

MICROBIOLOGY

Boyer Center for Molecular Medicine 354F, 203.737.1087

<http://medicine.yale.edu/micropath>

M.S., M.Phil., Ph.D.

Director of Graduate Studies

Walther Mothes

Professors Serap Aksoy (*Epidemiology*), Susan Baserga (*Molecular Biophysics and Biochemistry; Genetics; Therapeutic Radiology*), Choukri Ben Mamoun (*Internal Medicine; Microbial Pathogenesis*), Ronald Breaker (*Molecular, Cellular, and Developmental Biology; Molecular Biophysics and Biochemistry*), Richard Bucala (*Internal Medicine; Epidemiology; Pathology*), Michael Cappello (*Pediatrics; Epidemiology; Microbial Pathogenesis*), Yung-Chi Cheng (*Pharmacology*), Jason Crawford (*Chemistry; Microbial Pathogenesis*), Peter Cresswell (*Immunobiology; Cell Biology*), Daniel DiMaio (*Genetics; Molecular Biophysics and Biochemistry; Therapeutic Radiology*), Erol Fikrig (*Internal Medicine; Epidemiology; Microbial Pathogenesis*), Richard Flavell (*Immunobiology*), Jorge Galán (*Microbial Pathogenesis; Cell Biology*), Wendy Gilbert (*Molecular Biophysics and Biochemistry*), Andrew Goodman (*Microbial Pathogenesis*), Eduardo Groisman (*Microbial Pathogenesis*), Margaret Hosstetter (*Pediatrics*), Akiko Iwasaki (*Immunobiology; Molecular, Cellular, and Developmental Biology*), Barbara Kazmierczak (*Internal Medicine; Microbial Pathogenesis*), Albert Ko (*Epidemiology; Internal Medicine*), Jun Liu (*Microbial Pathogenesis*), Ruslan Medzhitov (*Immunobiology*), I. George Miller (*Pediatrics; Epidemiology; Molecular Biophysics and Biochemistry*), Walther Mothes (*Microbial Pathogenesis*), Melinda Pettigrew (*Epidemiology*), Carla Rothlin (*Immunobiology; Pharmacology*), Craig Roy (*Microbial Pathogenesis; Immunobiology*), Dieter Söhl (*Molecular Biophysics and Biochemistry; Chemistry*), Richard Sutton (*Internal Medicine; Microbial Pathogenesis*), Jeffrey Townsend (*Biostatistics; Ecology and Evolutionary Biology*), Christian Tschudi (*Epidemiology*), Paul Turner (*Ecology and Evolutionary Biology*), Yong Xiong (*Molecular Biophysics and Biochemistry*)

Associate Professors Murat Acar (*Molecular, Cellular, and Developmental Biology; Physics*), Charles Dela Cruz (*Internal Medicine; Microbial Pathogenesis*), Nathan Grubaugh (*Microbial Diseases*), Ya-Chi Ho (*Microbial Pathogenesis; Internal Medicine/ Infectious Diseases*), Farren Isaacs (*Molecular, Cellular, and Developmental Biology*), Priti Kumar (*Internal Medicine/Infectious Diseases*), John MacMicking (*Microbial Pathogenesis; Immunobiology*), Kathryn Miller-Jensen (*Biomedical Engineering; Molecular, Cellular, and Developmental Biology*), Noah Palm (*Immunobiology*), E. Hesper Rego (*Microbial Pathogenesis*), Christian Schlieker (*Molecular Biophysics and Biochemistry; Cell Biology*)

Assistant Professors Amy Bei (*Epidemiology of Microbial Diseases*), Allison Didychuk (*Molecular Biophysics and Biochemistry*), Ellen Foxman (*Laboratory Medicine; Immunobiology*), Benjamin Goldman-Israelow (*Medicine*), Stavroula Hatzios (*Molecular, Cellular, and Developmental Biology*), Caroline Johnson (*Environmental Health Sciences*), Yelizaveta Konnikova (*Pediatrics/Neonatology*), Maudry Laurent-Rolle (*Infectious Diseases*), David Martinez (*Immunobiology*), Michael O'Donnell (*Molecular, Cellular and Developmental Biology*), Hualiang Pi (*Microbial Pathogenesis*), Craig Wilen

(*Laboratory Medicine; Immunobiology*), Jing Yan (*Molecular, Cellular, and Developmental Biology*)

FIELDS OF STUDY

The Graduate Program in Microbiology is a multidepartmental, interdisciplinary Ph.D. program in training and research in the study of microorganisms and their effects on their hosts. The faculty of the program share the view that understanding the biology of microorganisms requires a multidisciplinary approach; therefore, the Microbiology graduate program emphasizes the need for strong multidisciplinary training. The program is designed to provide individualized education in modern microbiology and to prepare students for independent careers in research and teaching. Students can specialize in various areas, including bacteriology, virology, microbe-host interactions, microbial pathogenesis, cell biology and immunobiology of microbial infections, microbial genetics and physiology, structural biology, parasitology, microbiome, and microbial ecology and evolution.

