

# IMMUNOLOGY PROGRAM

*Chair, Executive Committee for the Immunology Program:* Irving Weissman (Professor of Pathology, and Developmental Biology)

*Director for Immunology Program:* Hugh McDevitt (Professor of Microbiology and Immunology)

*Director for Clinical Immunology Program:* C. Garrison Fathman (Medicine/Immunology and Rheumatology)

## **Participating Departments and Faculty:**

*Biological Sciences:* Patricia P. Jones (Professor)

*Cardiothoracic Surgery:* Carol Clayberger (Associate Professor, Research; and Pediatrics)

*Chemistry:* Harden M. McConnell (Professor, emeritus\*)

*Genetics:* Leonard A. Herzenberg (Professor), Lenore A. Herzenberg (Professor, Research)

*Medicine/Bone Marrow Transplantation Program:* Robert Negrin (Associate Professor), Judith Shizuru (Associate Professor)

*Medicine/Immunology and Rheumatology:* C. Garrison Fathman (Professor), Jane R. Parnes (Professor), Samuel Strober (Professor), Paul J. Utz (Assistant Professor)

*Medicine/Oncology:* Gilbert Chu (Associate Professor, and Biochemistry), Ronald Levy (Professor), Shoshana Levy (Professor, Research)

*Microbiology and Immunology:* Yueh-Hsiu Chien (Associate Professor), Mark M. Davis (Professor), K. Christopher Garcia (Assistant Professor, and Structural Biology), Hugh O. McDevitt (Professor)

*Molecular and Cellular Physiology:* Richard S. Lewis (Associate Professor)

*Molecular Pharmacology:* Garry P. Nolan (Associate Professor, and Microbiology and Immunology), Phyllis Gardner (Associate Professor, and Medical/Clinical Pharmacology, and Cardiovascular Medicine)

*Neurology and Neurological Sciences:* Lawrence Steinman (Professor, and Pediatrics)

*Pathology:* Eugene C. Butcher (Professor), Michael Cleary (Professor), Gerald R. Crabtree (Professor, and Developmental Biology), Edgar G. Engleman (Professor, and Medical/Immunology and Rheumatology), Joseph S. Lipsick (Professor), Sara Michie (Associate Professor), Raymond A. Sobel (Associate Professor), Irving L. Weissman (Professor, and Developmental Biology)

*Pediatrics:* Alan M. Krensky (Professor), David B. Lewis, (Associate Professor), Elizabeth Mellins (Associate Professor), Dale T. Umetsu (Professor)

*Structural Biology:* Peter Parham (Professor, and Microbiology and Immunology)

*Surgery:* Sheri Krams (Assistant Professor, Research), Olivia Martinez (Associate Professor, Research)

\* Recalled to active duty

## **GRADUATE PROGRAMS**

### **MASTER OF SCIENCE**

Students in the Ph.D. program in Immunology may apply for an M.S. degree in Immunology, assuming completion of appropriate requirements. Students must complete:

1. Three full-tuition quarters of residency as a graduate student at Stanford.
2. At least 45 units of academic work, all of which must be in courses at or above the 100 level, 36 units of which must be at or above the 200 level.
3. Three quarters of graduate research (Immunology 300), consisting of rotations in the labs of three faculty members.
4. Course work in Immunology as follows: one course in basic immunology (Biology 230, Microbiology/Immunology 200 or equivalent Advanced Immunology such as Immunology 200 and 201); Principles of Biological Technologies (Microbiology/Immunology 215); Cell Biology of Physiological Processes (Molecular and Cellular Physiology 221).

5. Graduate-level biochemistry and molecular biology (Biochemistry 200, 201, or equivalents).
6. Course work in Immunology 311 (Seminar in Immunology), and Immunology 311A (Seminar Discussion in Immunology).
7. Participation in journal clubs, and attendance at the weekly Immunology seminar and at the annual Stanford Immunology Scientific Conference.
8. One written qualifying exam and proposal before candidacy.

### **DOCTOR OF PHILOSOPHY**

University requirements for the Ph.D. are described in the "Graduate Degrees" section of this bulletin.

The interdepartmental Immunology Program offers instruction and research opportunities leading to a Ph.D. in Immunology. The goal of the program is to develop young investigators who have a solid foundation in immunology as well as related sciences and who can carry out innovative research. The program features a flexible selection of courses and seminars to enrich the students' backgrounds, combined with extensive research training in the laboratories of the participating immunology faculty.

