

## **History & 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 Ph.D. 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 the 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 School of Medicine was reorganized in 1985, and since then the IGG has been administrated by the Office of Biomedical Graduate Studies (BGS). The BGS office provides the 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 IGG encourages applications from a faculty with a broad range of research interests and recruits students from various scientific backgrounds.

## **Training Mission**

The Immunology Graduate Group identifies outstanding Ph.D. 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, the 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.

The IGG accomplishes its training goals by:

1. providing trainees with a foundation of knowledge through coursework, seminars, a journal club, and interactions with visiting scientists;

2. training students to evaluate the current literature and develop questions into testable hypotheses;
3. 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

1. a comprehensive knowledge of the immune system and its regulation, and
2. the skills necessary for a career in biomedical science.

## **Courses**

### **A. Required Courses in Immunology**

All students must demonstrate understanding of course material by (1) completing examinations, (2) writing the appropriate assignments, and (3) achieving a minimum B final course grade in each course. If they do these things, students will remain in Good Standing in the program. The following courses are required for all students:

- Immunology 506 Immune Mechanisms
- Immunology 508 Immune Responses
- Immunology 520 Elective Tutorials in Immunology
- Immunology 599 Immunology Faculty Research Seminar
- Immunology 601 Molecular Immunology
- Immunology 605 Current Topics in Molecular and Cellular Immunology
- Immunology 607 Advanced Topics in Molecular and Cellular Immunology (Grant Proposals)
- Immunology 699 Laboratory Rotation

### **B. 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.

#### C. Laboratory Rotations

All students must complete three twelve-week laboratory rotations. To ensure that students are exposed to different research projects, the IGG requires the students to rotate in three different IGG faculty members' laboratories. Student will be 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.

#### D. Ethics Training

Students must understand what is considered ethical behavior in the biomedical research community. Both the BGS Office and the 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. The 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. The IGG faculty expects that each student will show evidence of his/her 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.

#### A. First Preliminary Exam

Format - This is a half hour presentation in a closed session before the members of the Student Affairs Committee. The Ph.D. students take the First Preliminary Exam after the 2nd Laboratory Rotation, usually at the end of Spring Semester of the 1st year. The M.D./Ph.D. students usually go at the end of the Fall Semester of their 1st year in the Program.

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 2nd 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 unless there is raw data that cannot be displayed in any other manner. The Student Affairs Committee will ask general concept questions to help them assess the student's knowledge of Immunology.

Evaluation - The Committee will then excuse the student and decide if the student passed or failed the exam. This decision is forwarded to the Executive Committee of the Program. If the student fails the exam, the Committee will also forward recommendations for remedial action or acknowledgment of extenuating circumstances. If the Executive Committee determines the student is deficient, remedial action including additional coursework, presentations in journal clubs, or a re-exam will be assigned. Only under very unusual circumstances will the student be dismissed from the program at this time.

Notification - The Student Affairs Committee will send the student an analysis of his/her performance on the exam. This is when the student learns if s/he passed.

#### B. Second Preliminary Exam

Format - The Second Preliminary Exam has three parts: - (1) a short paper, (2) an hour presentation in an open session of the students and faculty of the IGG, and (3) a closed session of questioning by the Student Affairs Committee. The Ph.D. students take the Second Preliminary Exam after the 3rd Laboratory Rotation, in fall of the 2nd year. The M.D./Ph.D. students go in the summer at the end of their 1st year in the program.

Purpose - During the Second Preliminary, or Qualifying Exam, the Student Affairs Committee evaluates the student's progress and tries to determine if the student is capable of Ph.D. 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 3rd Laboratory Rotation. There are three parts to the exam: (1) a concise, five-page report of the experiment's rationale, summary of the laboratory research, and relevant data and the student's interpretation of that data; (2) an open 40-50 minute research seminar that all IGG students and faculty are invited to attend, and (3) a closed oral exam before the Student Affairs Committee.

