



University of
Pittsburgh

School of
Medicine



Program in
Microbiology
& Immunology

Ph.D. PROGRAM IN MICROBIOLOGY AND IMMUNOLOGY

STUDENT/FACULTY HANDBOOK

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The PMI web site is: <https://www.pmi.pitt.edu>

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A. ORGANIZATION OF THE SCHOOL OF MEDICINE (SOM) GRADUATE PROGRAMS

Origin of the Program in Microbiology and Immunology (PMI).

The PMI came into existence upon approval by the University Provost, Dr. Patricia Beeson, in May 2017. The PMI is administered by the Dean, Dr. Arthur S. Levine, of the School of Medicine and conforms to academic governance by the Provost of the University. The PMI is a successor to the separate PhD programs in Molecular Virology & Microbiology and Immunology. These two programs combined to form the PMI as part of a reorganization.

A.1. Office of the Dean

Associate Dean for Graduate Studies John P. Horn, Ph.D. oversees graduate programs in the School of Medicine and reports to Dean Anantha Shekhar, M.D., Ph.D.

A.2. SOM Graduate Council:

The Graduate Council is a standing committee in the School of Medicine chaired by the Associate Dean for Graduate Studies. Council members include the director of each SOM Graduate Program, the director of the M.D./Ph.D. program, and one student representative, usually the president of the Biomedical Graduate Student Association (BGSA).

A.3. Program in Microbiology and Immunology Committees

Admissions and Recruitment Committees

Curriculum Committee

Student Evaluation and Progress Committee

Comprehensive Examination Committee

A.4. Biomedical Graduate Student Association (BGSA)

The BGSA is the University sanctioned organization of graduate students within the School of Medicine.

Web link: <http://www.bgsa.pitt.edu/>

A.5. Financial Aid

All students in good standing receive support in the form of a stipend, health insurance and tuition remission. Students are appointed annually on a 12-month, full time basis. In the first year, students are supported through Dean's fellowships administered through the School of Medicine. Afterwards the Dissertation Advisor is responsible for the stipend and related costs. Current stipend levels are posted at somgrad.pitt.edu.

Students should direct questions about the PMI and the procedures and policies described herein to their research mentor, the Program Director (or Associate Director), or to the Graduate Office, M240 Scaife Hall (412-648-8957).

B. GRADUATE DEGREE REQUIREMENTS

B.1. Requirements for the Ph.D.

The PMI is comprised of formal course work and original laboratory research, which is designed to allow attainment of a Ph.D. in 4-6 years. The University requires students seeking the Ph.D. degree to engage in a minimum of one term of full-time doctoral study that excludes any other employment, except as approved by their departments. Ph.D. degree work must be completed within ten years from initial registration for graduate study. If the student has received credit for a master's degree appropriate to the field of study, then all requirements for the Ph.D. degree must be completed within eight years.

A minimum total of **72 credits** is required to satisfy the Ph.D. requirement. Of this, **32 credits** must come from approved courses, not including directed study credits or dissertation research credits.

Students are graded according to the A-F letter grade or S/NS (sufficient/not-sufficient) grading system for most courses. An "I" (incomplete) grade must be made up according to the stipulations of the faculty director of the course, Program Director, and University policy.

Graduate students not fluent in English are strongly encouraged to take a University Course in conversational English, to allow active and full participation in the program. This course does not have to be taken for credit and does not contribute to the student's Quality Grade Point Average.

University policy requires a cumulative QPA of at least 3.0 for graduation. The PMI program further requires a minimum grade of B in all required courses and in those elective courses counted toward the 32-credit requirement and maintain at least a 3.0 QPA. If a student fails to maintain the minimum grade requirement, then the curriculum, executive and/or student evaluation committee will decide whether to dismiss the student from the program or allow the student to retake any required course for which a grade less than a B was received. In such cases the student will be placed on academic probation.

B.2. Requirements for a Master's Degree.

Students are not admitted to the PMI graduate program with the express purpose of obtaining a M.S. degree. In certain cases, however, it may be necessary that a student in the Ph.D. program be transferred to a terminal M.S. degree. Students pursuing a M.S. degree in Microbiology and Immunology will be required to complete the same course work as described for the Ph.D. program and to prepare and successfully defend a Master's Thesis.

C. THE PMI GRADUATE TRAINING PROGRAM

C.1. Introduction

This document contains general information about the PMI graduate program. The most up-to-date information can be found at the PMI program web site: <https://www.pmi.pitt.edu>

C.2. Administrative Structure of the PMI Program

Program Director: Robert Binder, Ph.D. (term 2021-2023)

Associate Director: Zandrea Ambrose, Ph.D. (term 2021-2023)

Admissions Committee: voting members consisting of 3 faculty each from the general areas of interest of 1-Immunology and 2-microbiology (the latter with a mixture of interest in bacteria and viruses), plus two current PMI graduate students in good standing, one from each general area of interest indicated above. Finally, the committee is chaired by one faculty member from PMI, who will assign applications for review and serve as a non-voting member. Terms are for 3 years, one of which may be as chair.

Comprehensive Examination Committee:

TBA (Chair)

Curriculum Committee:

Lawrence Kane, Ph.D. (Chair)

Robert Binder, Ph.D.

Jennifer Bomberger, Ph.D.

Neal DeLuca, Ph.D.

Anthony Richardson, Ph.D.

Executive Committee:

Zandrea Ambrose, Ph.D.

Robert Binder, Ph.D.

Lawrence Kane, Ph.D.

Mark Shlomchik, M.D., Ph.D.

Tom Smithgall, Ph.D.

