PROGRAM HANDBOOK

Graduate Program in Immunology
University of Pennsylvania
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Updated Summer 2017
History and Scope of Immunology Program

Education and research in Immunology has a 60-year history at the University of Pennsylvania. The program began when a group of faculty doing research in Immunology established the Immunology Graduate Group (IGG) in 1971 to develop a formal program of doctoral studies.

The faculty persuaded the University to recognize the medical significance of immunological phenomena, and thus support was granted for this new program. The faculty of IGG are drawn from eight different units of the University of Pennsylvania: College of Arts and Sciences; Medical School; Hospital of the University of Pennsylvania; Children’s Hospital of Philadelphia; Dental School; Veterinary School; The Wistar Institute; and Institute for Cancer Research.

Graduate education in the Perelman School of Medicine was reorganized in 1985, and since then the program has been administrated by the Office of Biomedical Graduate Studies (BGS). The BGS office provides IGG and other graduate programs at the medical school with record keeping capabilities, course quality control, University oversight, and some financial resources.

Immunology is essentially a study of complex biological processes. Immunology research issues intersect with all life sciences and with some physical sciences, including chemistry and physics; this breadth of topics provides diverse research opportunities for the immunology trainees. This training is designed, therefore, to provide the basic knowledge and laboratory experience that will facilitate productive investigation in whatever specialized area the student chooses. As such, the faculty encourage applications from individuals with a broad range of research interests and recruits students from various scientific backgrounds.

Training Mission

The Immunology Graduate Group identifies outstanding PhD candidates, recruits them to the University of Pennsylvania, and trains them to be productive scientists. Our training program provides students with mentorship and helps them develop the skills they need to become independent research scientists. However, because our graduates also pursue careers other than research, our training program is designed also to prepare students for these careers. Pursuant to this overall goal, IGG seeks to provide each trainee with a comprehensive understanding of the foundation of modern immunology: students learn the applications of and importance of both the conceptual and experimental perspective, and they also learn the contemporary and historical views associated with the study of immunology.
IGG accomplishes its training goals by:

- Providing trainees with a foundation of knowledge through coursework, seminars, a journal club, and interactions with visiting scientists;
- Training students to evaluate the current literature and develop questions into testable hypotheses;
- Providing trainees with an intensive basic research experience.

**Program Structure**

The program structure of the graduate program in Immunology includes formal coursework, informal journal clubs and seminars, interactions with outside senior scientists, and a formal research experience. Successful students will gain a comprehensive knowledge of the immune system and its regulation and the skills necessary for a career in biomedical science.

**Required Courses**

All students must demonstrate understanding of course material by: 1) completing examinations, 2) writing the appropriate assignments, and 3) achieving a minimum final grade of B in each course.

The following courses are required for all PhD students:

- IMUN 506 Immune Mechanisms
- IMUN 507 Immune Functions
- IMUN 599 Immunology Faculty Research Seminar
- IMUN 601 Cellular Immunology
- IMUN 607 Grant Writing
- IMUN 699 Laboratory Rotation
- BIOM 555 Eukaryotic Gene Expression
- BIOM 600 Cell Biology and Biochemistry
- BIOM 611 Biological Data Analysis

Combined degree students are required not required to complete BIOM 600 and IMUN 601.

**Distribution Requirements**

In addition to the Required Courses, the curriculum requires all students to take two courses from the core courses in Cell and Molecular Biology, Biochemistry and/or Molecular Genetics. Professional school courses will satisfy one or two of these courses for Combined Degree and CIGDP students. Because these students vary in their preparation for graduate
school, each student’s individual curriculum will be decided after consultation with the graduate group chair and the chair of the Curriculum and Combined Degree Advisory Committees. The purpose of these courses is to provide the students with the breadth of knowledge required to gain a thorough understanding of immunological processes.

Courses that satisfy the distribution requirement include Cell Biology (CAMB 600), Eukaryotic Gene Expression (CAMB 555), and Biochemistry (BMB 600). Students should discuss their plans to fulfill the distribution requirement with the Curriculum Committee chair and the graduate group chair. We encourage students to select courses that will reinforce their specific scientific interests and/or address topics that the students have not received adequate instruction in. Students who have a defined interest in an area related to Immunology, but distinct (i.e. Virology) may select all three courses in a specialized area so as to achieve comprehensive training in this subject. The program is structured to provide broad-based training in biomedical sciences while still remaining flexible with regard to the individual interests of the students. Combined degree students may use courses completed as part of the basic science curriculum to satisfy some or all of the distribution course requirements.

