Microbiology and Immunology

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Courses given in Microbiology and Immunology have the subject code MI. For a complete list of subject codes, see Appendix B.

The Department of Microbiology and Immunology offers a complete program of training leading to the Ph.D. degree, as well as research training, courses, and seminars for medical students and postdoctoral fellows. Research interests focus on two broad areas, host-parasite interactions, and the function of the immune system. Individual laboratories investigate mechanisms of pathogenesis and the physiology of viruses, bacteria, and protozoan parasites, as well as the lymphocyte function in antigen recognition, immune response, and autoimmunity.

Graduate Programs

Master of Science

A regular M.S. program is not offered, although this degree is awarded under special circumstances. Candidates for master’s degrees are expected to have completed the preliminary requirements for the B.S. degree, or the equivalent. In addition, the candidate is expected to complete 45 quarter units of work related to microbiology; at least 25 of these units should concern research devoted to a thesis. The thesis must be approved by at least two members of the department faculty.

Doctor of Philosophy

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

Application, Admission, and Financial Aid—Prospective Ph.D. candidates should have completed a bachelor’s degree in a discipline of biology or chemistry, including course work in biochemistry, chemistry, genetics, immunology, microbiology, and molecular biology. The deadline for receipt of applications with all supporting materials is December 15.

Applicants must file a report of scores on the general subject tests and on an advanced test (normally in cellular and molecular biology, chemistry, or biochemistry) of the Graduate Record Examination (GRE). It is strongly recommended that the GRE be taken before October so that scores are available when applications are evaluated.

In the absence of independent fellowship support, entering postdoctoral students are fully supported with a stipend and tuition award. Highly qualified applicants may be honored by a nomination for a Stanford fellowship. Successful applicants have been competitive for predoctoral fellowships such as those from the National Science Foundation and Howard Hughes Medical Institute.

Program for Graduate Study—The Ph.D. degree requires course work and independent research demonstrating an individual’s creative, scholarly, and intellectual abilities. On entering the department, students meet an advisory faculty member and together they design a timetable for completion of the degree requirements. Typically, this consists of first identifying gaps in the student’s undergraduate education and determining courses that should be taken. Then, a tentative plan is made for two to four lab rotations (one rotation per quarter). During the first year of graduate study in the department, each student also takes six or seven upper-level (200-series) courses. Three of these courses, Principles of Biological Techniques, Medical Microbiology, and Advanced Pathogenesis of Bacteria, Viruses, and Eukaryotic Parasites, are specific requirements of this department. Three courses, Advanced Genetics, Molecular Biology, and Cell Biology, are part of the core curriculum that is required of many graduate students in Stanford Biosciences.

In Spring Quarter of the second year, each student defends orally a formal research proposal on a topic outside the intended thesis project. The outline of this proposal is due to the Graduate Program Steering Committee by March 1st. Based on successful performance on this proposal, the student is admitted to candidacy. In the Autumn Quarter of the second year, a research proposal based on the student’s own thesis topic is defended to his or her thesis committee. Teaching experience and training are also part of the graduate curriculum. All graduate students are required to act as teaching assistants for two quarters. In addition, first- and second-year graduate students are required to participate in a biweekly journal club.

Courses

MI 25N. Modern Plagues—Stanford Introductory Seminar. Preference to freshmen. The molecular and medical aspects of several new and old microorganisms that infect humans. Goal: to place modern human plagues in scientific and historical perspective and to provide an introduction to the fields of molecular biology and microbiology.

3 units, Aut (Boothroyd)

MI 103. Parasites/Pestilence: Infectious Public Health Challenges—(Same as HUMBIO 103.) Parasitic and other diseases with public health impact. Pathogenesis, clinical syndromes, complex life cycles, and the interplay among environment, vectors, hosts, and reservoirs in historical context to understand public health policy approaches to halting disease transmission. Focus is on WHO TDR (World Health Organization Tropical Disease Research) targeted disease entities: river blindness (onchocerciasis), sleeping sickness (African Trypanosomiasis), leishmaniasis, schistosomiasis, mycobacterial disease (tuberculosis and leprosy), malaria, toxoplasmosis, dracunculiasis, intestinal helminthiasis, and miscellaneous and emerging infections. Guest lecturers and experts in disease control and research of local and international renown. Problem sets, exams, and original proposal to solve a current disease.