Evaluation - The student's written report must be approved by the Rotation Supervisor and submitted to the Student Affairs Committee two weeks before the oral exam. The 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: 1) define the research question clearly; 2) defend or, alternatively, suggest alternatives to the experimental approach;

3) interpret preliminary studies and supporting literature; 4) defend ideas criticized by the audience; and 5) 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 Student Affairs 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 decide if the student's performance in the Second Phase Exam demonstrates deficiencies in the student's scientific rigor that might compromise his/her ability to carry out thesis-level research. This recommendation is passed on to the 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 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 level exams; and, 4) evaluations by Rotation Supervisors. Only under very unusual circumstances will a student be allowed to retake the Second Phase Exam.

### **Advancement to Candidacy**

Advancement to candidacy indicates that the student possesses the organizational and conceptual skills necessary for Ph.D. 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.

#### **A. 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 Advisor within six months. The Advisor will help select four faculty members to serve on the Thesis Committee. Two of the faculty members must be in the IGG. The thesis advisor 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 12 months. At this time the committee will select a chairperson, who will document the progress of the student on the Thesis Committee Meeting Evaluation Form. 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 12 months.

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 Immunology Group 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.

## B. Dissertation Requirements

The Ph.D. 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 Ph.D. 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.

### 1) 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.

## 2) 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.

## 3) 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.

## 4) 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.

### C. Dissertation Defense

The guidelines listed below must be followed precisely and the Chair of the Thesis Committee must notify the IGG Coordinator in writing of each progressive step.

- \* Thesis committee formally grants permission to student to write their dissertation and student may then set their tentative defense date

- o Student is responsible for having Thesis Committee Chair notify IGG Chair/Coordinator that that the student has been given permission to write

- o Student must notify IGG Coordinator of defense date as soon as it is set so a room can be reserved

- o Student has six months to submit thesis from time that permission to write is granted. If the student does not meet the submission deadline then another thesis committee meeting must be convened to review the student's progress

- \* Student, with thesis committee approval, submits the name of an outside reviewer, from an academic institution other than Penn, to the IGG Chair for approval at a minimum of six weeks prior to defense date

- \* With mentor approval, the student must submit their completed dissertation to their thesis committee for review at minimum six weeks prior to defense date

- \* Student should follow up with their thesis committee four weeks prior to defense date so that they can make any recommended changes prior to submitting their dissertation to the external reviewer.

- \* Student is also responsible for making sure that the Thesis Committee Chair communicates his/her approval for submitting the dissertation to the external reviewer to the IGG Chair/Coordinator

- \* Student must send dissertation along with Criteria for Dissertation Review (provided by IGG Coordinator) to the outside reviewer at least three weeks prior to defense date

- \* Student is responsible to follow up with external reviewer and ensure that he/she submits comments to both the IGG Chair/Coordinator and Thesis Committee Chair prior to the defense date

- \* If student does not give thesis committee and outside reviewer sufficient time (according to the above timeline) to examine dissertation then they jeopardize the preservation of their defense date. In such circumstances, their defense date can be canceled at the discretion of the IGG Chair

- \* For the dissertation defense, the Thesis Committee operates without the active participation of the Thesis Mentor. The defense itself will be preceded by a seminar on the dissertation results by the candidate.

- \* Upon successfully defending their thesis, student receives Form 153-Certification of Dissertation from IGG Coordinator to bring with them on their deposit date

\* Student also receives Form 154-Postgraduate Information from the IGG Coordinator. The student must complete form and send it back to the IGG Coordinator along with a copy of their Title/Abstract pages as part of their graduation requirements

For information concerning the critical dates that must be met to graduate at the time desired, see:

<http://www.sas.upenn.edu/GAS/home/grad&beyond/graduation.html>

### **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 5<sup>th</sup> 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, the IGG encourages and requires participation in both formal and informal forums that promote interactions with other scientists and the free exchange of ideas.

The 1st and 2nd 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. Short descriptions of some of these programs are:

#### 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.

#### Philadelphia Immunology Conference

Approximately 200 Immunologists in the Philadelphia and surrounding areas attend this annual conference. The format includes two lectures from distinguished outside scientists and presentations from the IGG faculty and trainees, and scientists and trainees from the other biomedical institutions and companies in the Philadelphia area.