Laboratory Rotations

All students must complete three twelve-week laboratory rotations. To ensure that students are exposed to different research projects, a student’s first and second, and second and third rotations must be in different labs (i.e. the first and third rotations can be in the same lab but the second and third rotations cannot be in the same lab). Students are evaluated and graded on each rotation by the supervising faculty member. The dissertation laboratory is usually chosen from one of these rotation labs, although this is not always required. ALL laboratory assignments must be approved in advance by the IGG chair. The students’ preliminary exams will be based on the projects they encounter in these laboratory rotations.

Ethics Training

Students must understand what is considered ethical behavior in the biomedical research community. Both the BGS Office and IGG require all students to attend at least one ethics training session per year to remain in good standing in the program. The BGS Office coordinates these sessions and notifies students of dates and times they are offered. IGG faculty are required to participate in ethics training once every three years to remain in the group.

Preliminary and Qualifying Exams

Preliminary and/or qualifying exams are tools used to assess the organizational and conceptual abilities of the student in the context of his/her practical experience in the laboratory. Faculty expect that each student will show evidence of knowledge of
immunological concepts that is consistent with his/her level in the program. There are two formal exams, both administered by the Student Affairs Committee. Both exams serve as forums for faculty to evaluate the student’s knowledge of immunology, but the exams are different in the depth of expertise required of the student.

First Preliminary Exam

Format: The first preliminary exam is a half-hour, chalk talk-style presentation in a closed session before an examining committee composed of IGG faculty. PhD students take the first preliminary exam after the second laboratory rotation, usually at the end of the spring semester of the first year. MD/PhD students typically take this exam at the end of the fall semester of the first year (i.e. MD/PhD year 3).

Purpose: The first preliminary exam is used to determine the strengths and weaknesses of the individual student at a point in the training process where changes can be made in the course of study to accommodate his/her needs. Most students find the first preliminary exam useful in practicing their presentation skills and in preparing for the second preliminary exam.

Content: During the presentation, the student must convey an understanding of the rationale for the second laboratory rotation and a plan for future experiments. If data are presented, the student must analyze them critically. The student may not use projection or overhead slides, but may give the examining committee a two-page handout. The examining committee will ask general concept questions to help them assess the student’s knowledge of immunology.

Notification: The examining committee will send the student an assessment of his/her performance on the exam. There is no pass/fail or graded component to the first exam.

Second Preliminary Exam

Format: The format of the second preliminary exam is a short paper, a presentation open to the Penn Immunology community, and a closed session of questioning by the examining committee.

PhD students take the second preliminary exam after the second laboratory rotation, in the middle of the fall semester of the second year. MD/PhD students take this exam at the end of the spring semester of the first year (i.e. MD/PhD year 3).

Purpose: During the second preliminary exam, the examining committee evaluates the student’s progress and to determine if the student is capable of PhD-level research. If the student passes the second preliminary exam, the Executive Committee will meet to determine if the student should be advanced to Dissertation Status. No student may be advanced to Dissertation Status without passing this qualifying exam.
Content: The exam is based on the project undertaken by the student during the second laboratory rotation. There are three parts to the exam:

1. A five-page report
   - The paper should take the form of a short manuscript similar to a JI Cutting Edge article or a JEM Brief Definitive Report (BDR). The paper should include relevant background and rationale for the hypothesis presented, a discussion of the systems used, the results, and discussion and brief future directions
   - This report is limited to five pages, including references
2. An open 30- to 40-minute research seminar that all IGG students and faculty are invited to attend
3. A closed oral exam before the examining committee.

Evaluation: The student’s written report must be approved by the rotation supervisor and submitted to the IGG coordinator and the chair of the Student Affairs Committee one week before the oral exam; this report will be submitted to the examining committee. The examining committee will review the report before the exam, identify areas of potential weakness, and report problems to the student. The research seminar portion of the exam is open to all faculty and students. During the research seminar the student is expected to demonstrate the ability to:

   - Define the research question clearly
   - Defend or, alternatively, suggest alternatives to the experimental approach
   - Interpret preliminary studies and supporting literature
   - Defend ideas criticized by the audience
   - Answer questions from the audience

The degree of success in meeting these tasks indicates the student’s expertise in the research completed in the laboratory project.