+ The current chair of the admissions committee

C.3 Responsibilities of Program Representatives

Program Director: The director will oversee the program, administer program activities as needed, serve on the SOM graduate council, serve on the Executive Committee, serve as a mentor to all first year PMI graduate students, and participate in the evaluation of the first-year class. Course directors will report directly to the program director. The director's term will span a period of two years and is renewable upon subsequent nominations and elections (by the executive committee). The directorship will alternate between investigators with a primary focus in microbiology or immunology.

Associate Director: The associate director will serve on the executive committee, substitute for the director at the graduate council meetings and communicate program updates to their department. The associate directorship will also alternate between investigators with a primary focus in microbiology or immunology, always being the opposite of the Director.

Admissions and Recruitment Committees: Representatives will supervise the maintenance of the PMI admissions website, evaluate applicants to PMI, help organize the recruitment weekend visits of applicants, participate in selection of members of the incoming class, and represent the interests of PMI during orientation events. Terms on the admissions committee will last three years and members will be appointed by the executive committee.

A representative from this committee will also attend regular meetings of the school-wide Recruitment Committee, which addresses issues such as increasing the quality and diversity of applicants applying to Pitt graduate programs and competing successfully with other top-level graduate programs.

Curriculum Committee: Members of the curriculum committee will meet on a bi-annual basis to evaluate the content and quality of the Program Course Offerings.

Comprehensive Examination Committee: The committee will be responsible for overseeing the Comprehensive Examination required of each student in the fall of the second year. The Chair will receive proposals from students, distribute to Examination Committee members to review, chair the study section review of all written proposals and create an oral defense committee for each student, as described in more detail in section F of this document. Remaining committee members will participate in the examination process by serving on the study section to review written proposals.

Executive Committee: Members of the committee will meet frequently to discuss time-sensitive Program issues such as the nomination and election of the Program Director and the processing of faculty membership applications. The chair of the committee will be responsible for scheduling meetings on an as-needed basis.

Student Evaluation Committee: The format of this evaluation will be determined by the program director and evaluation committee. Annual evaluations by the PMI student and their mentor will be completed and reviewed.

Student Representative to the BGSA: This individual will be elected by the students and represent the Program within the BGSA, and coordinate student-sponsored events as needed.

C.4. PMI Faculty Membership Criteria

- 1) Graduate Faculty status
- 2) Extramural research funding: current or recent history
- 3) Independence: space and funding
- 4) Experience mentoring graduate students: past and present
- 5) Appropriateness of research program for immunology/microbiology graduate student training
- 6) Participation in the teaching of PMI and/or other graduate students
- 7) Participation in other PMI graduate program activities: journal clubs, seminar series, graduate thesis committees, comprehensive examination committees

C.5. PMI Program Faculty

A comprehensive and current list of PMI Graduate Program faculty is available at: <https://www.pmi.pitt.edu/faculty>

C.6. PMI Program Students

A comprehensive and current list of PMI Graduate Program students and graduates is available at <https://www.pmi.pitt.edu/students>

D. PMI CURRICULUM

D.1. Advising and Evaluation

Upon admission to the PMI, students will be assigned a first-year mentor, specifically either the Director or Associate Director of the Program. The first-year mentor will provide advice on research and academic requirements and choices, choice of rotation labs, as well as assist in the decision regarding ultimate choice of a laboratory in which to complete their Ph.D. research. The mentor also will represent the student's interests at meetings with the PMI curriculum and evaluations committee, should there be concerns about academic progress. Once a student formally joins a laboratory in which to complete their Ph.D. research, their primary mentor will be the faculty member who heads that lab.

Students will be continually evaluated by the steering committee with respect to grade point average and grades from research rotations. Students will be assessed based on coursework and laboratory rotations. If a student is not performing at a satisfactory level, remedial action will be suggested, or the student may be placed on academic probation or they may be dismissed from the program.

D.2. Curriculum

PMI students will take Principles of Microbiology and Immunology in the Fall term of the first year. Principles of Microbiology and Immunology is a required course for all incoming students in the PMI. The course is team-taught and designed to introduce and reinforce core concepts of the microbiological and immunological sciences. Students will also be taught how to read and analyze the scientific literature, through a weekly paper discussion session, with an emphasis on both current and classic papers in the field. Two laboratory rotations, lasting 7 weeks each, will be completed during the Fall of the first year.

After the first semester PMI students will choose between Comprehensive Immunology or Comprehensive Microbiology (or possibly both). These lecture and discussion courses will introduce the students to the advanced concepts of modern immunology and microbiology, respectively. This will be taken in the Spring of the first year along with two additional laboratory rotations, each lasting 7 weeks, and Immunology Research Seminar or Experimental Pathogen Biology.

Classes are generally scheduled in the morning to allow time for laboratory rotation work in the afternoon, and the schedules for the classes will not overlap. Students should choose second semester classes based on their own interests and the requirements of the laboratory that they anticipate joining. Consultation with the program director is required prior to enrolling in classes for the second semester.

Courses in statistics, scientific writing and biomedical ethics, offered in the summer at the end of the first year, are also required.

PMI students will have more flexibility in the second-year curriculum. In Fall and Spring semesters of their second year, PMI students will choose an elective course(s) as needed or desired. Electives appropriate for PMI students are listed here: <https://www.pmi.pitt.edu/curriculum>

In addition, students will take Immunology Research Seminar plus Contemporary Topics in Immunology or Micro RIP plus Microbiology Seminar.

Other curriculum requirements will be TA: Medical Microbiology, which will be taken in the Spring of the second and third year.