#### Immunobiology Meeting

About 25 years ago, Dr. John Cebra established an annual three-day immunology meeting featuring one plenary lecture and 15-minute oral presentations by predoctoral and postdoctoral trainees. Immunologists from Johns Hopkins University, the University of Virginia, the University of Maryland, and the University of Pennsylvania continue to participate in this meeting every year.

#### Annual Retreat

The Immunology Graduate Group has an annual one-day Retreat featuring an invited outside speaker and short talks and poster presentations by the Graduate Group trainees. All Immunology Graduate Group students beyond the first 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.

### **Descriptions of Immunology Courses**

#### BIOM 600-Cell Biology & Biochemistry

Director: John Weisel

Taught: Fall Term, M (12-3 PM), WF (1-3 PM)

Credit: 1 c.u.

### Immunology 506 – Immune Mechanisms

Director: David Allman, Ph.D.

Prerequisites: Permission of Director

Taught: Fall term, M (12PM – 3PM), WF (1PM – 3PM)

Credit: 1 c.u.

The course assumes basic knowledge of the immune system. This course is a team taught, lecture-based course which utilizes primary experimental and the primary literature to examine basic cellular and molecular aspects of the immune system. The course will begin with a general overview, move to a discussion of receptor families, cell types, and processes of recombination and antigen presentation. The course will then examine the development and activation of the innate and adaptive immune response. Lectures in each relevant topic will be followed by discussion groups focusing on primary readings.

### Immunology 508 - Immune Responses

Directors: Pete Felsburg, V.M.D., Ph.D., and Kate Sullivan, M.D., Ph.D.

Prerequisites: Immunology 506 or equivalent and permission of Director

Taught: Spring term, MWF (9AM – 11AM)

Credit: 2 c.u.

This course is designed to (1) extend the basic immunology principles addressed in 506, and (2) apply the fundamental principles of the mechanism of immune recognition and development presented in 506 to the immune response in health and disease in vivo. The course is designed as a series of minicourses which may change from year to year. Each minicourse will cover an important topic in immunology in detail. Students must take three minicourses over the spring semester and must take at least one each from the basic and applied immunology categories.

Each minicourse will consist of 6 hours/week for 4 weeks. The semester will be divided into 3 sessions with between 2 to 3 minicourses offered each session. The minicourses will be taught as a combination of formal lectures and seminar-format discussions of relevant literature. Each minicourse will have a slightly different format.

### Immunology 520 - Elective Tutorials in Immunology

Director: Avinash Bhandoola, Ph.D.

Pre-requisites: A senior undergraduate, graduate or professional school course in Immunology.

Taught: Fall semester, arranged individually by students and faculty.

Credit: 1 c.u.

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. The course is currently the only immunology elective and is, therefore, required for all Immunology Graduate Group students. It is also open as an elective to BGS students that meet the pre-requisite.

#### Immunology 599 - Immunology Faculty Research Seminar

Directors: Jonathan Maltzman, M.D. and Paula Oliver, Ph.D.

Prerequisites: Permission of Graduate Group Chair

Taught: Fall and Spring Term, Thursdays (10AM – 11AM)

Credit: 1 c.u. spanning 2 semesters

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.

#### Immunology 601-Molecular Immunology

Director: Jordan Orange, M.D., Ph.D.

Taught: Fall Term, T (9AM-10AM)

Credit: 0.5 c.u.

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.

#### Immunology 605 - Current Topics in Cellular and Molecular Immunology

Directors: Phillip Scott, Ph.D. and Larry Turka, M.D.

Prerequisites: Immunology 506 or permission of director

Taught: M or W (2PM – 4PM). The class is split into two sections.

Credit: 1 c.u.

Developments in cellular and molecular immunology are discussed by students using the current literature as a resource. This course reinforces the concepts presented in Immunology 506. Students gain experience in critically evaluating current literature and

orally presenting and defending their ideas. In the first part of the course the students present one or two papers relevant to current topics in immunology. In the second part of the course the student select a research topic and write and defend a small research proposal.

#### Immunology 607 - Grant Writing

Director: David Allman, Ph.D.