A closed session before the examining committee will follow the open session. At this time, the committee will more thoroughly examine the student’s performance in the rotation and clarify issues raised by the written document and the open session. During this phase of the exam, members of the committee will ask the student questions to test understanding of the research and general concepts in immunology. The committee will then excuse the student and ask the rotation advisor to assess the performance of the student in the laboratory and his/her aptitude for thesis-level research. The committee will then excuse the rotation advisor and discuss the student's performance in the laboratory. This recommendation is passed on to the IGG Executive Committee who will then make the final decision regarding advancement to dissertation status or dismissal from the program.

Notification: The student will receive a written report from the Executive Committee. Factors that influence this decision include: 1) performance in coursework; 2) participation in journal clubs and seminars; 3) performance in the first and second preliminary level
exams; and, 4) evaluations by rotation supervisors. Only under very unusual circumstances will a student be allowed to retake the second preliminary exam.

**Advancement to Candidacy**

Advancement to candidacy indicates that the student possesses the organizational and conceptual skills necessary for PhD level research, and is judged capable and prepared to begin thesis work. At this time, the responsibility of monitoring the student’s progress shifts from the Student Affairs Committee to the student’s thesis committee.

After the second preliminary examination, the Executive Committee will review the student’s performance in the graduate program. Although the student must possess at least a B average in all coursework, including independent studies and laboratory rotations, the most important aspect of this evaluation is the student’s performance in laboratory work and the Second Preliminary Exam. At this stage, the Executive Committee will recommend to the graduate group chair to (1) advance the student to Dissertation Status or (2) dismiss him/her from the program. In unusual situations, this decision may be deferred until a student takes remedial measures.

**Dissertation Research**

Upon advancement to candidacy, the student must do the following:

1. Select a thesis laboratory and begin a research project in that laboratory within a month.
2. Choose a thesis mentor within one month and a thesis committee within six months. The mentor will help select four faculty members to serve on the thesis committee. Two of the faculty members must be in IGG. The thesis mentor and members must be approved by the IGG chair, who will then officially appoint the thesis committee. Subsequent changes in membership can only be made with the permission of the thesis committee and IGG chair.
3. Meet with the thesis committee and mentor within twelve months. At this time the committee will select a committee chair, who will document the progress of the student on the *Thesis Committee Meeting Evaluation Form*. The committee chair must be a member of IGG. The form must be reviewed by the student and mentor and then placed in the student’s file within a week of each formal meeting. At each meeting the committee will decide the interval of time until the next meeting. The thesis committee chair will ensure that the committee meets at least once a year; under no circumstances shall it be more than twelve months.

Note: MD/PhD students are required to select a thesis committee within three months and hold the first thesis committee meeting within six months of the second preliminary exam.
Student Progress

The thesis committee is responsible for evaluating the student’s progress toward the degree. If the Committee feels the student’s progress is unsatisfactory, they will notify the IGG chair. The chair will call a meeting of the Executive Committee to discuss and determine the appropriate course of action. In extreme situations, the Executive Committee can recommend the student’s dismissal from the Program.

Quality of Research

The thesis committee must also evaluate the scientific quality and importance of the student’s work and decide when to grant permission to write the thesis. Formal permission to write the thesis implies that all of the data the student will include in the document has been reviewed by the thesis committee and meets with their approval.

Relevance of Research

The thesis committee must also ensure that the body of work accomplished by the student is relevant and important to the scientific community. These criteria can be met if the student has at least two papers published or in press in peer-reviewed scientific journals. If the student has not published two papers, the thesis committee will evaluate the work within the proposed thesis and predict if the student can reasonably expect that s/he will publish two papers on the work. At this point, the chair of the thesis committee should notify the IGG chair in writing that the Committee plans to grant permission to write the thesis. Upon receiving official permission to write, the candidate must complete the thesis within six months. Failure to do so will place the student in unsatisfactory standing, and the Executive Committee will meet to discuss the student’s situation.