The sequence of classes is summarized in the table below (credits in parentheses);

Year 1 (Fall)	Year 1 (Spring)	Year 1 (Summer)	Year 2 (Fall)	Year 2 (Spring)	Year 3 (Fall)	Year 3 (Spring)
Principles of microbiology and immunology (6) 2 lab rotations (4)	Comprehensive Immunology (4) AND/OR Comprehensive Microbiology (4) 2 lab rotations (4) Experimental Pathogen Biology (2) OR Immunology Seminar (1)	Biomedical ethics (2) Statistics (2) Scientific writing (2)	Electives (2+) Immunology Seminar (1) AND Contemporary topics in Immuno (1) OR Micro RIP (1) AND Microbiology Seminar (1)	Electives (2+) Immunology Seminar (1) AND Contemporary topics in Immuno (1) OR Micro RIP (1) AND Microbiology Seminar (1) TA; Medical microbiology (1)		TA; Medical microbiology (1)

If a student fails to achieve a passing grade in any course, make-up exams may be offered. This is entirely at the discretion of the course director and in consultation with the program director. Students concerned about performance in a course should discuss this with the director at the earliest opportunity.

A wide range of additional graduate courses are available through the School of Medicine. The most current list of courses is available from the web site (<http://www.gradbiomed.pitt.edu/current-students/course-information>).

D.3. Research

Laboratory research is the major component of all biomedical Ph.D. programs. The PMI supervises the process of research rotations during the first year. Students are expected to complete four-to-five research rotations during the first year. At the end of each rotation, the student is required to complete a written report of 2-3 pages (including figures) and prepared according to the style suggested for contributors to the Journal of Biological Chemistry. When the written report is complete, the rotation mentor will review the performance of the student and assign a letter grade for the rotation. Failure to maintain satisfactory laboratory performance will result in dismissal from the program.

It is expected that four rotations of seven weeks each will be performed in different laboratories of members of the PMI training faculty. This will provide the student with an adequate opportunity to identify an area of research interest and to establish a relationship with a potential dissertation advisor, and potential dissertation committee members. It is possible for students to take a fifth rotation, if necessary.

There are several circumstances where the requirement for four rotations or laboratories might be relaxed. For example, if a student has completed a Master's degree thesis based on original research, a report of this project may be submitted in place of a rotation report. Alternatively, students may want to do a second rotation in the same laboratory if they have already identified a dissertation advisor, or

may even want to rotate in a laboratory outside of the PMI. In such cases the student must petition the Program Director for approval.

D.4. Additional Program Activities

In addition to coursework and seminars, members of the PMI community will also come together at an annual joint retreat, put on by a committee of PMI graduate students and sponsored by the MMG and Immunology departments. This on-site retreat, will feature faculty and student speakers representing the PMI program. In this regard, it will be open to all faculty and trainees interested in microbiology and immunology, including those residing in affiliated departments, such as Pediatrics, Medicine and Surgery, for example. All PMI students will be required to attend and to present a poster at the PMI retreat. A subset group of students will be chosen to present oral presentations, based on the poster abstracts.

All PMI students will be required to attend and present at Research in Progress (RIP).

E. PMI DEGREE REQUIREMENTS

E.1. Course Requirements—PhD Track

COURSE TITLE	CREDITS
Principles of MI	6 Cr
Rotations (4)	8 Cr
Biomedical ethics	2 Cr
Statistics	2 Cr
Scientific Writing	2 Cr
Comprehensive/Exptl. (Micro <u>or</u> Immuno)	4 Cr
Contemporary Topics or Micro RIP (2 semesters minimum)	2-4 Cr
Seminar (Micro <u>or</u> Immuno)	2-4 Cr
Medical Microbiology TA	2 Cr
Electives (2)	4-6 Cr

~34-40 Credits

(at least 34 course-work credits needed)

Per University of Pittsburgh guidelines, a minimum of 72 credits is required for the PhD in Microbiology and Immunology over a minimum of 6 full-time terms. 9 to 15 credits constitute full-time study in the fall and spring terms and 3 credits is considered full-time for the summer term. A minimum of 32 of those credits will come from coursework while a minimum of 40 credits must be earned for dissertation research, acquired after passing the doctoral comprehensive examination.

E2. Course Requirements—MD/PhD Track

Admission into the PMI for medical students who wish to pursue the degree is subject to prior approval by the Director of Graduate Studies in PMI and the thesis mentor who is a member of the graduate faculty in the PMI. This will apply to students who matriculate directly into the combined MD/PhD Program (MSTP) and also to medical students who apply to join the MSTP during or after year 1 or year 2 of medical school.

Per University of Pittsburgh guidelines, a minimum of 72 credits is required for the PhD in Microbiology and Immunology over a minimum of 6 full-time terms. 9 to 15 credits constitute full-time

study in the fall and spring terms and 3 credits is considered full-time for the summer term. A minimum of 32 of those credits will come from coursework while a minimum of 40 credits must be earned for dissertation research, acquired after passing the doctoral comprehensive examination.

For MD/PhD students, 19 credits (16 curriculum plus 3 rotation) are granted toward the coursework successfully completed during the first 2 years of medical school at the University of Pittsburgh. A minimum of 13 credits of remaining coursework will be fulfilled by the following courses:

COURSE TITLE	CREDITS
Transfer credits from medical school curriculum	16 Cr
Transfer credits from medical school rotations (3)	3 Cr
Comprehensive/Exptl. (Micro <u>or</u> Immuno)	4 Cr
Contemporary Topics or Micro RIP (2 semesters minimum)	2 Cr
Seminar (Micro <u>or</u> Immuno)	2 Cr
Medical Microbiology TA	2 Cr
*Electives	<u>3 Cr</u>

~32 credits (or more)

*Electives may include the Molecular Medicine course (1 credit), the Professional Development course (1 credit), and/or non-required courses offered by medical school graduate programs (as approved by the Program Director).