Students applying to the program typically have an undergraduate major in biological sciences, but majors in other areas are acceptable if the applicants have had sufficient course work in biology and chemistry. Formal application should be made by December 15. Applications are evaluated by the Immunology Predoctoral Committee based on scores on the GRE exams (including the subject test in either biology, biochemistry, or chemistry), which should be taken by the October test date; grades; evidence of prior research experience; letters of recommendation, including letters from research sponsor(s); and commitment to a career in biomedical research. Interested Stanford medical students are welcome to apply to the program; they should contact the program director.

Students admitted to the program are offered financial support covering tuition, a living stipend, insurance coverage, and an allowance for books/travel. Applicants are urged to apply for independent fellowships such as from the National Science Foundation and the Howard Hughes Medical Institute. Fellowship applications are due in November of the year prior to matriculation in the graduate program. Because of the small number of department-funded slots, students who have been awarded an outside fellowship will have an improved chance of acceptance into the program.

On matriculation, each student is assisted in selecting courses and lab rotations in the first year and in choosing a lab for the dissertation research. Once a dissertation adviser has been selected, a dissertation committee including at least two Immunology faculty, and including the dissertation adviser, is constituted to guide the student during the dissertation research. The student must meet with the dissertation committee at least once a year.

Candidates for Ph.D. degrees at Stanford must satisfactorily complete a three-year program of study that includes 72 units of graduate course work and research and nine full-tuition quarters of residency. At least 3 units must be taken with each of four different Stanford faculty members.

The requirements for the Ph.D. degree in Immunology include the following:

1. Training in biology and cognate disciplines equivalent to that provided by the undergraduate Biology major at Stanford.
2. Completion of the following courses (or their equivalents from undergraduate work):
  - a) Basic immunology (Biological Sciences 230 or Microbiology and Immunology 200)
  - b) Advanced Immunology (Immunology 201, 202)
  - c) Biochemistry and molecular biology, graduate level (Biochemistry 200)
  - d) Cell Biology of Physiological Processes (Molecular and Cellular Physiology 221)
  - e) Statistics (Biology 141 or Health Research and Policy 202)
  - f) Principles of Biological Technologies (Microbiology/Immunology 215)
  - g) Graduate level genetics (Genetics 201)

- h) Responsible Conduct in Science (Medicine 255)
3. First-year students are required to take both the Seminar in Immunology (Immunology 311) and the companion course, Seminar Discussion in Immunology (Immunology 311A). Students in their second year and above must participate in the Seminar in Immunology (Immunology 311) and may opt to take the companion course, Immunology 311A. Students who have not yet achieved TGR status must register for 1 unit. Students attend the weekly Immunology Seminar Series (5-6 p.m. Tuesdays). Students read the papers of and have dinner with visiting seminar speakers two or three times each quarter, and meet with a faculty member to discuss the material.
  4. Elective courses as agreed upon by the student, adviser, and advisory committee. Electives may be chosen from graduate courses and seminars in any of the biomedical science departments and programs.
  5. Completion in the first year of three one-quarter rotations. Two weeks after taking the written portion of the qualifying examination process, students shall present their lab rotation research projects to the Predoctoral Committee and the Immunology community at large.
  6. Teaching assistantship in two immunology courses. A teaching assistantship requirement may be fulfilled by proposing a graduate student-initiated course (Immunology 315), Topics in Immunology.
  7. For admission to candidacy, completion of two requirements by the end of the Autumn Quarter of the second year: a comprehensive written examination in immunology and related biomedical sciences must be completed satisfactorily by the end of Spring Quarter of the first year. Finally, students must prepare and defend a research proposal on their dissertation research by December 31, the end of Autumn Quarter of their second year. Administration and evaluation of these requirements is the responsibility of the student's dissertation committee.
  8. Participation (through regular attendance and oral presentation) in one of the faculty-sponsored immunology journal clubs for at least the first two years. Students are also expected to attend the graduate students' journal club, the Tuesday evening immunology seminars, and the annual Stanford Immunology Scientific Conference.
  9. Passing of the University oral examination on the dissertation research, which is to be taken only after the student has substantially completed the research. The examination is preceded by a public seminar in which the candidate presents his/her research.
  10. Completion of a Ph.D. dissertation, resulting from independent investigation and constituting a contribution to knowledge in the area of immunology.

