

Microbiology and Immunology

School of Medicine Indianapolis

Chairperson

Professor Hal E. Broxmeyer*

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Departmental URL

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Primary Faculty

(An asterisk [*] denotes membership in the University Graduate School faculty with the endorsement to direct doctoral dissertations.)

Distinguished Professor

Hal E. Broxmeyer*

Chancellor's Professors

Janice S. Blum*, Ann Roman*

Professors

Randy Brutkiewicz*, Roman Dziarski*, Xin-Yuan Fu*, Roy W. Geib*, Johnny J. He*, Louis M. Pelus*, Robert H. Schloemer*

Associate Professors

Carla J. Aldrich, Ghalib Alkhatib*, Alexander L. Dent*, Mary T. Johnson, Michael J. Klemsz*, Steven Larsen*, Glenn J. Merkel*, Martin L. Smith*, Warner Wegener* (Emeritus), Charles E. Wilde III*

Assistant Professors

Margaret E. Bauer*, Wilbert Derbigny, Xiaofeng Frank Yang, Andy Yu

Secondary Faculty

Professors

Byron Batteiger* (Medicine), Darron Brown* (Medicine), D. Wade Clapp* (Pediatrics), Kenneth Cornetta* (Medicine), Mary Dinauer* (Pediatrics), Kenneth Fife* (Medicine), Mark Kaplan*

Graduate Office
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(Pediatrics), Mark Pescovitz* (Surgery), Stanley Spinola* (Medicine), Edward Srour* (Medicine), David Wilkes* (Medicine)

Associate Professors

Thomas Gardner* (Urology), Laura Haneline (Medicine, Pediatrics), Raymond M. Johnson (Medicine), Chinghai Kao (Urology), Reuben Kapur*

Associate Scientist

Meei-Huey Jeng* (Medicine)

Graduate Advisor

Professor Robert H. Schloemer*, Medical Science Building 420, (317) 274-2270; fax: (317) 274-4090; rschloe@iupui.edu

Degrees Offered

Master of Science and Doctor of Philosophy

Special Departmental Requirements

(See also general University Graduate School requirements.)

Admission Requirements

The Graduate Record Examination General Test is required. For the Ph.D.: see IBMS requirements. For the Master of Science degree: undergraduate courses in basic biology, including cell biology and genetics; general and organic chemistry; physics; mathematics, including calculus. Biochemistry is recommended. Deficiencies should be removed during the first year of enrollment. Overall grade point average of at least 3.0 (B).

Master of Science Degree

Course Requirements

At least 30 credit hours, including thesis, G865 Fundamental Molecular Biology, G817 Eukaryotic Cell Biology, G505 Responsible Conduct of Research, J802 Introduction to Research, at least three courses within a Department of Microbiology and Immunology focus area (excluding J822 General and Medical Microbiology), and 2 credit hours of J830 Seminar in Microbiology. At least 20 of the required 30 credit hours must be in courses other than research.

Grades

Overall average of at least a B (3.0).

Comprehensive Examination

Required at completion of second semester of study.

Thesis

Required (a minimum of 8 credit hours of J810).

Final Examination

Oral defense of thesis.

Doctor of Philosophy Degree

Focus Areas

The major focus areas are immunology, pathogenesis, and cancer. Students entering the program may design a course of study from one of these areas through a combination of selected course work and research activities.

Course Requirements

A total of 90 credit hours, of which a minimum of 26 credit hours must be in courses other than research. In addition to 3 rotations (G718 Research in Biomedical Science, 6 cr.), each student will take at least 20 credits of coursework, including the 6 core courses (12 credits) required in the IBME curriculum (G715 Biomedical Science I – Biochemical Basis of Biological Processes [3 cr.], G716 Biomedical Science II – Molecular Biology and Genetics [3 cr.], G717 Biomedical Science III – Cellular Basis of Systems Biology [3 cr.], G655 Research Communications Seminar [1 cr.], G855 Experimental Design and Research Biostatistics [1 cr.], and G505 Responsible Conduct of Research [1 cr.]), and at least 3 courses (5 cr.) chosen from courses suggested within a focus area of Immunology, Pathogenesis, or Cancer: G729 Introduction to Immunological Systems (1 cr.), G728 Fundamental Concepts of Infection and Pathogenesis (1 cr.), G852 Concepts of Cancer Biology (2 cr.), G720 Stem Cell Biology (1 cr.), J807 Current Topics in Immunology (2 cr.), J829 Current Topics in the Molecular Genetics of Microorganisms (2 cr.), and J842 Neoplastic Determinants (2 cr.).