MD/PhD students will be subject to maintaining the same GPA requirements and ethical standards as are applied to graduate students as described in the Graduate Student and the MD/PhD program Handbooks. Comprehensive exams may be taken as early as the end of the first year in residence in the PMI, typically after most formal course work is completed.

E3. Course Descriptions

MSMI 2000 Principles of Microbiology and Immunology (6 cr)

This is a required course for all incoming students in the PMI, to be taken in the Fall of the first year. This is a team-taught course designed to introduce, and reinforce, core concepts of the microbiological and immunological sciences. Students will also be taught how to read and analyze the scientific literature, through a weekly paper discussion session, with an emphasis on both current and classic papers in the field. Fall semester.

MSMI 2200 Comprehensive Microbiology (4 cr) / MSMI 2420 Experimental Pathogen Biology (2 cr)

This course will focus on the molecular basis of bacterial, parasitic and viral pathogenesis. Topics include microbial physiology and genetics, gene expression, virulence factors, pathogenic strategies of bacterial agents, the molecular basis of viral pathogenesis and current advances in therapeutic strategies.

Experimental Pathogen Biology is a second-tier course that will expose the students to classical and contemporary literature in modern microbiology (including both bacteriology and virology). Emphasis will be on paper analysis, methods and critical evaluation of primary data. This course will parallel the topics presented in the Comprehensive Microbiology lecture course, which is recommended to be taken simultaneously with Experimental Pathogen Biology. Principles of Microbiology and Immunology, or an equivalent course (approved by Course Director) is a prerequisite. Spring semester.

MSMI 2210 Comprehensive Immunology (2 cr) / MSMI 2230 Experimental Basis of Immunology (2 cr)

This is a second-tier lecture and discussion course that will introduce the students to the fundamental concepts of modern immunology. The course will cover cells, tissues and organs of the immune system. Furthermore, in depth analyses of the development, activation, effector functions, and regulation of immune response will be presented in this course.

Experimental Basis is a second-tier course that will expose the students to classical and contemporary literature in modern immunology. Emphasis will be on paper analysis and critical evaluation of primary data. This course will parallel the topics presented in Comprehensive Immunology lecture course, which must be taken before or simultaneously with Experimental Basis of Immunology. Spring semester.

MSMI 2240 Intro to Immunobiotherapeutics (2 cr)

This course provides a comprehensive overview of the principles and the technology upon which immunobiotherapeutics are based. The course focuses on the overall aims of using small molecules, antibodies, genes and cells as immunotherapeutic agents. It covers the use of viral and non-viral agents as gene delivery vehicles, cells as therapeutic agents and small molecules as delivery and therapeutic vehicles. The course also covers diseases and disorders in which immunobiotherapy has proven safety and demonstrated successful outcomes like cancer, mendelian disorders and autoimmunity. Fall semester.

MSMI 2250 Teaching Assistant Medical Microbiology (1 cr)

This course will introduce graduate students to the principles of teaching. The students will be trained in basic teaching techniques as well as provided material for teaching students specific concepts. As part of this course, students will participate in teaching first-year medical students the fundamentals of microbiology, in conjunction with the Laboratory and Problem Based Learning sections of the Molecular Pathogenesis of Infectious Disease course of Basic Science Medical School block. Each student will be responsible for 8-10 medical students in a laboratory setting. The student will present basic laboratory techniques, explain concepts of microbiology and infectious disease, including diagnostic tests, interpretation of results, and data management. In addition, the student will assist the Faculty Facilitator in the Problem Based Learning Sessions where they will review laboratory findings with the students. Spring semester.

MSMI 2290 Directed Study (1 – 9 cr)

This course provides the student an opportunity to carry out a specific laboratory project in any area of interest relevant to microbiology and/or immunology. All semesters.

MSMI 2300 Scientific Writing in Microbiology and Immunology (2 cr)

This course is designed to familiarize students with the basics of submitting research grants. The course includes a review of the types of research grants most commonly applied for by PIs, the general structure and content of these applications and the most common mistakes by new grant writers. Students will be provided with example research grants and will be expected to review these grants and serve as reviewers of writing sections. Summer semester.

MSMI 2350 Introduction to Biostatistics for MI Graduate Students (2 cr)

This is a self-contained, two-credit course on basic principles and practices of statistical inference and data analysis for students whose primary work is in the laboratory. After completing the course, students will be able to perform basic statistical analyses and be aware of the principles and limitations associated with those analyses. The course will also give them the background necessary to effectively use GraphPad software. The course meets twice a week for two hours, and classes will usually consist of a computer-based practicum sandwiched between two half-hour lectures. Topics include: discovery and validation in the laboratory; data management; graphics; probability concepts; probability distributions; one- and two-sample statistical tests; point estimates and confidence intervals; analysis of cross-tabulations; statistical modeling; other topics in which the class is interested. The prerequisite is proficiency with pre-calculus college algebra. Summer semester.

MSMI 2450 Immunology Research Seminar (1 cr)

Each class is divided into a Research report and a Paper discussion designed to develop skills needed for scientific presentation. The student research progress report details the background, reasoning, analyses, critical evaluation of experimental strategies, data analysis and interpretation of their experimental results. Students are expected to discuss issues and answer questions from other graduate students and faculty. The research paper discussion is designed to teach students to critically evaluate and present published data in contemporary scientific research articles. Students, in consultation with the course director, select published articles for presentation and discussion. Fall and Spring semesters.

