

BioMolecular Sciences



Molecular, Cellular and Integrative Physiology PhD Program Requirements

Course Requirements

Lecture Classes

- PSL 829: Cellular and Integrative Physiology II (Fall, hybrid format, 3 credits)
- PSL 828: Cellular and Integrative Physiology (Spring, in-person, 3 credits)
- At least 9 credits from elective courses (800 level and higher) that have been approved by the Physiology Graduate Program Director, in consultation with their research advisor.

Note: elective courses should be selected by the student to support their specific research/training interests. The dissertation mentor and guidance committee may also suggest elective courses to develop knowledge and skills relevant to the dissertation research topic. Format of elective courses varies.

Seminar Classes (at least 4 credits):

- PSL 950: Topics in Physiology. Four PSL 950 courses to be taken at any time during the PhD program.

PSL 950 courses are 1 credit each, topics vary by semester and are typically held in-person. Other 800-level seminar courses can be substituted for up to 2 cr of the requirement, per approval of MCIP Grad Program Director. You can take one PSL 950 topics course up to two times, but the remaining credits must come from different topics.

Teaching Requirement

- One semester as a Teaching Assistant (usually completed during the second year in the program)

Other Requirements

- Graduate School Responsible and Ethical Conduct of Research (RECR) Seminar Series & refresher each year (pg 7)

Encouraged Activities to Develop your Skill in Scientific Research and Communication

- Participation in Physiology Research Forum (every other week during fall & spring semesters)
- Participation in Department of Physiology Seminars (Thursdays, 4-5 pm during fall & spring semesters)
- Participation in the Annual Physiology Department Retreat

Comprehensive Exam

The Comprehensive Exam involves the following components:

1. **Preparation of a written proposal based on the dissertation project:** This proposal can be generated in consultation with the mentor. It must be written in the form of a current NIH predoctoral fellowship (1 page for specific aims + 6-page research plan).
2. **Preparation of a 3-page proposal on a topic given by the Doctoral Guidance Committee.** This proposal must be completed independently, without help from the dissertation mentor
3. **Oral presentation of the proposed research project in an open seminar.** The student can confer with the dissertation mentor in preparing this presentation
4. **Closed-Door Examination with the Doctoral Guidance Committee.** This occurs after the open seminar. The examination committee consists of the Guidance Committee plus an appointed member of the Physiology Graduate Advisory Committee. The student's dissertation advisor is not allowed to be present for, or to participate in this component of the examination.

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Envisioned Timeline for MCIP PhD Program

Year	Fall	Spring
1	PSL 829: Cellular and Integrative Phys II Elective 1 BMS Research Forum Rotations	PSL 828: Cellular and Integrative Phys I Elective 2 BMS Research Forum
2	PSL 950: Topics in Physiology Elective 3 (in Fall or Spring) PSL 999: Dissertation Research <i>(Recommend 3 credits)</i> Guidance Committee Selection Dissertation Research TA Requirement in Fall <u>or</u> Spring	PSL 950: Topics in Physiology PSL 999: Dissertation Research <i>(Recommend 3 credits)</i> First Guidance Committee Meeting Dissertation Research TA Requirement in Fall <u>or</u> Spring
End of Year 2: Beginning of Year 3	Comprehensive Exam: written proposal, research presentation, committee questions	
3	PSL 950: Topics in Physiology PSL 999: Dissertation Research <i>(Recommend 3 credits)</i>	PSL 950: Topics in Physiology PSL 999: Dissertation Research <i>(Recommend 3 credits)</i>
4 and 5	PSL 999: Dissertation Research <i>(Recommend 3 credits)</i>	PSL 999: Dissertation Research <i>(Recommend 3 credits)</i>
Culmination: Dissertation Defense (Must be Registered for at least 1 credit PSL 999 during semester you defend)		

Year 1:

- Rotations, RECR training and Selection of Research Advisor (by end of Spring semester)
- No need to enroll in Research Credits (PSL 999) until Year 2

Pre-Comprehensive Exam:

- If NOT on an Assistantship: need to be registered for at least **6** total credits each fall and spring
- If on an Assistantship: need to be registered for at least **3** total credits each fall and spring
- Summer: Do not need to register for credits *unless* taking a summer course

Post-Comprehensive Exam:

- Must be registered for at least **1** credit each fall and spring
- Summer: Do not need to register for credits unless completing defense during the summer. Consult MCIP Program Assistant and Graduate Program Director for specific guidance.