Grades

Overall average of at least a B (3.0).

Minor

A minimum of 12 credit hours in a related field or in life science. These credits must be in lecture or laboratory courses other than research and must meet the requirements of the department in which the minor is taken. For the life sciences minor, a minimum of 6 credit hours must be obtained in one department.

Ph.D. Minor in Cellular and Molecular Biology of Biomedical Systems

A minimum of 12 credit hours of course work outside the student's major department, including G865 Fundamental Molecular Biology and either G817 Eukaryotic Cell Biology or F705 Molecular and Cellular Physiology (unless these are required by the major department). Since the minor is intended to expose the student to both cellular and molecular biology, at least one course (and preferably two) from each area should be taken. Courses for the minor must be selected from the following list and approved by the advisory committee, the minor repre-

sentative of which will be selected from outside the student's major department. Courses: Anatomy D863, D866; Biochemistry B807, B810, G817, B841; Medical and Molecular Genetics Q612, Q620, Q622; Microbiology and Immunology J805, J821, J826, J828, J837, J838; Pharmacology and Toxicology F808, F832, F834, F835, F842, F843; Physiology and Biophysics F705, F710, F724, F765; Graduate G595, G865, G890.

Ph.D. Minor in Cancer Biology

A minimum of 12 credit hours outside of the student's major department, including two courses from the following list of five: Q622 Cytogenetics of Malignancies (2-3 cr.), F819 Chemical Carcinogenesis (3 cr.), J842 Neoplastic Determinants (2 cr.), G724 Molecular Cancer Genetics (1 cr.), G852 Concepts of Cancer: Signaling Gone Awry (2 cr.), G505 Responsible Conduct of Research must also be taken.

The remainder of the minor will be selected from the following courses: *Graduate* G715 Biomedical Science I–Biochemical Basis of Biological Processes; G716 Biomedical Science II–Molecular Biology and Genetics; G717 Biomedical Science III–Cellular Basis of Systems Biology; G720 Stem Cell Biology; G726 Developmental Genetics; G729 Immunology I–Introduction to the Immune System; GRAD-G737/ANAT-D851 Introduction to Histology/Histology; G748 Principles of Toxicology 1; G848 Bioinformatics, Genomics, Proteomics, and Systems Biology; G817 Molecular Basis of Cell Structure and Function; G749 Introduction to Structural Biology; G807 Structural and Chemical Biology; G837 Mammalian DNA Repair and Disease; G727 Animal Models of Human Disease; *Medical and Molecular Genetics* Q620 Human Cytogenetics; Q622 Cytogenetics of Malignancies; *Microbiology and Immunology* J807 Current Topics in Immunology; J829 Current Topics in Molecular Genetics of Microorganisms; J842 Neoplastic Determinants; *Pharmacology and Toxicology* F819 Chemical Carcinogenesis; F820 Cancer Chemoprevention.

The minor program must be approved by the student's Advisory Committee, which will take into consideration the student's total didactic experience. In the case of combined M.D./Ph.D. students, the Committee may approve substitution of appropriate medical school courses. The minor representative on this Committee will be selected from outside the student's major department and must be a member of the Cancer Biology Training Program.

Qualifying Examination

Within the first 25 months of studies (18 months for combined M.D./Ph.D.), the student submits a written research proposal in the form of a grant application to the advisory committee. At this time, the student has both a written examination based on course work and an oral examination based primarily on the written research proposal. The student can request an extension of four months from the faculty to take the qualifying examination. Doctoral studies are continued if the qualifying examination and other work, including research, are deemed satisfactory by the majority of the advisory and research committees.

Final Examination

Oral defense of the dissertation.