MSMI 2460 Microbiology and Related Topics Seminar Series (1 cr)

Beginning in the second year of the program, microbiology leaning students will be required to attend a seminar series and turn in at least two seminar summaries each semester. Seminar attendance once a week at a seminar of the student's choice is required for each the fall and spring semesters and include presentations by nationally and internationally recognized visiting researchers, as well as internal researchers, in microbiology and related fields. Fall and Spring semesters.

MSMI 2480 Mechanisms of Microbial Persistence and Pathogenesis (2 cr) Microorganisms have evolved a vast array of mechanisms to avoid detection or elimination by host defenses, and to establish persistent infections that can lead to chronic or recurrent disease. The ability to establish persistent infections often complicates the successful therapeutic treatment of disease caused by such microorganisms. This course is designed to familiarize students with the mechanisms by which select bacterial and viral pathogens establish persistence in their host cells and/or organisms, and the subsequent considerations for pathogenesis and therapy. Alternate Fall semesters.

MSMI 3200 PhD Dissertation Research (1 – 14 cr)

After advancement to candidacy for the PhD degree, students enroll in this course to pursue original experimental laboratory research, the results of which will provide the substance of their doctoral dissertation. A minimum of 40 credits of this course is required for the PhD degree in the School of Medicine. All semesters.

MSMI 3220 Contemporary Topics in Immunology (1 cr)

This is a third-tier course in which students will read, present, and evaluate the primary literature in immunology. Each semester will feature an integrated set of papers addressing a current issue of interest to modern immunologists. The course may be taken more than once, since the topic addressed will change each semester. The prerequisite is Comprehensive Immunology or permission of the course director. Fall and Spring semesters.

MSMI 3230 Microbiology Research In Progress (1 cr)

The Micro Research In Progress (RIP) course meets weekly during which the students, in their second year or later, report on their research progress details including the background, reasoning, analyses, critical evaluation of experimental strategies, data analysis and interpretation of their experimental results. Students are expected to discuss issues and answer questions from graduate students, faculty and others in attendance. Emphasis is placed on the development of teaching and speaking skills needed for scientific presentation. Fall and Spring semesters.

MSMI 3270 Innate Immunity (2 cr)

This course will focus on the several aspects of host innate immunity against infection. Topics will include the conceptual basis for innate versus adaptive immunity, induction of innate immunity by pathogens, signaling by innate immune receptors, effector cells of the innate immune system, secreted effectors of innate immune signaling, and subversion of innate immune signaling by pathogens. Comprehensive Immunology is highly recommended, but are not prerequisites for the course. Alternate Spring semesters.

MSMI 3280 Immunology of Infectious Diseases (2 cr)

This course examines the immune responses to pathogens, as well as on immune evasion of microbes. The organisms studied include bacteria, parasites, and viruses. Topics focus on host-pathogen interaction and include innate immunity, modulation of antigen processing and presentation, pathogenic strategies for subversion of immune responses, effector functions of immune cells, and immunopathology. Principles of Microbiology and Immunology is a prerequisite. Lecture/paper discussion format. Fall semester.

MSIMM 3290 Autoimmunity and Immunopathology (2 cr)

This course will familiarize students with basic concepts of immune tolerance, autoimmunity and immunopathology. The course will focus on basic mechanisms, animal models of human disease and novel therapeutic approaches arising from these models. Applications to human disease will be discussed. Alternate Spring semesters.

MSMI 3435 Tumor Virology (2 cr)

This course introduces students to viruses known or suspected of causing tumors, with special emphasis on viruses causally linked to human cancer, including polyomaviruses, Epstein-Barr virus, Kaposi's sarcoma-associated herpesvirus, adenoviruses, papillomaviruses, hepatitis viruses, human T-cell 2lymphotropic virus. Topics focus on establishing causality between specific virus infections and cancer, oncogenes, tumor suppressors, oncogenic cofactors, disruption of innate/adaptive immune responses, latency, viral mimicry/piracy of cellular regulatory genes, genomic instability and role of non-coding RNAs in viral pathogenesis. Spring semesters.

INTBP 2290 Scientific Ethics and the Responsible Conduct of Research (1 cr)

The course is an introduction to the basic ethical issues which arise in the course of conducting scientific research. It is intended for graduate students and fellows in the biomedical sciences who have completed at least one year of graduate work. The course will be composed of informal lecture presentations followed by discussion of issues in small groups. Summer semester.

Additional Microbiology and Immunology program courses can and will be developed, as dictated by student and faculty interests and needs.

E.4. Publication Requirement

Publication of novel findings is an important part of being a research scientist and the principal way that scientific findings are disseminated. Students are therefore required to publish at least one first-author paper of original research, for completion of the Ph.D. in PMI.

F. COMPREHENSIVE EXAMINATION

F.1. Introduction

Students enrolled in the Ph.D. program should take the Comprehensive Examination in the fall of the second year. The Comprehensive Examination will be administered after the student has completed most course work and has chosen a major advisor. In the summer, at the end of the first year, students will meet with the chairperson of the Comprehensive Examination Committee to discuss these guidelines.

Students will be required to submit a proposal in the format of an NIH R21 research grant to the Comprehensive Examination Committee chairperson, who will chair a study section of faculty members to evaluate each student's proposal. The student is graded pass/fail, with a simple majority vote of the panel deciding the grade. If passed on the written proposal, the study section will select faculty members to conduct an oral examination of the student. In the event of a failure, the student shall be given one opportunity to retake each failed component of the examination. In the event that a student fails either component twice, the action of the faculty shall be dismissal of the student from the program or recommendation of a plan for completion of a terminal M.S. degree.