Research Credits (PSL 999): Need Minimum of 24 Research Credits for Graduation (maximum 36 cr)

Years 2-5: Recommend registering for 3 cr of PSL 999 each fall/spring to ensure meeting 24 cr requirement

Years 6+ (if applicable): Recommend registering for 1 cr of PSL 999 each fall/spring to stay within cr maximum

More information can be found at: <https://physiology.natsci.msu.edu/academics/graduate/molecular-cellular-and-integrative-physiology-graduate-handbook/>

Sample Electives for Molecular, Cellular and Integrative Physiology

At least 9 credits from elective courses are required for the MCIP PhD program.

The purpose of elective courses is to support the student's specific research training career interests. Students are therefore recommended to confer with their dissertation mentor, guidance committee, and/or the MCIP Graduate Program Director to identify relevant elective courses to facilitate their training goals.

Below is a list of elective course suggestions, but students are not confined to these topics or specific choices. Any graduate course (800 level and higher) can count as an elective.

Animal Science

ANS 901: Visualization of Scientific Data (Fall, 1 credit)

Biochemistry and Molecular Biology

BMB 801: Molecular Biology (Fall, 3 credits)

BMB 802: Metabolic Regulation and Signal Transduction (Spring, 3 credits)

BMB 805: Protein Structure, Design, and Mechanism (Spring, 3 credits)

BMB 825: Cell Structure and Function (Spring, 3 credits)

BMB 829: Special Problems in Macromolecular Analysis and Synthesis (Fall, *Must take 301 + any others*)

- Module 301: Introduction to Methods in Biochemistry and Molecular Biology (1 credit)
- Module 302: Recombinant DNA and Genome Editing (1 credit)
- Module 303: Discovery and Analysis of Molecular Interactions (1 credit)
- Module 304: Separation and Analysis of Cells and Molecules (1 credit)
- Module 305: Molecular Structure Elucidation and Analysis (1 credit)

Cell and Molecular Biology

CMB 855: Advanced Mammalian Genetics (Fall, 1 credit)

Computational Mathematics, Science and Engineering

CMSE 890: Bioinformatics (*Offered in 1 credit modules.*)

- Module 301: Programming Foundations for Bioinformatics (1 credit)
- Module 302: Statistical Analysis and Visualization of Biological Data (1 credit)
- Module 303: Data Handling: Unix and Python (1 credit)
- Module 304: Intro to Genomics (1 credit)
- Module 305: Transcriptomic Data Analysis (1 credit)
- Module 310: Gaps, Errors and Missteps in Statistical Data Analysis (1 credit)

Microbiology, Genetics, and Immunology

MGI 852-854: Immunology (Fall odd years, three consecutive 1 credit modules)

MGI 835: Eukaryotic Molecular Genetics (Spring, 3 credits)

Microscopy

NSC 837: Confocal Microscopy (Fall and Spring, 3 credits)

Neuroscience

NEU 801: Molecular, Cellular and Developmental Neuroscience I (Fall, 3 credits)

NEU 802: Systems and Behavioral Neuroscience I (Fall, 3 credits)

NEU 803: Molecular, Cellular and Developmental Neuroscience II (Spring, 3 credits)

NEU 805: Systems and Behavioral Neuroscience II (Spring, 3 credits)

Pathology & Diagnostic Investigation

PDI: 851: Advanced General Pathology (Fall of even years, 3 credits)

Pharmacology

PHM 801: Fundamental Principles of Pharmacology and Toxicology (Fall, 3 credits)

PHM 802: Cellular, Molecular and Integrated Systems Pharmacology (Fall, Spring, 3 credits)

PHM 829: Neuropharmacology (Fall, 3 credits)

PHM 830: Experimental Design and Data Analysis (Fall or Summer, 3 credits, online, 3 credits)

PHM 980 (Section 005): Pharmacology of Excitable Cells (Spring, 2 credits)

Physiology

PSL 813: Molecular Mechanisms of Human Disease and Targeted Therapies (Fall of odd years, 3 credits)

PSL 950 Courses

Four PSL 950 courses are required for the MCIP PhD program.