Prerequisites: Immunology 605 or permission of director

Taught: Fall term, T (10AM – 12PM)

Credit: 1 c.u.

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

Second, we would like you to sharpen your oral presentation skills. Accordingly, you will be required to give a presentation describing the scientific background and experimental rationale for your proposal as well as a brief description of your research plan.

Third, we hope to give you some insights into how grants are processed and reviewed by the NIH. To this end, you will participate in a mock study section in which you will evaluate and score grants written by fellow students. We will also be given a presentation from an NIH grants administration staff member who will provide you with 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, you will become familiar with some of the administrative aspects of grant preparation, including preparing a budget, routing grants through the system, and other items.

#### Immunology 609 – Vaccines and Immunotherapeutics

Directors: David Weiner, Ph.D. and Paul Offit, Ph.D.

Prerequisites: Biology, biochemistry, or immunology courses at the advanced college level.

Taught: Fall term, WR (3:30 PM– 5:30PM)

Credit: 1 c.u.

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, is a specific focus of the course.

**Immunology 699 – Laboratory Rotation**

Directors: Staff

Prerequisite: Permission of Chairman

Taught: All semesters

Credit: 1-3 c.u.

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 Ph.D. 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).

**Sample Course Outline (PhD)**

	<b>YEAR ONE</b>	
<b>FALL</b>	<b>SPRING</b>	<b>SUMMER</b>
<b>IMUN 506 Immune Mechanisms</b>	<b>IMUN 508 Immune Responses</b>	<b>IMUN 699 Laboratory Rotation 2 (con't)</b>
<b>IMUN 599 Faculty Research Presentations</b>	<b>IMUN 599 Faculty Research Presentations</b>	<b>IMUN 699 Begin Laboratory Rotation 3</b>
<b>IMUN 699 Laboratory Rotation 1</b>	<b>IMUN 699 Laboratory Rotation 2</b>	<b>1<sup>st</sup> Preliminary Exam Based on Rotation 2</b>
<b>Cell 600 Cell Biology &amp; Biochemistry</b>	<b>IMUN 605 Topics in Cell/Mol Immun</b>	
<b>IMUN 601 Molecular Immunology</b>		
	<b>YEAR TWO</b>	
<b>FALL</b>	<b>SPRING</b>	
<b>IMUN 699 Laboratory Rotation 3 (con't)</b>	<b>IMUN 607 Grant Writing Topics in Cell/Mol Immun</b>	

<b>IMUN 520 Directed Tutorial in Immunology</b>		
<b>2<sup>nd</sup> Preliminary Exam Based on Rotation 3</b>		
	<b>END FORMAL COURSEWORK</b>	

The Electives taken during Fall, Year One, must be chosen from the recommended courses in BMB, CAMB, and INSC (below). One elective may be deferred to Spring semester if the student wishes to take a course not offered during Fall semester.

**Biochemistry and Molecular Biophysics (BMB) Neuroscience (INSC)**

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

**Cell and Molecular Biology (CAMB)**

- CAMB 600 Cell Biology (Fall)

**Genetics**

- CAMB 555 Eukaryotic Gene Expression (Spring)
- CAMB 539 Prokaryotic Molecular Genetics (Fall)
- CAMB 608 Regulation of Eukaryotic Gene Expression (Fall)

**Microbiology**

- CAMB 545 Fundamental Virology (Spring)
- CAMB 601 Advanced Virology Seminar (Fall)
- CAMB 621 Seminar in Retroviral Biology (Spring)

**Sample Course Outline (MD/PhD)**

<b>YEAR</b>	<b>TERM</b>	<b>MEDICAL SCHOOL COURSE</b>	<b>GRADUATE SCHOOL COURSE</b>
<b>1</b>	<b>Fall</b>	<b>Module 1 Module 3</b>	<b>IMUN 599 Faculty Research Presentations</b>
<b>1</b>	<b>Spring</b>	<b>Module 2 Module 3</b>	<b>IMUN 599 Faculty Research Presentations (con't)</b>
<b>1</b>	<b>Summer</b>		<b>Lab Rotation</b>