F.2. Comprehensive Examination Proposal (written component)

The Comprehensive Examination is based on the student's thesis research area (see below). Unless an exception is granted, the student must submit an Abstract describing the planned research project by September 15 and the full written proposal by October 15. Preparation of the written documents should follow the guidelines below and can be further clarified by the Chair of the Comprehensive Examination committee if required. The examination will require that the student submit and defend a proposal in the format of an NIH R21 research grant, with the following guidelines:

a. General Guidelines. The proposal is expected to be conceptually sound and adequately documented. The student is responsible for preparing an original research proposal. Dissertation advisors and others may be consulted on specific scientific issues, but the document must be prepared exclusively by the student. Advisors may not directly discuss the written proposal with the student or edit the written proposal for style or content. However, advisors may continue to discuss the conceptual aspects of a student's project with them, as this is important to facilitate their scientific advancement in the laboratory. In addition, an advisor may work with a student in preparing them for their oral examination, but may not directly coach them in preparing answers to specific questions that may arise from the written proposal. Once the oral examination has been passed, the advisor should work with the student to provide additional feedback on the written proposal. Attribution to published and unpublished sources must be comprehensive. The written proposal must be original to the student, although the project may have been outlined previously in the advisor's grant. The written proposal must include well-defined hypotheses and rationale, interpretation of expected and/or current results and alternative approaches, as well as the significance of the proposed experiments. Overall significance to the field of research also should be discussed.

b. Format. The proposal shall be single spaced, with margins no smaller than 0.5 inches and no larger than 1.0 inch. The font used shall be **11 pt. Arial**, although smaller type (9-10 pts) may be used in figures and legends. The written research proposal must adhere to the following page guidelines:

- Title Page
 - Abstract Page (1-2 paragraphs)
 - Specific Aims Page: not to exceed one page
 - Significance and Innovation: usually 1-2 pages
 - Research Plan: usually 4-5 pages
- 6 page max. for Signif, Innov. and Res. Plan combined
- Tables and figures must be integrated into the Significance, Innovation, Research Plan 6 pages
 - Literature Cited: not to exceed four pages; must include complete citation with all authors, year, title, journal, volume, inclusive pages (see e.g. *Journal of Experimental Medicine* format).

c. Policy on consultation. Students are encouraged to seek feedback on the written proposal and practice for the oral defense from other students, but not faculty members. Those whose written English skills are considered weak may wish to consult the Writing Center in the Cathedral of Learning (ext. 46556), which provides individualized help with writing skills.

F.3. Administration of the Comprehensive Examination

a. Submission of the proposal. Students shall take no more than **four weeks** from their laboratory work in the writing of their Comprehensive Examination proposal. Upon completion, an electronic (**PDF only**) copy shall be submitted to the chairperson of the Examination Committee. An electronic copy of the Specific Aims of the Advisor's grant(s) on the specific area should also be submitted at the same time.

b. Examination committee. As soon as possible (PREFERABLY WITHIN TWO WEEKS OF SUBMISSION OF THE PROPOSAL), the Examination Committee will convene and review the written proposals in a study section format. If the written proposal is passed (see below), an oral defense committee will be formed for each student. With the advice of appropriate faculty members on the Examination Committee, the chairperson shall establish for each student's proposal, a panel of faculty

members (and its chairperson) competent to evaluate the subject of the research proposal for the oral defense. Each panel shall consist of three members, at least two of whom are members of PMI. At least two members of the panel will have served previously on a comprehensive examination panel. The chairperson of the Examination Committee will distribute the proposal to members of the selected panel within one week of its approval and determine a date for the oral exam. The student's thesis advisor shall not serve on a panel established to evaluate one of his/her students.

c. Evaluation of the proposal. The written proposal should be assessed mainly for clarity, scientific accuracy and internal consistency. The proposal should not be evaluated like an R01 proposal, i.e. significance and innovation should be given less weight than the above criteria (although the student should still be able to explain the significance and novelty).

i. *Study Section Format.* Written proposals will be reviewed by three Examination Committee members and presented to the entire committee by the Primary Reviewer. Review and discussion will be conducted as a NIH Reviewer Panel. The Examination Committee chairperson will also chair the study section.

ii. *Initial assessment.* Four initial outcomes are possible: Pass (no changes or revisions required), provisional pass (small factual or stylistic comments, which can be quickly revised), minor revision (e.g. one sub-Aim in need of significant revision) or major revision (seriously flawed hypothesis and/or approach). The student will submit a revised proposal, including a brief response (one-page limit) to the original critiques within 2 weeks (provisional pass), 4 weeks (minor revision) or 6 weeks (major).

iii. *Pass/Fail.* The Committee will reach a decision about the suitability of the revised proposal (i.e. responsiveness to the critiques) within **one week**. If the revised document is still judged to be inadequate, the student will be judged to have failed the written component. A second unacceptable written exam performance shall constitute a second failure, and the student will be subject to dismissal or other action as noted in section 1, above.

d. Oral examination

i. *Logistics.* The oral examination for each student should be scheduled within four weeks after submission of a sufficient written proposal. At the beginning (in the absence of the student) the Comprehensive Examination Panel chairperson (or a representative) will briefly address the committee, communicating the ground rules for the examination. The oral examination will be held in a closed session, with only the student and three members of the examination panel in attendance. The student will begin the examination with an oral presentation (not to exceed 15 minutes). Slides depicting Specific Aims or figures/tables from within the proposal may be used. The oral examination shall not exceed two hours, inclusive of the student's opening presentation. The research proposal shall be the sole document available to the student during the oral examination.