Dissertation Requirements

The PhD dissertation is a document that describes the body of research accomplished while in the thesis laboratory and, moreover, places this work within the framework of the specific field of study and immunology in general. By its very nature the dissertation is a scholarly and comprehensive discussion of the laboratory work, the literature leading up to and justifying the importance of the research, and a thorough discussion of the interpretation and importance of the findings. The dissertation is not merely the "stapling together" of published and unpublished manuscripts written by the student. The written dissertation demonstrates to the scientific community that the PhD candidate is able to define and execute hypothesis-driven research and able to define its contribution to the advancement of scientific knowledge.

The body of the dissertation has four sections.
Introduction

This section is a comprehensive review and analysis of all the relevant literature on the thesis topic. This review provides an argument for the relevance and logic of the proposed hypotheses, and allows the student to justify the experimental systems used. The literature review also provides background information and references so that the dissertation can be evaluated and understood by scientists outside of the immediate field.

Experimental Work

This section comprises multiple chapters, each associated with experimental results that test independent hypotheses or separate questions. The entirety of the experimental work that is related to each or all of the questions addressed in the thesis laboratory is presented and interpreted in the context of a unified theme or area of study. All data and results presented must be of high quality and capable of withstanding peer review. The candidate can reasonably conclude that work accepted for publication and/or reviewed and previously accepted by their thesis committee meets this standard.

Besides experimental data and results, this section can also include descriptive tables, figures, and photographs that provide clarification and summaries of the experimental studies and models proposed. In all cases it is expected that these summaries and models will be supported by the data actually presented in the body of the thesis.

Finally, each experimental result chapter should be accompanied by a short discussion. This discussion should summarize the results presented in that section or chapter, and does not substitute for the thorough discussion described in the next section.

Discussion

This is among the most important sections of the dissertation, although it is often the one receiving the least attention during preparation. The discussion is not just a reiteration of the experimental results. Rather, the discussion is a critical survey of the important findings of the study. In this section, these findings should be interpreted in the context of the underlying theme or hypotheses outlined in the Introduction. Furthermore, the importance of the major findings and their interpretation should be discussed in a comprehensive manner as they relate to the field, both currently and within a historical perspective. In this regard, it is useful to return to the Introduction and explain to the educated scientist, but not necessarily an expert in your field, why your studies are important and how they explain, clarify, or expand upon current controversies or unanswered questions in your field of study.

Finally, and of equal importance, where do these studies fit in the general field of Immunology? This area of the discussion is speculative, but speculation is encouraged as long as it is logical and consistent with the data and the literature. The dissertation is an
opportunity to exhibit creativity and ability to express this creativity within the constraints of sound scientific judgment.

Literature Cited

This section lists all published and in-press studies referred to in all other sections of the thesis. Although review articles may be cited in some cases, it is usually most appropriate to cite the primary work. References from textbooks are rarely appropriate.

Dissertation Defense

Permission to Write and Scheduling a Defense Date

- When a thesis committee formally grants permission to student to write her/his thesis, the student must notify the IGG coordinator that permission to write has been granted.
- The student must notify the IGG coordinator of the defense date as soon as it is scheduled so a room can be reserved.
- The student has six months from the time that permission to write is granted to submit the thesis. If the student does not meet the submission deadline then another thesis committee meeting must be convened to review the student’s progress.

Submitting the Thesis

- The student must submit a complete thesis to the committee at least three weeks prior to the defense date.
- The student should follow up with the thesis committee one week prior to the defense date to confirm that the thesis is acceptable and the defense can move forward.
- If student does not give the thesis committee and outside reviewer sufficient time to examine their dissertation, the student jeopardizes the preservation of their defense date. In such circumstances, the scheduled defense date can be canceled at the discretion of the IGG chair.

External Reviewer

An external reviewer is a scientist from an academic institution other than Penn. Although an external reviewer is not required, it is encouraged.
• If the student would like an outside reviewer at her/his defense, the student, with thesis committee approval, must give the name of the outside reviewer to the IGG chair for approval at least six weeks prior to the defense date.
• With mentor approval, the student submits a completed dissertation to their thesis committee for review at least six weeks prior to the defense date.
• The student follows up with the thesis committee four weeks prior to the defense date so that they can make any recommended changes prior to submitting their dissertation to the external reviewer.
• The student ensures that the thesis committee chair communicates his/her approval for submitting the dissertation to the external reviewer to the IGG chair/coordinator.
• The student sends the dissertation and the document “Criteria for Dissertation Review” (provided by the IGG coordinator) to the outside reviewer at least three weeks prior to the defense date.
• The student follows up with the external reviewer to ensure that she/he submits comments to both the IGG chair/coordinator and thesis committee chair prior to the defense date.

