MICROBIOLOGY AND IMMUNOLOGY

Emeriti: (Professors) Sidney Raffel, Leon T. Rosenberg, Bruce A. D. Stocker; *Professor (Research)* Esther M. Lederberg
Chair: John Boothroyd
Professors: Ann Arvin, John C. Boothroyd, Yueh-hsiu Chien, Mark M. Davis, Stanley Falkow, Stephen J. Galli, Harry B. Greenberg, Karla Kirkegaard, A. C. Matin, Hugh O. McDevitt, Edward S. Mocarski, Garry Nolan, Peter Parham, Phillip Pizzo, Charles Prober, David Relman, Peter Sarnow, Gary K. Schoolnik, Lucy S. Tompkins
Assistant Professors: Christopher Garcia, Peter Jackson, David Schneider, Julie Theriot
Associate Professor (Teaching): Robert D. Siegel
Courtesy Assistant Professor: Christopher Contag (Pediatrics)

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 predoctoral 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, scholastic, 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, Microbial Pathogenesis, 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 Winter 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 May 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

25N. Stanford Introductory Seminar: Modern Plagues—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.
2 units, Aut, Spr (Boothroyd, Chien)

26Q. Stanford Introductory Seminar: The Threat of Emerging Antibiotic Resistance and What We Can Do About It—Preference to sophomores. Resistance of bacteria to antibiotics has reached alarming proportions. From the 1930s to the early '70s, the discovery of several classes of highly effective antimicrobial agents enabled us to nearly eliminate the threat of bacterial disease. But this situation is drastically changed as a result of widespread antibiotic resistance in bacteria. The causes and potential solutions.
3-5 units (Matin) not given2001-02

54Q. Stanford Introductory Seminar: Strategies in Molecular and Cellular Imaging—Preference to sophomores. The tools for studying the molecular basis of disease have been largely limited to methods that require tissue sampling and analysis outside the body. Tools are being developed to reveal the molecular basis of disease in living animal models and in humans. The various imaging modalities that are being used to develop these tools, and the current approaches that are being employed to follow cells, assess gene expression patterns, and evaluate disease processes in vivo. Students use their understanding of biology to design an imaging strategy that uses one imaging modality to address a selected biological question. Prerequisite: one year of college-level biology.
3 units, Spr (Contag)

115A. Humans and Viruses—(Same as Human Biology 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.
6 units, Win (Siegel)

115B. Seminar: The Vaccine Revolution—(Same as Human Biology 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 literature review on a specific topic. Emphasis is on the development of critical reading, analysis, experimental design, and interpreta-

tion of data. Students give four oral presentations and lead discussions based on their scientific journal reading. Enrollment limited to 10. Prerequisite: 115A.

5 units (Siegel) not given 2001-02

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: Chemistry 31, 33, 35. Recommended: Biological Sciences 31.

3 units, Win (Matin, Staff)

198A-F. Undergraduate Directed Reading—Prerequisite: consent of instructor.

15 units maximum, any quarter (Staff)

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

1-15 units, any quarter (Staff)

200. Immunology for Medical Students—(Same as 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. 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.

3 units, Win (Lewis, Staff)

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)

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, Spr (Matin, Staff)

206. Animal Viruses—For advanced graduate and medical students. The structure, molecular biology, and genetics of RNA and DNA animal viruses. Lectures on the molecular biology of virus replication and gene expression and the nature of the host-virus interaction. Concise treatment of eukaryotic molecular and cell biology in the context of viruses. Problem sets, discussion groups. Prerequisites: Biological Sciences core, an understanding of molecular biology, biochemistry.

3 units, Aut (Mocarski, Staff)

208. Topics in Virology—Informal advanced seminar in a topical area of the molecular biology of viruses. Student participation in presentations required. May be taken repeatedly. Prerequisite: 210.

1 unit, Spr (Staff)

209. Microbial Pathogenesis—For graduate, medical, 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.

2 units, Aut (Falkow, Staff)

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.

4 units, Win (Sarnow, Staff)

211. Advanced Immunology I—(Same as Immunology 201.) 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 (Chien, Staff)

212. Advanced Immunology II—(Same as Immunology 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)

215. Principles of Biological Technologies—(Same as Immunology 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)

299. Directed Reading—Prerequisite: consent of instructor.

18 units maximum, any quarter (Staff)

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.

18 units maximum, any quarter (Staff)

459. Frontiers in Interdisciplinary Biosciences—(Cross-listed in multiple departments in the schools of Humanities and Sciences, Engineering, and Medicine; students should enroll directly through their affiliated department if listed, otherwise enroll in ChE 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)