ADMISSIONS REQUIREMENTS

To enter the Ph.D. program, students apply to the Microbiology track within the interdepartmental graduate program in the Biological and Biomedical Sciences (BBS), <http://bbs.yale.edu>. An undergraduate major in biology, biophysics, biochemistry, microbiology, or molecular biology is recommended; the GRE General Test or MCAT is no longer required, and scores will not be considered if submitted.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Coursework generally occupies the first two years of study. Each student, together with a faculty committee, outlines a course of study tailored to the individual's background and career goals. A program of course work may include general microbiology, virology, parasitology, and/or microbial genetics, as well as complementary courses in such areas as epidemiology, cell biology, immunology, biochemistry, and genetics. Students must take a minimum of four courses, three of which have to be in microbiology. Students must receive a grade of Honors in two full-term courses. All students participate in three laboratory rotations (MBIO 670, MBIO 671, and MBIO 672), with different faculty members, in their area of interest. Laboratory rotations ensure that students quickly become familiar with the variety of research opportunities available in the program. A qualifying proposal, defended in an exam on the student's thesis project, is given before the end of the second year. Students then undertake an original research project under the direct supervision of a faculty member. In the third year, students organize their thesis committee and prepare a dissertation prospectus, which is submitted to the graduate school after approval by their committee. The student is then admitted to candidacy. Upon completion of the student's research project, the Ph.D. requirements conclude with the writing of a dissertation and its oral defense.

An important aspect of graduate training in microbiology is the acquisition of teaching skills through participation in courses appropriate for the student's scientific interests. These opportunities can be drawn from a diverse menu of lecture, laboratory, and seminar courses given at the undergraduate, graduate, and medical school levels. Ph.D. students are expected to participate in two terms (or the equivalent) of teaching. Students are not permitted to teach during their first year.

In addition to all other requirements, students must successfully complete IBIO 601, Fundamentals of Research: Responsible Conduct of Research, prior to the end of their first year of study. This requirement must be met prior to registering for a second year of study. In their fourth year of study, all students must successfully complete B&BS 503, RCR Refresher for Senior BBS Students.

MASTER'S DEGREES

M.Phil. The M.Phil. degree can be awarded to Ph.D. students who have been admitted to candidacy. See Degree Requirements under Policies and Regulations.

M.S. This degree may only be granted to students who are withdrawing from the Ph.D. program prior to advancing to candidacy. To be eligible for this degree, a student must have completed at least four graduate-level term courses at Yale, chosen from a number of main courses including, but not limited to: MBIO 530, MBIO 680, MBIO 685, MBIO 686, MBIO 734, and CBIO 602. Two of these four courses must be related to microbiology. Students must have received at least one Honors or two High Pass grades. In addition, students must have received a Satisfactory grade in the following courses: IBIO 601, MBIO 670, MBIO 671, MBIO 672, MBIO 701, and MBIO 702. Students who are eligible for or who have already received the M.Phil. will not be awarded the M.S.

MBIO 530a / IBIO 530a / MCDB 530a, Biology of the Immune System Grace Chen, Ann Haberman, Carla Rothlin, Kevin O'Connor, Carrie Lucas, Ellen Foxman, Markus Müschen, Andrew Wang, Peter Cresswell, Jordan Pober, Joao Pereira, Craig Roy, Joseph Craft, Paula Kavathas, Noah Palm, Craig Wilen, Jeffrey Ishizuka, Daniel Jane-Wit, and David Schatz

The development of the immune system. Cellular and molecular mechanisms of immune recognition. Effector responses against pathogens. Immunologic memory and vaccines. Human diseases including allergy, autoimmunity, cancer, immunodeficiency, HIV/AIDS.

MBIO 601b / IBIO 601b, Fundamentals of Research: Responsible Conduct of Research Staff

A weekly seminar presented by faculty trainers on topics relating to proper conduct of research. Required of first-year Immunobiology students, first-year CB&B students, and training grant-funded postdocs. Pass/Fail. o Course cr

MBIO 670a and MBIO 671a and MBIO 674b, Laboratory Rotations Ya-Chi Ho
Rotation in three laboratories. Required of all first-year graduate students.

MBIO 685b, The Biology of Bacterial Pathogens II Hesper Rego

This interdisciplinary course focuses on current topics related to host-pathogen interactions. Each week a lecture is given on the topic, followed by student presentations of seminal papers in the field. All participants are required to present a paper.

MBIO 686a, The Biology of Bacterial Pathogens I Jorge Galan and Maria Lara-Tejero
The course provides an introduction to basic principles in bacterial pathogenesis. Topics focus on the bacterial determinants mediating infection and pathogenesis, as well as strategies to prevent and treat diseases. Each week a lecture is given on the topic,

followed by student presentations of seminal papers in the field. All participants are required to present a paper.

MBIO 700b, Seminal Papers on the Foundations of Modern Microbiology Priti Kumar

A required course for Microbiology first-year students; not for credit. The course is offered every spring. Students present and discuss papers describing fundamental discoveries in areas related to microbiology. The goal is to familiarize students with the process of scientific discovery and with the history of major developments in the field. Topics include important discoveries involving major human pathogens, fundamental processes in molecular biology, and the development of technology that has a major impact on current biomedical research. o Course cr

MBIO 701a and MBIO 702b, Research in Progress Priti Kumar

All students, beginning in their third year, are required to present their research once a year at the Graduate Student Research in Progress. These presentations are intended to give each student practice in presenting the student's own work before a sympathetic but critical audience and to familiarize the faculty with the research.

MBIO 703a and MBIO 704b, Microbiology Seminar Series Ya-Chi Ho

All students are required to attend all Microbiology seminars scheduled throughout the academic year. Microbiologists from around the world are invited to describe their research.

MBIO 734b / GENE 734b / MB&B 734b, Molecular Biology of Animal Viruses

Walther Mothes and Maudry Laurent-Rolle

Lecture course with emphasis on mechanisms of viral replication, oncogenic transformation, and virus-host cell interactions.