The Defense

During the defense, the thesis committee operates without the active participation of the mentor. The defense itself is preceded by a public seminar on the dissertation results by the candidate. This seminar is followed by a closed session in which the candidate answers questions from her/his committee.

Dissertation Publication

When uploading the final draft of the thesis, students are given an option to delay the release of her/his thesis. The student or the PI may want to delay publication when a paper is in press, a patent application is pending, etc. Students must talk with her/his PI prior to uploading the thesis.

Delays longer than one year require additional paperwork that must be completed prior to uploading the final draft of the thesis.

Recertification Policy

For students who reach a fifth year post candidacy, several steps will be taken to establish the underlying basis for inordinately slow academic progress, and to reach agreement on how to proceed to best serve the student. This process will occur annually, if need be, for students beyond their 5th year post candidacy.
The student, his/her mentor, and the thesis committee chairperson will meet with the IGG executive committee and will review all work completed to date, outline any extenuating circumstances that may have delayed progress, and propose an academic plan and timetable for completion of the degree, not to exceed one year. Exceptions to this rule may be considered by the executive committee only under extenuating circumstances, (e.g.; a student has changed thesis laboratory during their training, but is making satisfactory progress in the new lab).

Following this presentation and any discussion, and in the absence of the mentor and student, the executive committee will confer and will either:

1. Recommend extension, indicating their rationale for deciding that satisfactory academic progress is being made. Further they may either accept the plan for completion of degree or further modify to the plan, at their discretion. The plan will be conveyed in writing under the IGG chairperson's signature to the student, mentor and thesis committee chairperson. In addition, the IGG chairperson, or his/her designee, will become an ex officio member of the thesis committee. The student and mentor will then meet with the thesis committee and report milestones at four month or more frequent intervals, with the IGG chair acting as liaison to the executive committee; or
2. Recommend a terminal masters degree, with an outline of requisites for conferral; or
3. Recommend termination without degree. Upon satisfactory re-certification, the student must complete all requirements for the PhD, including deposit of the dissertation, within one year.

**Forums for Scientific Exchange**

We realize that the majority of scientific information and experience is gained not only from one’s work on a project but also through interactions with other scientists. Often critical insights come from the most unexpected directions. Recognizing this fact, IGG encourages and requires participation in both formal and informal forums that promote interactions with other scientists and the free exchange of ideas.

The first- and second-year students are required to attend the weekly IGG Journal Club and the Immunology Colloquium. More senior students are strongly encouraged to attend, but the Program realizes that in some cases other seminar programs and journal clubs may be more appropriate to their institutional obligations and interests.

All students are required to attend the Annual Retreat. In addition, ALL students must give at least one presentation per year, preferably on the progress of his/her dissertation research. This can take the form of a presentation at the Annual Retreat or a presentation at a local or national meeting, or at the student chalkboard seminars held throughout the year.
Immunology Colloquium

Weekly seminar series with external invited speakers covering diverse immunological topics. Attendance is mandatory for all students to remain in good standing in the graduate program.

Annual Retreat

The Immunology Graduate Group has an annual retreat featuring an invited outside speaker and short talks and poster presentations by the graduate group trainees. All Immunology Graduate Group students beyond the second year will present each year at the Retreat. Postdoctoral fellows in the laboratories of graduate group faculty are also welcome to attend and present posters.

Course Descriptions

BIOM 555 Gene Expression

Regulation of gene expression including chromatin structure, transcription, DNA modification, RNA processing, translation, control of gene expression via microRNAs and post translational processing. [Spring, 1 credit]

BIOM 600 Cell Biology & Biochemistry

An intermediate level graduate course designed to introduce students to the molecular components and physiological mechanisms that underlie the structure and function of cells. The course is designed as an in depth survey to cover general concepts central to the field of biochemistry and cell biology and to emphasize these concepts within the context of current scientific research questions and technical approaches. [Fall, 1 credit]

BIOM 611 Biological Data Analysis

Provides an introduction to important topics in biostatistical concepts and reasoning and instructions on practices in data analysis. Labs will help students learn and implement the methods using R. Though there are some formulae and computational elements to the course, the emphasis is on interpretation, concepts, and applications. [Spring, 1 credit]