The purpose of PSL 950 courses is to examine a specific physiological topic and to engage in its scientific literature. Via participating in these courses students will acquire knowledge of the topic, as well as developing skill in critically evaluating primary literature, experimental design, and scientific communication.

Students may take a specific “topic” PSL 950 course more than once but are strongly encouraged to engage in a variety of topics over the course of their training. Simply put, physiology is a broad field and it is important to be exposed to multiple topics and disciplines within this exciting discipline. (Also, variety is the spice of life, so try some!)

Below are PSL 950 topics offered in the past, but specific topics may vary by semester.

Physiology Seminars (Fall semesters) – 1 credit

Instructors: Geoffroy Laumet, Eunhee Yi, Qingguang Zhang

In this one-credit journal club-style course, which meets once per week, students will discuss a paper from the Physiology seminar speaker that is presenting the following week. The idea is to expose students to the speaker’s work, get them more comfortable with their ideas & techniques, and to have better engagement during the speaker’s lunch and seminar. Students will read and discuss the specialized methods used by the speaker’s lab and how they led to the current understanding. Students are responsible for leading one presentation on an article, and for reading and discussing papers presented by others. The presented article should be approved by the instructor in advance.

Motivated Behaviors (Fall semesters) – 1 credit

Instructors: Michelle Mazei-Robison, AJ Robison, Gina Leininger

This one credit seminar course will examine the neuronal circuitry regulating motivated behaviors, such as intake of drugs, natural rewards, or avoidance of aversive stress, anxiety or pain. The instructors' expertise ranges across many motivated behaviors, and together they support a broad, dynamic discussion of this field. Students will read, present and discuss journal articles with the group on the neuronal regulation of motivated behavior. Via these activities, students will learn the cutting-edge techniques used to study neural regulation of behavior, how to utilize them and their relative advantages and weaknesses. Students will also develop their skill in critical evaluation of the literature, experimental design and scientific communication.

Mitochondria in Health and Disease (Fall semesters) - 1 credit

Instructors: Jason Bazil

This one credit seminar course will examine mitochondria and their role in normal physiology and disease. Students will read, present and discuss journal articles with the group related to mitochondria and their impacts on function. Via these activities, students will learn the cutting-edge techniques used to study mitochondrial structure and function, how to utilize them and their relative advantages and weaknesses. Students will also develop their skill in critical evaluation of the literature, experimental design and scientific communication.

Immune Based Mechanisms of Disease (Spring semesters) - 1 credit

Instructors: Andrea Doseff, Kathy Gallo

This one credit seminar course will examine the mechanistic roles of the immune system in diseases, including Cancer, Atherosclerosis, Infectious Disease, and Autoimmunity. Each module will be introduced by a distinguished guest speaker and followed by student presentations and discussion of journal articles. The contribution of key immunoregulatory networks (Toll like receptors, NLRP, inflammasome, NF- κ B) and molecular mechanisms significant to inflammation (immune evasion, T cell exhaustion, and tolerance) will be covered. The impact of these mechanisms on clinical applications will also be discussed. Please contact Dr. Andrea Doseff at doseffan@msu.edu. Taught in conjunction with PHM 980 - 006.

Research Seminars in Cancer Biology (Spring semesters) - 1 credit

Instructors: Eran Andrechek

Cancer-specific topics. Instructor approval needed for override into course - please contact Dr. Andrechek at andrech1@msu.edu

CMB 800: Principles of Effective Scientific Writing (Spring semesters) - 1 credit

Instructor: Margaret Petroff, PhD

Overview: The course is designed to teach and reinforce the principles of effective writing in the context of scientific abstracts, manuscripts, and grants. Material will range from use of impactful words to construction of sentences, paragraphs, and papers. Topics covered will include editing, word choice, writing within word limits, use of active/passive voice, effective punctuation, and the writing process. Course will be held in person and is available via zoom for Grand Rapids and other non-East Lansing students. We will use in-class lectures, discussions, and homework assignments.