2	Fall	Module 2 Module 3	Seminar OR Continue Lab Rotation
2	Spring	Module 4 (January-June)	
2	Summer	Boards Step One (August)	Lab Rotation
3	Fall		IMUN 506 and One Elective, Continue Lab Rotation, 1 <sup>st</sup> Preliminary Exam
3	Spring		IMUN 508, IMUN 605, Lab Rotation
3	Summer		2 <sup>nd</sup> Preliminary Exam, Begin Thesis Lab
4	Fall		Continue Thesis Lab
4	Spring		IMUN 607, Continue Thesis Lab
4	Summer		Thesis Lab
5	Year		Continue Thesis Lab (one year +)
6	Fall	Clinic Re-entry Prep Late Fall	Continue Thesis Lab, Dissertation Defense
6	Spring	Clerkships and/or Advanced Clinics (Modules 4&5)	
6	Summer	Clerkships and/or Advanced Clinics (Modules 4&5)	
7	Fall	Clerkships and/or Advanced Clinics (Modules 4&5); Dean's Letter	
7	Spring	Clerkships and/or Advanced Clinics GRADUATION	

### Student Activities

Annual Retreat

All IGG students are required to attend the Annual Retreat each spring. The 3rd year students each present a short seminar of their research, and the other students submit posters for the afternoon poster session. Three students always serve on the Retreat Committee and help make decisions regarding the guest speaker (always a famous scientist who will present a seminar), the location, and the day's schedule.

### Chalkboard Seminars

The Chalkboard Seminars are organized entirely by the students. This is a seminar series held one evening a month. This seminar series 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 Professor Program

Each year, the 3rd year class invites between five and eight 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 afterwards for an informal dinner. The dinner provides an opportunity to discuss science in a relaxed environment.

## **Graduate Group Committees**

### Executive Committee

- Steven Reiner, Chair
- David Allman
- Jan Burkhardt
- Mike Cancro
- Andrew Caton
- Pete Felsburg
- Mark Greene
- Christopher Hunter
- Gary Koretzky
- Terri Laufer
- Yvonne Paterson
- Warren Pear

- Phillip Scott
- John Wherry

#### Student Affairs Committee

- Andrew Caton, Chair
- David Allman
- David Artis
- Avinash Bhandoola
- Jan Burkhardt
- Mike Cancro
- Jan Erikson
- Terri Laufer
- Steven Reiner

#### Combined Degree Committee

- Gary Koretzky, Chair

#### Curriculum Committee

- David Allman, Chair

#### Admissions Committee

- John Wherry, Chair
- David Allman
- David Artis
- Craig Bassing
- Avinash Bhandoola
- Jan Burkhardt
- Mike Cancro
- Jan Erikson
- Christopher Hunter
- Terri Laufer
- Gary Koretzky
- Jordan Orange
- Warren Pear
- Steven Reiner
- Phillip Scott

#### Membership Committee

- Peter Felsburg, Chair

#### Retreat Committee

- Jonathan Maltzman, Co-Chair
- Michael May, Co-Chair

#### **Administrative Structure**

## Chairperson

The Chairperson is an individual responsible for governance of the IGG. The IGG Chair oversees all committees of the 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:

1. supervises day-to-day operations of the IGG
2. serves on all IGG Committees
3. attends to the funding of all IGG students
4. helps Training Grant principal investigators identify students appropriate for their training programs
5. serves on the Biomedical Graduate Studies Advisory Committee
6. meets with students on a regular basis
7. oversees the Graduate Group Coordinator
8. tracks the progress of the students and maintains the students' files
9. oversees the Faculty composition of the Program
10. approves rotation and thesis laboratories and assures regular thesis committee meetings
11. gives final approval of the Dissertation
12. 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 Ph.D. 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 the 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:

1. Reviewing applications to the Program
2. Selecting applicants to interview
3. Interviewing students
4. Organizing recruitment efforts
5. 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 the 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 1st and 2nd year students. This Committee 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 the 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 the 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 IGG Weekend 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 the Immunology Graduate Group students and faculty members.