IMUN 506 Immune Mechanisms

This course assumes basic knowledge of the immune system. The course is a team-taught, lecture-based course that utilizes experimental data from the primary literature to examine basic cellular and molecular aspects of the immune system. The course begins with general overviews, moves to more detailed introductions of innate and adaptive immune cells, and
then examines the activation and integration of innate and adaptive immune mechanisms. Several sessions focusing on presentation and discussion of primary papers will follow lectures that cover related topics. [Fall, 1 credit]

IMUN 507 Immune Functions

This course assumes basic knowledge of the immune system. The course is a team taught, lecture-based course that utilizes experimental data from the primary literature to examine basic cellular and molecular aspects of the immune system. The course is an extension of Immunology 506 and focuses on advanced topics in immunology and specific examples of immunological diseases. Several sessions focusing on presentation and discussion of primary papers will follow lectures that cover related topics. [Spring, 1 credit]

IMUN 520 Elective Tutorials in Immunology

This tutorial course is designed to provide students with an in-depth knowledge of a specific branch of Immunology. The tutorial can be used to enable students to become more deeply acquainted with the literature related to their thesis projects or to expand on a topic that the student found interesting in one of their basic courses. This course is open as an elective to all BGS students who meet the pre-requisite. [Fall, 1 credit]

IMUN 599 Immunology Faculty Research Seminar

This is a two-semester course that will expose the student to the ongoing research of the Immunology Graduate Group. The format of the course will be presentations by individual faculty members on their laboratory research. [Fall and Spring, 0.5 - 4 credits each semester]

IMUN 601 Cellular Immunology

This course is offered as a parallel course to introductory cell biology to specifically illustrate cell biological principles as they apply to the immune system. The course meets weekly and covers landmark immunology papers that advance our understanding of the immune system through the cell biology of immune cells. Specific concepts covered over the course of the semester include: imaging, intracellular traffic, molecular motors, quality control, ion channels, intracellular gradients, cytoskeleton, and organization of signaling. The format includes student presentations linking basic cell biology to the immunological work to be discussed followed by a faculty-directed analysis of a paper with special emphasis on its cell biology. The course ends with a brief paper discussing a cell biological principle as illustrated by immune studies. [Fall, 0.5 credits]

IMUN 607 Grant Writing

The goals of this course are several. First, the basic principles of grant writing are introduced. In this regard, a primary objective of the course is to teach how to describe ideas and experimental objectives in a clear and concise manner within the standard NIH grant
format. To accomplish this, students will be required to write an NIH “RO1” type grant proposal based on your current laboratory project.

The second goal is to sharpen oral presentation skills. Accordingly, students will be required to give a presentation describing the scientific background and experimental rationale for their proposals as well as a brief description of their research plans.

Third, we will provide some insights into how grants are processed and reviewed by the NIH. To this end, students will participate in a mock study section in which they will evaluate and score grants written by fellow students. There will also be a presentation from an NIH grants administration staff member, who will provide a description of how grants are assigned to particular institutes and study sections at the NIH and how grant applications are processed after the review process. Finally, some of the administrative aspects of grant preparation will be addressed, including preparing a budget, routing grants through the system, and other items. [Spring, 1 credit]

IMUN 609 Vaccines and Immunotherapeutics

The goal of the Vaccines course is to expand on student's general understanding of the immune system and to focus this understanding towards the application of vaccination. Furthermore the course will give the student a sense of how these principles are applied to vaccine and immune therapeutic development. The course covers basic science as well as the Clinical, Ethical & Political implications of Modern Vaccines.

Initial lectures will review immune mechanisms believed to be responsible for vaccine-induced protection from disease. Subsequent lectures build on this background to explore the science of vaccines for diverse pathogens, including agents of bioterrorism as well as vaccines for cancer. An appreciation for the application of laboratory science to the clinical development of vaccines is provided in the next section of the course along with lectures that focus on the ethical implications of vaccines in different situations. The financial implications of specific vaccines and their impact on the global community are a specific focus of the course. [Fall, 1 credit]

IMUN 699 Laboratory Rotation

Laboratory research conducted with approval of laboratory director. Two different rotations covering usually the spring semester of the first year through the fall semester of the second year are required of Immunology PhD students. Rotations will be defended in preliminary examinations at the end of the spring rotation of the first year (in late May) and at the end of the summer/fall rotation of the second year (in late October and/or early November). [Fall and Spring, 1 credit each semester]
Sample Course Outline (PhD)

NOTE: MD/PhD and VMD/PhD students are not required to enroll in BIOM 600 and IMUN 601. In addition, BIOM 611 can be taken in spring of the first year or spring of the second year. Combined-degree students take the first rotation during the second year of professional training. The second and third rotations are in the fall and spring (respectively) of the first year of doctoral study; each of these rotations concludes with a preliminary exam.

