - Phsl 8242 (Joe’s grant writing)
  - Phsl 5096 (seminar)
  - Phsl 5097 (Alessandro’s Stress Physiology) - Optional
  - Phsl 8888 (fill in thesis credits)
  - Stats Course (if still needed)

Summer

☐ give seminar

☐ Register for Phsl 8888 (up to 14 credits)

☐ File Degree Program Transmittal form to Grad School (DGS Asst will help you with this)

☐ Write thesis research proposal (see NIH guidelines: http://grants1.nih.gov/grants/guide/pa-files/PA-09-207.html)

☐ Establish an Oral Prelim Committee – 4-5 (3-4 from IBP and 1 outside IBP)

☐ Assign/Update Preliminary Oral Examining Committee online: http://www.grad.umn.edu/students/forms/doctoral/index.html

☐ Schedule Oral Exam online: http://www.grad.umn.edu/students/prelimschedule/index.html

☐ Distribute proposal at least two weeks prior to OPE

☐ OPE late summer early fall
Year 3 Checklist

Fall Semester

☐ Register for 12 credits of thesis credits – Phsl 8888 (if needed – 24 total is required)

Spring Semester

☐ Register for 1 credit of Phsl 8444

Summer

☐ Give seminar and thesis committee meeting

Year 4 & 5 Checklist

Fall Semester

☐ Register for 1 credit of Phsl 8444

Spring Semester

☐ Register for 1 credit of Phsl 8444

☐ Give seminar and thesis committee meeting


☐ Schedule Thesis Defense: http://www.grad.umn.edu/students/forms/doctoral/index.html

Summer

☐ Give seminar and thesis committee meeting
Appendix D

DEGREE COMPLETION STEPS

Doctor of Philosophy
Doctor of Education

In order to receive your degree, the following procedures must be completed. You must maintain active student status by registering every fall and spring semester until your degree is awarded. All forms must be submitted to the Graduate Student Services and Progress (GSSP) office unless otherwise noted. Contact your graduate program office for program-specific requirements and deadlines.

1. Complete Graduate Degree Plan
   Submit at least one semester prior to your preliminary oral exam

2. Assign members to preliminary oral exam committee
   Complete at least one month prior to exam via www.grad.umn.edu/students/forms/docto.shtml

3. Complete Preliminary Written Exam
   Program staff report results to GSSP. Must be on file with GSSP to be authorized to take preliminary oral exam

4. Schedule preliminary oral exam
   Notify GSSP of scheduled exam at least one week in advance

5. Submit Preliminary Oral Report
   Submit for your record to reflect doctoral candidacy

6. Assign members to doctoral final exam committee
   Complete at least one month prior to exam via www.grad.umn.edu/students/forms/docto.shtml

7. Request Graduation Packet
   Packet will include the Graduate Application for Degree form and Reviewers’ Report form. You can request it in person or online up to one semester before your doctoral final exam.

8. Schedule doctoral final exam
   Notify GSSP of scheduled exam at least one week in advance

9. Submit Graduate Application for Degree
   Submit to One Stop by the first business day of anticipated month of graduation

10. Submit Reviewers’ Report
    Submit prior to your defense

11. Submit Doctoral Final Exam Report
    Submit no later than the last business day of anticipated month of graduation

12. Submit dissertation/project
    Submit by the last business day of anticipated month of graduation. Consult Graduation Packet for formatting guidelines.

Questions?
Contact the Graduate Student Services and Progress office (160 Williamson Hall)
http://www.grad.umn.edu/students/docto.shtml

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