3 units, Spr (Smith)

MI 115A. Humans and Viruses—(Same as HUMBIO 115A.) Overview of human virology. Topics illustrate concepts in biology and the social sciences, focusing on emerging infections, viral classification, transmission and prevention, vaccination and treatment, eradication of disease, viral pathogenesis, mechanisms of virally-induced cancer, and viral evolution. Topics: molecular biology of genetic shift and drift in influenza virus, cellular tropism of HIV, developmental biology of virally-induced birth defects, clinical aspects of infantile diarrhea, social aspects of the common cold, policy issues of blood antibody tests, factors in pathogenesis and transmission of prions. Prerequisites: Human Biology core or consent of instructor.

4-6 units, Win (Siegel)

MI 115B. The Vaccine Revolution—(Same as HUMBIO 115B.) Advanced seminar. The human aspects of viral disease, focusing on recent discoveries, especially in the area of vaccine development and emerging infections. Journal club format: students select articles from primary scientific literature, write formal summaries, and synthesize it into a
SCHOOL OF MEDICINE

MI 127N. Infectious Disease: Fact and Fiction—Stanford Introductory Seminar. Preference to freshmen. Modern science has developed methods of fighting infectious diseases and their human toll including public sanitation, vaccination, and antibiotics, but emergent and re-emerging infections such as HIV, Ebola, and dengue, as well as bioterrorism, remain a threat. Civilizations have historically dealt with frightening topics like this through the arts. The science behind infectious diseases and their treatments, and its portrayal in the movies. Old and new horror and science fiction films including Invasion of the Body Snatchers, Outbreak, The Andromeda Strain, Blade, Alien, and X-Files episodes. Readings include Scientific American and other primary scientific journals. Students critique a film from the perspective of a scientist.

3 units, Aut (Schneider)

MI 185. Topics in Microbiology—In-depth coverage of basic topics: diversity, molecular regulation, growth, bioenergetics, and unique metabolic processes. Student papers on current topics (e.g., antibiotic resistance, molecular approaches to bioremediation) for presentation. Prerequisites: CHEM 31, 33, 35. Recommended: BIOSCI 31.

3 units, Win (Matin, Staff)

MI 198A-F. Directed Reading—Investigation sponsored by individual faculty, hours and units arranged. Fields of research open to students are decided in consultation with sponsoring faculty member.

1-15 units, any quarter (Staff)

MI 199. Undergraduate Research—Individual study or research in microbiology or immunology by arrangement with a faculty member. Possible fields: microbial molecular biology/physiology, microbial pathogenicity, immunology, virology, and molecular parasitology. Prerequisites: appropriate backgrounds for various areas, consent of instructors.

1-18 units, any quarter (Staff)

MI 200. Immunology for Medical Students—(Same as PATH 220, IMMUNOL 200.) The basic concepts of immunology and the role of the immune system in a variety of diseases, utilizing case presentations of diseases including autoimmune diseases, infectious disease, transplantation, immunodeficiency diseases, hypersensitivity reactions, and allergic diseases. Weekly problem sets based on case reports and publications drawn from the clinical literature. Emphasis is on application of the fundamental concepts of immunology.

1-4 units, Win (Lewis, Staff)

MI 201. Infectious Basis of Disease—Presentation of the spectrum of human illness induced by viruses, bacteria, fungi, and medical parasites, including protozoans and helminths. Classification, epidemiology, transmission, pathogenesis, diagnosis, treatment, control, vaccination, and other preventive measures. Emphasis is on the syndromic approach to disease. Lectures, demonstrations, lab sessions, and small group evaluation of clinical correlates. Use of interactive multimedia instructional program, MICROBE, CWP, and labs. Prerequisite: medical student status.