Year 1 – PhD

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<th>Fall</th>
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<tr>
<td>IMUN 506 Immune Mechanisms</td>
<td>IMUN 507 Immune Functions</td>
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<td>IMUN 599 Faculty Research Seminar</td>
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<td>IMUN 601 Cellular Immunology</td>
<td>BIOM 555 Gene Expression</td>
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<td>BIOM 600 Cell Biology &amp; Biochemistry</td>
<td>BIOM 611 Biological Data Analysis</td>
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<td>IMUN 699 Laboratory Rotation I</td>
<td>IMUN 699 Laboratory Rotation II</td>
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Summer

First Preliminary Exam
IMUN 699 Laboratory Rotation III

Year 2 – PhD

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<tr>
<td>IMUN 699 Laboratory Rotation III (cont’d)</td>
<td>IMUN 607 Grant Writing</td>
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<tr>
<td>Elective (optional)</td>
<td>IMUN 899 Pre-dissertation Research</td>
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<td>Second Preliminary Exam</td>
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Electives

Students have the option to take electives as part of their coursework. The best time to take electives is in the second and third years. The list below includes a selection of courses in BMB, CAMB, and INSC. Electives can be taken beginning in the first year with permission of the IGG chair and the student's advisor.

Biochemistry and Molecular Biophysics

- BMB 508 Macromolecular Biophysics
- INSC 587 Neurobiology of Disease
- BMB 550 Macromolecular Crystallography

Neuroscience

- INSC 587 Neurobiology of Disease
Cell and Molecular Biology

- CAMB 539 Prokaryotic Molecular Genetics
- CAMB 545 Fundamental Virology
- CAMB 555 Eukaryotic Gene Expression
- CAMB 600 Cell Biology
- CAMB 601 Advanced Virology Seminar
- CAMB 608 Regulation of Eukaryotic Gene Expression
- CAMB 621 Seminar in Retroviral Biology

Immunology

- IMUN 520 Elective Tutorials in Immunology
- IMUN 609 Vaccines and Immunotherapeutics

**Student Activities**

**Annual Retreat**

All IGG students are required to attend the Annual Retreat each spring. Students in years 3+ present talks, and other students submit posters for the afternoon poster session. Students may serve on the Retreat Committee and help make decisions regarding the program.

**Student Research in Progress Seminar**

This series is organized entirely by the students. This is a seminar series held one evening per month and was created to give the advanced students an opportunity to present their research work in front of the Immunology student body. Aside from being valuable to the student for his/her professional growth and development, this series also serves as a means for social interaction among the students.

**Journal Club**

The student-organized Journal Club meets weekly at a time agreeable to all the current students. At each meeting, a student presents one or two current publications of the seminar speaker scheduled for the next week’s Immunology Colloquium series. This exercise is to help students prepare for the material that will be presented at the seminar.
Visiting Faculty

Each year, students in the third-year cohort invite between three to five distinguished scientists to visit the University. The distinguished guest meets with faculty during the day, presents a seminar at the Immunology Colloquium series in the afternoon, and meets with students in the evening for an informal dinner. The dinner provides an opportunity to discuss science in a relaxed environment.

Graduate Group Committees

Executive Committee

- David Allman, Chair
- Paula Oliver, Vice-Chair
- Rémy Bosselut
- Igor Brodsky
- Janis Burkhardt
- Michael Cancro
- Sara Cherry
- Laurence Eisenlohr
- Bruce Freedman
- Mark Greene
- Christopher Hunter
- Taku Kambayashi
- Terri Laufer
- Michael May
- Warren Pear
- Phillip Scott
- Sunny Shin
- Erica Stone
- Andrew Wells
- John Wherry

Student Affairs Committee

- Terri Laufer, Chair
- Sunny Shin, Co-Chair
- Edward Behrens
- Daniel Beiting
- Igor Brodsky
- Janis Burkhardt
• Michael Cancro
• Jorge Henao-Mejia
• Martha Jordan
• Taku Kambayashi
• Paula Oliver
• Erica Stone
• Andrew Wells