ii. *Standards.* It will be the panel's task to evaluate the student's understanding of basic concepts from coursework in their major field of study, content of the research proposal, and the basic concepts and scientific literature underlying the proposal. The oral examination should not be used as an opportunity to correct serious flaws within the written proposal. At the end of the oral examination, the panel will vote in private to pass/fail the student. A simple majority shall prevail. There shall be no conditional pass/fail decision. The panel chair will immediately notify the student of the decision and evaluation of performance. A critique written by the comprehensive examination panel chairperson, evaluating the exam performance and the pass/fail decision, shall be submitted to the chairperson of the Examination Committee, who shall distribute copies to the Director of PMI, the student, the student's Advisor and the program coordinators for record keeping.

iii. *Failure/re-examination.* In the event of failure of the oral exam, a student will have one opportunity to re-take that component of the exam, and will be advised by the exam panel whether it would be appropriate to revise the written component (only if no previous revision was required prior to the first oral exam) before re-taking the oral component. The re-examination panel will consist of three faculty, at least two of whom will be from the PMI. The panel should consist of one original panel member and

two replacement members, at the discretion of the Examination Committee Chairperson. A second unacceptable oral exam shall constitute a second failure, with the student subject to dismissal or other action as noted in section 1, above.

iv. A "pass" of the comprehensive examination shall be accomplished when both of the following conditions are met: (i) the written proposal is considered sufficient as presented, and (ii) the student has performed knowledgeably in the oral defense of the proposal. The panel, at the time of the oral examination, whether the student passes or fails, must also sign the required "Comprehensive Examination Report" three-part form, which should then be submitted to the Graduate Studies Office (M240 Scaife Hall) for processing.

G. ADVANCEMENT TO CANDIDACY & FORMATION OF A DISSERTATION COMMITTEE

Following completion of course work and passing the comprehensive examination, the student undertakes the steps required for advancement to candidacy for the Ph.D. degree, outlined below.

Students should form a dissertation committee within one month of passing their Comprehensive Examination. The committee shall consist of at least five faculty members. The Dissertation Advisor is included in the committee but another faculty member must be designated Chair of the committee. The majority of members must be from the PMI faculty, and the majority of members must have Graduate Faculty status. The student is not limited to faculty from the School of Medicine or the University of Pittsburgh. The Director of the PMI will review the committee. Upon approval from the Director, the student should then email the PMI Coordinators to obtain the forms that will be required at their first committee meeting.

The thesis committee should meet within three months of formation, before the end of March in the student's second year. Per the policy of the Graduate Office, all committee members must be present at the first meeting. Prior to the meeting, a written thesis proposal should be provided to each committee member. At this meeting, the dissertation research project is presented in detail to the committee; if the committee approves the proposal, the student should make certain that the required graduate school forms that were obtained from the PMI Coordinators are completed for advancement to candidacy for the Ph.D. degree. The students should ensure that all required signatures are on the three forms before submitting all forms to the Graduate Office (M240 Scaife Hall) for processing. Final approval of committee membership rests in the hands of the Associate Dean for Graduate Studies.

Following the initial thesis committee meeting, additional meetings must be held at six-month intervals. The student must submit, one week prior to the scheduled committee meeting, a brief written summary (1-2 pages) of their research progress since the previous committee meeting.

Students shall meet with their thesis committee every six months. Each time a thesis committee meets (including the first meeting), a brief report of this meeting written by the chair must be sent to all thesis committee members and to the PMI coordinators so that this information can be included in the student's academic file.

H. DISSERTATION AND FINAL ORAL EXAMINATION

When a determination has been made by the thesis committee that the student is nearing completion of their degree, the committee may give the student permission to begin working on their written dissertation. This generally occurs about six months from the anticipated graduation date.

The student's dissertation must provide evidence of original scholarly research of sufficient quality to be published in a leading scientific journal. Laboratory work for which a student receives wages (for example, work performed when the student was employed as a technician) is not eligible for any part of the dissertation research. The student's dissertation committee will meet at the time that the student's research is nearly complete and will authorize the student to begin writing the dissertation. The style

and format of the dissertation must conform to the standards set forth by the Graduate Council. It is strongly recommended that the student share a preliminary draft of the dissertation with their committee chair and/or dissertation advisor. A final copy must be submitted to the dissertation committee at least two weeks prior to the dissertation defense date.

The dissertation defense consists of a formal, public seminar on the subject of the dissertation. This is followed by a closed-door examination of the student by the Thesis Committee members. If the decision of the committee is not unanimous, the case is referred to the Dean for resolution. The degree in Microbiology and Immunology, will be granted by the School of Medicine, University of Pittsburgh.

A student must be on active status (must be registered for a minimum of three credits during a 12-month period) and must register for at least one credit during the term in which they are graduated. Students who complete all the degree requirements in one term but are graduated the next term may petition the dean for a waiver of this requirement. A student who is on inactive status must be readmitted and registered for three credits in order to be graduated.

At least one month prior to defense, the student must make arrangements with the Director of the PMI and one of the PMI Coordinators, for the final defense. The School of Medicine stipulates that the following requirements must be met before the last day of the term in which the student has applied for graduation. Students apply for graduation through the Graduate Studies Office website (<http://www.somgrad.pitt.edu/programs/phd-programs/phd-graduation-form>).

After the final defense, the following should be delivered to the Graduate Office as one package:

1. One copy of the final approved dissertation (unbound, final corrected version), with title page signed by all thesis committee members
2. Three additional copies of the abstract (350 word maximum double-spaced), initialed in the upper right-hand corner by the student's advisor
3. Signed Dissertation Defense Report (obtained from PMI Coordinator prior to the defense)
4. Signed Dissertation Approval Report (obtained from PMI Coordinator prior to the defense)
5. Signed ETD Approval Form (obtained from PMI Coordinator prior to the defense)
6. 3 copies of the title page
7. 1 copy of the dissertation committee membership page
8. Submit the alumni form and CV electronically as directed on the SOM graduation website (the links are in the detailed email we send out at the time of application for graduation).