## COURSES

Course work and lab instruction in the Immunology Program conform to the Policy on the Use of Vertebrate Animals in Teaching Activities as stated in the front of this catalog.

**200. Immunology for Medical Students**—(Same as Microbiology and Immunology 200.) Introduces the basic concepts of immunology and the role of the immune system in a variety of diseases, utilizing case presentations of diseases in which the immune system plays a major role (autoimmune diseases, infectious disease, transplantation, immunodeficiency diseases, hypersensitivity reactions, and allergic diseases). Basic concepts of the development and function of the immune system are integrated with case material to illustrate how the immune system causes and prevents a variety of endocrine, renal, dermatologic, neurologic, and musculoskeletal diseases, and how organ and tissue transplantation can be used to restore normal function following destruction of particular organs or tissues by immune or other mechanisms.

*3 units, Win (Lewis, Staff)*

**200A. Problem Solving in Immunology**—(Same as Microbiology and Immunology 200A.) Optional recommended companion to 200. Weekly problem sets are based, wherever possible, on case reports and publications drawn from the clinical literature concerning the topics covered in

lectures and case presentations during the week. Emphasis is on application of the fundamental concepts of immunology.

*1 unit, Win (Lewis, Staff)*

**201. Advanced Immunology I**—(Same as Microbiology and Immunology 211.) For graduate students and advanced undergraduates. Lecture/discussion featuring current problems in immunology. Topics: genetics and structure/function relationships of antibodies, T-cell receptors, MHC antigens; accessory molecules; lymphocyte differentiation and activation; cellular regulation of immune responses; autoimmunity and other problems in clinical immunology. Prerequisites: biochemistry, basic or introductory immunology course, consent of instructor (for undergraduates).

*3 units, Win (Garcia, Staff)*

**202. Advanced Immunology II**—(Same as Microbiology and Immunology 212.) Critical readings of the immunological literature and specific areas of immunology. Classic problems and emerging areas are covered based on primary literature. Student and faculty presentations. Prerequisite: 201.

*3 units, Spr (McDevitt, Staff)*

**215. Principles of Biological Technologies**—(Same as Microbiology and Immunology 215.) The principles underlying commonly utilized technical procedures in biological research. Lectures on gel electrophoresis, nucleic acid hybridization, protein purification and stabilization, light microscopy, and computer search algorithms for protein and nucleic acid databases. Prerequisites: biochemistry, organic chemistry, and physics.

*2 units, Spr (Kirkegaard)*

**221. Cell Biology of Physiological Processes**—(Same as Biological Sciences 214.) The basic mechanisms of membrane and cellular biogenesis in relation to physiological processes. Emphasis is on the regulatory and signaling mechanisms involved in coordinating complex cellular phenomena, such as cellular organization, function, and differentiation. Topics: cellular compartmentalization, transport and trafficking of macromolecules, organelle biogenesis, cell division, motility and adhesion, and multicellularity. Prerequisites: Biological Science core, Biochemistry 201.

*5 units, Win (Kopito, W. Nelson)*

**230. Introduction to Medicine**—For doctoral students. Introduces the information and approaches used by physicians to understand human disease, focusing on a small number of multisystem disorders: type I and type II diabetes mellitus, using lectures/discussion sections, computer demonstrations (including Web resources and disease simulation software), and guided use of Medical School teaching materials and taped lectures in small groups. Student projects of their own choosing involve other multisystem diseases.

*3 units, Spr (Mellins, Parnes)*

**290. Teaching of Immunology**—Practical experience in teaching by serving as a teaching assistant in an immunology course.

*(Staff)*

**300. Research**—Research for graduate students in the Ph.D. program in Immunology.

*1-15 units (Staff)*

**311. Seminar in Immunology**—Enrollment limited to graduate students in the Ph.D. program in Immunology. Current research topics in immunology.

*1 unit, Aut, Win, Spr (Mellins)*

**311A. Seminar Discussion in Immunology**—Enrollment limited to graduate students in the Ph.D. program in Immunology, and is required

of first-year graduate students. Students read and discuss papers of speakers in the Immunology Seminar Series and meet with the speakers to discuss their research.

*1 unit, Aut, Win, Spr (Mellins)*

**315. Special Topics in Immunology**—Graduate student initiated seminar, in journal club style. Previous topics included evolutionary immunology and the principles of vaccine development.

*1 unit (Staff)*