Curriculum Committee

• Michael May, Chair
• De'Broski Herbert
• Paula Oliver
• Erica Stone
• Andrew Wells
• Golnaz Vahedi (BGS Core Curriculum)

Admissions Committee

• Laurence Eisenlohr, Co-Chair
• Taku Kambayashi, Co-Chair
• David Allman
• Craig Bassing
• Igor Brodsky
• Janis Burkhardt
• Michael Cancro
• Christopher Hunter
• Paula Oliver
• Warren Pear
• Phillip Scott
• John Wherry

Fellowships Committee

• Sunny Shin, Chair

Career Development Committee

• Janis Burkhardt, Chair
• Youhai Chen


- Jonathan Maltzman
- Jonni Moore
- Andrei Thomas-Tikhonenko

Retreat Committee

- Bruce Freedman
- Michael May

Advising

- Paula Oliver
- Sara Cherry

**Administrative Structure**

Chairperson

The chairperson is an individual responsible for governance of IGG. The IGG chair oversees all committees of IGG and selects Course Directors for all courses. The chair convenes meetings of the Executive Committee and sets the agenda for these meetings. The chair sets the agenda and presides over biannual Faculty Meetings.

In addition to these responsibilities, the chair also:

- Supervises day-to-day operations of the IGG
- Serves on all IGG Committees
- Attends to the funding of all IGG students
- Helps Training Grant principal investigators identify students appropriate for their training programs
- Serves on the Biomedical Graduate Studies Advisory Committee
- Meets with students on a regular basis
- Oversees the graduate group coordinator
- Tracks the progress of the students and maintains the students’ files
- Oversees the Faculty composition of the Program
- Approves rotation and thesis laboratories and assures regular thesis committee meetings
- Gives final approval of the dissertation
- Prepares the resource document for graduate group reviews
The chair serves a three-year renewable term. In the Spring semester of the third year of a term, the Personnel Committee requests nominations for the chair and then contacts the nominees to determine if they would agree to serve. Nominations must be of senior level (Associate or Full Professor) individuals from the Standing Faculty of the University. The chair is expected to be experienced in training PhD level students.

Executive Committee

The Executive Committee is an advisory committee to the chair. It is composed of the IGG chair and at least five other senior members of IGG. The membership will represent the concerns of Student Affairs, Curriculum, and Admissions Committees in addition to the primary training grants supporting students in the Program. The Executive Committee’s responsibilities are to maintain integration of the various graduate group programs and to review significant changes in policy, direction, or intent as recommended by other Committees or members prior to final approval by the membership at large. The Executive Committee will decide on the advancement to candidacy for each student in the Program. For this reason, the membership should always broadly represent each aspect of the students’ training program. The chair of the Executive Committee is always the IGG chair.

Admissions Committee

The primary duties of the Admissions Committee include:

- Reviewing applications to the Program
- Selecting applicants to interview
- Interviewing students
- Organizing recruitment efforts
- Ranking applicants and submitting lists to the BGS Office Admissions Committee approval and ranking

The chair of the Admissions Committee will sit on the BGS Admissions Committee and represent IGG. S/he will also be a member of the IGG Executive Committee.

Student Affairs Committee

The Student Affairs Committee reviews the progress of all first- and second-year students. This Committee and administers the First and Second Phase Oral Examinations. The chair of the Student Affairs Committee sits on the IGG Executive Committee.
Curriculum Committee

The Curriculum Committee reviews the existing curriculum and evaluates how the students’ needs are met by the available courses. Modifications to the existing curriculum are initiated by this Committee and approved by the Executive Committee and then by the membership of IGG. Two IGG students will serve on this Committee.

The chair of this committee prepares the agenda and runs committee meetings, attends BGS Curriculum Committee meetings, and sits on the IGG Executive Committee.

Membership Committee

The Membership Committee evaluates faculty applications for membership in IGG. This committee reviews applications and votes for nomination and election to membership. This Committee also solicits nominations for IGG chair and tabulates votes from the membership.

Retreat Committee

The Retreat Committee coordinates the Annual Retreat. They are responsible for inviting a guest speaker to discuss his/her work. The co-chairs also organize chalk talks and poster presentations given by IGG students and faculty members.