Forms required:

1. Survey of Earned Doctorate (used by National Research Council)
2. Agreement form to permit publication of the dissertation by University Microfilms, Inc.
3. An official receipt from University Cashier (G-7 Thackeray Hall) for payment of dissertation binding/microfilming fees.

Students are required to submit an electronic version of the thesis using the ETD submission process (<https://etd.pitt.edu/submit>) as required by University Policy.

Appendix – Forms (all are available by contacting the PMI Coordinator)

- Rotation form (Available via DocuSign, contact Program Coordinator)
- Template for rotation report
- Rotation evaluation
- Thesis committee meeting report form (To be filled out by the thesis committee chair and returned to Program Coordinator)
- Yearly progress evaluation (summary, mentor and self)



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PMI Rotation Form

Date:

Student name:

Rotation mentor:

This confirms that both the student and mentor named above have agreed to a rotation in the mentor's lab.

Signature of Student

Signature of Rotation Mentor

Signature of Program Director



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PMI Rotation Report

Guidelines for Writing and Submitting a Laboratory Rotation Report

Students are responsible for submitting a copy of the rotation report to the Rotation Advisor, the PMI Program Director and the PMI Coordinators by the due date.

Students and Rotation Advisors are asked to discuss the rotation as well as the report and complete the attached evaluation form. Rotation Advisors should complete the evaluation form and must submit the form to the program coordinators, via email, by the due date.

Writing the rotation report is a required exercise that provides an opportunity to gain experience writing a scientific paper. While the faculty understand that it is often difficult to obtain a “real paper’s worth” of data in the course of a laboratory, writing the report will be a valuable experience in organizing your thoughts and experimental results in a scholarly way that brings the rotation project to a proper conclusion.

At the end of each rotation, the student is required to complete a written report of 2-3 pages (including figures) and prepared according to the style suggested for contributors to The Journal of Biological Chemistry, which can be found here: <http://www.jbc.org/site/misc/ifora.xhtml>.

When the written report is complete, the rotation mentor will review the performance of the student and assign a letter grade for the rotation. As per our program guidelines, failure to maintain satisfactory laboratory performance will result in dismissal from the program.



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PMI Rotation Evaluation

Student name:

Date:

Lab Mentor:

Overall GRADE (select from drop down): A+

	Excellent	Acceptable	Unacceptable	Unable to Assess
Effort in Lab	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reads Primary Literature	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Independence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Analytical Skills	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Technical Skills	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Verbal Communication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Written Communication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Interpersonal Skills	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Responsible Conduct of Research	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Intellectual Contributions to Lab	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rotation Report	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:



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PMI Thesis Committee Meeting Report

Student name:

Meeting date:

Committee members present:

Adequate progress (select from drop down)? Yes

Permission to write (select from drop down)? No

Specific comments:



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PMI Yearly Progress Evaluation - Summary

Date:

Student:

Advisor:

Standing in the Program (select one):

- Good Progress – No concerns noted
- Some Concerns – See below
- Major Concerns – Please contact the Program Director

Program guidelines stipulate meetings with your thesis committee every 6 months.

Students just completing their Comprehensive Exam should form a thesis committee as soon as possible and meet with them within 6 months.

Students are encouraged to discuss their progress in the program with the Director and/or with their laboratory mentor.

Specific Comments



Yearly Student Self-evaluation

1. Name and Date:
2. Advisor:
3. Date entered graduate program (month & year):
4. Have you passed the comprehensive exam? Yes No
5. List all journal clubs and seminar series you attended regularly this year and indicate how many times you presented in each of them in the past year.
6. Have you formed a dissertation committee? Yes No
7. Has your dissertation proposal been approved at the first meeting? Yes No
 - a. Please list the members of the committee (* next to committee chair name):
8. Dates of all dissertation committee meetings (Not just this past year):
9. How often do you formally meet with your advisor to discuss your research, progress, and career options? (For example: weekly, twice a month, monthly, rarely, never, etc.)
 - a. Do not include meetings/discussions in the context of lab meetings.
10. List all papers submitted or accepted for publication from your doctoral studies.
11. List all abstracts presented at meetings thus far during your time in the program. Include abstracts submitted/accepted for upcoming meetings. Indicate whether poster or oral presentations.
12. List your major research and career goals for the next year (e.g., plan to submit a paper; defend thesis; start looking for a post-doc, etc.)
13. What are your goals for further training and/or employment after completion of your thesis?
14. Please attach or send a current NIH Biosketch.
15. **Optional:** Please discuss any concerns you have with your mentor that you feel should be brought to the attention of the PMI Evaluations Committee. This statement will NOT be shared with the mentor it will be kept confidential.



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Yearly Student Evaluation - Mentor

Student name:

Date:

	Outstanding	Excellent	Acceptable	Not Acceptable	Unable to Assess
Effort in Lab	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reads Primary Literature	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Independence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Analytical Skills	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ability to Perform Technical Tasks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ability to Express Self Verbally	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ability to Express Self in Writing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ability to Interact with Others	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Integrity in Lab Work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Contributes Intellectually to Lab	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall Evaluation:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please provide a brief synopsis of the student's progress, noting any major concerns. Specifically comment on the status of current and upcoming publications. This statement will be shared with the student. *All students are required to have published [or accepted for publication] at least one first-author manuscript of original research before defending their dissertation.*

Optional: Please discuss any major concerns you have with the student that you feel should be brought to the attention of the PMI Evaluations Committee. This statement will NOT be shared with the student.