9 units, Aut (Siegel, Staff)

MI 203. Biological Stress Response—In-depth coverage of current literature, with student participation. Possible topics: the nature and molecular regulation of the stress response; biochemistry and structural biology molecular chaperones; the role of stress proteins in the pathogenic process; psychoneuroendocrinology; multidrug resistance. Enrollment limited. Prerequisites: Biological Sciences core, upper-division course in molecular biology/genetics or biochemistry.

3 units (Matin, Staff) alternate years, given 2003-04


3 units, Spr (Mocarski, Staff)

MI 209. Medical Microbiology—For graduate and advanced undergraduate students. Required of first-year graduate students in Microbiology and Immunology. Introduction to the concepts of microbial pathogenesis with emphasis on the mechanisms employed by pathogenic microorganisms in establishing infection in the host, and the responses of the host to infection. Prerequisite: understanding of biochemistry and molecular biology.

1-3 units, Aut (Falkow)

MI 210. Advanced Pathogenesis of Bacteria, Viruses and Eukaryotic Parasites—For graduate, medical, and advanced undergraduate students. Required for first-year graduate students in Microbiology and Immunology. Exploration of the molecular mechanisms by which microorganisms invade animal and human hosts, express their genomes, interact with macromolecular pathways in the infected host, and induce disease. Problem sets and recent literature pertaining to microbial pathogenesis. Prerequisite: 209.

5 units, Win (Sarnow, Staff)

MI 211. Advanced Immunology I—(Same as IMMUNOL 201.) For graduate students and advanced undergraduates. 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 immunology course; consent of instructor for undergraduates.

3 units, Win (Chien, Staff)

MI 212. Advanced Immunology II—(Same as IMMUNOL 202.) 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: 211.

3 units, Spr (Garcia, Staff)

MI 213. Advanced Immunology III—(Same as IMMUNOL 203.)

2 units, Sum (Davis)

MI 215. Principles of Biological Technologies—(Same as IMMUNOL 215.) Required of first-year graduate students in Microbiology and Immunology. 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)

This file has been excerpted from the Stanford Bulletin, 2002-03, pages 653-655. Every effort has been made to insure accuracy; late changes (after print publication of the bulletin) may have been made here. Contact the editor of the Stanford Bulletin via email at arod@stanford.edu with changes, corrections, updates, etc.
MI 231. Stem Cells and Gene Therapy—Cell mediated and gene therapy as a novel form of drug delivery. Vectors, cell types, and relevant genetic and acquired diseases are discussed in a series of lectures, and in student and guest presentations. Prerequisites: biochemistry and molecular biology.
2-3 units, Spr (Nolan, Blau)

MI 299. Directed Reading—Prerequisite: consent of instructor.
1-18 units, any quarter (Staff)

MI 399. Graduate Research—Students who have satisfactorily completed the necessary foundation courses may elect research work in general bacteriology, bacterial physiology and ecology, bacterial genetics, microbial pathogenicity, immunology, parasitology, and virology.
1-18 units, any quarter (Staff)

MI 450. Introduction to Biotechnology—(Enroll in CHEMENG 450, BIOC 450.)
3 units, Spr (Robertson, Swartz)

MI 459. Frontiers in Interdisciplinary Biosciences—(Crosslisted in multiple departments in the schools of Humanities and Sciences, Engineering, and Medicine; students should enroll directly through their affiliated department, otherwise enroll in CHEMENG 459.) An introduction to cutting-edge research involving interdisciplinary approaches to bioscience and biotechnology; for specialists and non-specialists. Organized and sponsored by the Stanford BioX Program. Three seminars each quarter address a broad set of scientific and technical themes related to interdisciplinary approaches to important issues in bioengineering, medicine, and the chemical, physical, and biological sciences. Leading investigators from Stanford and throughout the world present the latest breakthroughs and endeavors that cut broadly across many core disciplines. Pre-seminars introduce basic concepts and provide background for non-experts. Registered students attend all pre-seminars in advance of the primary seminars, others welcome. Prerequisite: keen interest in all of science, engineering, and medicine with particular interest in life itself. Recommended: basic knowledge of mathematics, biology, chemistry, and physics.
1 unit, Aut, Win, Spr (Robertson)