RECR Requirements for the MCIP Doctoral Program

Adapted from <https://grad.msu.edu/researchintegrity>

- Items in black text are tracked automatically in Ability
- Items in red, blue, purple text are tracked by MCIP Program in Grad Info

YEAR 1

Due by the
end of the
student's
1st year

Complete These 4 CITI Modules

- Introduction to the Responsible Conduct of Research
- Authorship
- Plagiarism
- Research Misconduct

Complete 3 Hours of Discussion-Based Training

This requirement can be met in the following ways:

- MCIP Program-Provided RCR Training in Fall and Spring (1.5 hr each)
- [Workshops offered by the Graduate School](#) (1.5 hr each)
- One-on-one or group discussions with your advisor(s) on RCR topics (topic, instructors, date, and amount of time must be well documented)

YEAR 2

Due by the
end of the
student's
2nd year
and see
NOTE
below

Complete 3 of the CITI Modules From The Following List

- Collaborative Research
- Conflicts of Interest
- Data Management
- Mentoring
- Peer Review
- Financial Responsibility

Complete 3 Hours of Discussion-Based Training

This requirement can be met in the following ways:

- MCIP Program-Provided RCR Training in Fall and Spring (1.5 hr each)
- [Workshops offered by the Graduate School](#) (1.5 hr each)
- One-on-one or group discussions with your advisor(s) on RCR topics (topic, instructors, date, and amount of time must be well documented)

NOTE: You must have completed at least 6 hours total of discussion-based training before finishing the comprehensive exam and entering candidacy status

YEAR 3 and EACH YEAR AFTER

Complete 3 Hours of Annual Refresher Training

This requirement can be met in the following ways:

- Complete additional CITI modules (from the supplemental modules listed in CITI, each module counts as 45 min)
- Completing additional [face-to-face workshops from the Graduate School](#)
- MCIP Program-Provided RCR Training in Fall and Spring (1.5 hr each)
- One-on-one or group discussions with your advisor(s) on RCR topics (topic, instructors, date, and amount of time must be well documented)

Why Does MSU Require Research Integrity Training?

Research integrity is foundational to our scholarship, creative work, and core identity as MSU Spartans. It is not only required by rules (including federal, state, research sponsors, and MSU's [research](#) and [training](#) policies), integrity is essential for our research to have legitimacy and impact. Research integrity is so important to our development as scholars and creators that the Graduate School has developed minimum education requirements for all graduate students regarding the Responsible Conduct of Research, Scholarship, and Creative Activities (RCRSA, RCR for short). The Graduate School's RCRSA program requires (a) initial, basic education, and (b) supplemental, refresher training (see diagram on page 1).

Documenting Completion of Your Requirements

The university's training tracking system, [Ability](#), will automatically record completion of all CITI modules and Graduate School workshops. Students should work with their graduate program to document unit-led RCRSA training. Students must document discussion hours with their advisor by submitting them in the new Campus Solutions system. See instructions for all of the above on the [MSU Office of Regulatory Affairs's RCRSA website](#).

CITI Instructions

To complete the basic and supplemental CITI modules, follow these steps:

1. Log-in to CITI using your MSU NetID and password.
 - a. Click on the "CITI (actual training modules)" button below, *or*
 - b. Go directly to the [CITI Program website](#) and click "log-in through my institution."
2. (For first-time MSU CITI users) Follow the ['Get Started' instructions from MSU's Office of Regulatory Affairs \(ORA\)](#).
3. Under "Courses Ready to Begin", click "Start" next to "MSU Graduate School RCR Requirements."
4. Complete the 4 basic modules by the end of your first year.
5. For doctoral students, complete 3 modules from the "Supplemental Modules" also listed on this page (due before completing comprehensive exams and advancing to candidacy).

Applicability

The requirement that doctoral students must complete their 6 hours of discussion-based training before the comprehensive examination applies to doctoral students starting in Fall 2020 or later. Doctoral students who started between Spring 2017 and Summer 2020 must complete their 6 hours of discussion-based training before graduation. Departments and programs may have more specific requirements to meet the discussion-based and annual training. Students who entered in fall 2016, or before, have the option of following the academic unit's previous plan or the new requirements. Students should consult with their program about which option works best with their program of study.

Questions: Contact the MCIP Program Director, Gina Leininger (leininger@msu.edu) and Bradley Robinson (robin454@msu.edu)