Other Provision

Submission of a manuscript based on the dissertation research for publication in a primary journal in the field required. Students will develop teaching skills as instructors in J210 during the first two years of graduate training, and additional teaching experiences can be arranged.

Courses

J510 Infectious Microbes and Host Interactions (3 cr.)

P: Graduate-level biochemistry. Emphasis on the molecular and cellular events which permit pathogenic bacteria and viruses to enter human cells and disrupt cell function while evading the host's immune system.

J601 Medical Immunology (2 cr.) Introduction to natural and acquired immune mechanisms, with consideration of their significance to medicine. Topics will include both normal and abnormal immune processes, including recovery from and prevention of disease, immune-mediated pathological processes, tumor immunology, immunodeficiency, and auto-immunity. Designed to precede and complement J602 Medical Microbiology.

J800 Advanced Microbiology (cr. arr.)** P: Consent of instructor. The approach to problems in microbiology, including the application of techniques of bacteriology, genetics, immunology, mycology, parasitology, virology, and zoology.

J802 Introduction to Research (2 cr.) P: Consent of instructor. Laboratory research instruction in microbiology and immunology. Purpose is to introduce students to three different research programs in microbiology and/or immunology.

J805 Molecular Immunology (3 cr.) P: B500 or equivalent; consent of instructor. Characterization of immunologically relevant molecules in terms of molecular genetics, synthesis and assembly, structure-function and evolutionary relationships, and functional roles in immune responses. Entities to be considered include members of the immunoglobulin superfamily and functionally associated molecules.

J806 Immunochemistry: Laboratory (cr. arr.) P: J805 C. Antigen preparation; separation and purification of antibodies; modern methods of antibody determination and analysis.

J807 Current Topics in Immunology (2 cr.) P: Graduate standing, J805 or J840 or equivalent or consent of instructor. Discussion and review of current literature in selected topics in immunology. Emphasis on molecular and cellular events in lymphocyte activation and regulation. Topic varies from year to year. May be repeated for credit.

J810 Research in Microbiology (cr. arr.)** P: Consent of instructor. Data obtained in this course may be used to meet the thesis requirements for graduate degrees.

J821 Microbial Pathogenicity (3 cr.) P: Consent of instructor. This course will consider in detail the determinants of microbial virulence and the mechanisms of host responses to infection and how these two factors interact in the pathogenesis of infectious diseases.

J822 General and Medical Microbiology (3 cr.) Lectures covering the biology of various pathogenic organisms such as bacteria, viruses, fungi, and parasites, their role in human disease with emphasis on determinants of microbial virulence, the mechanisms of host responses to infection, and the role of these factors in the pathogenesis of disease.

J826 Bacteriology (3 cr.) P: J601 or J822 or their equivalent and consent of instructor. General concepts of bacteriology.

J828 Virology: Lecture (3 cr.) P: BIOC B500 or equivalent and consent of instructor. Basic biological principles of viruses; agents causing diseases in animals, including humans; interactions of animal viruses with their host cells in tissue culture.

J829 Current Topics in Molecular Genetics of Microorganisms (2 cr.) P: Graduate standing, J821, J828 or G865, consent of instructor. In-depth study of a specific topic in contemporary molecular genetics of microorganisms. Topic varies; may be taken for credit more than once.

J830 Seminar in Microbiology (1 cr.) P: Consent of instructor. Provides students with background and practical experience in communication of their research.

J840 Mechanisms of Immune Regulation (2 cr.) P: Consent of instructor. A current overview of the cellular mechanisms which regulate immune responses. Topics include cells and cytokines involved in antigen presentation, lymphocyte activation and function, development, and tolerance.

J842 Neoplastic Determinants (2 cr.) G865, G817 or equivalent and consent of instructor. Focus on the genetic basis of the cancer phenotype. Consider effects of DNA sequence mutations; chromosomal rearrangements, and/or introduction of new genetic information on DNA repair, oncogene products and tumor suppressors. Intra- and intercellular consequences of these discrete alterations will be included.

J854 Hematopoiesis (2 cr.) P: G817, G865, and consent of the instructor. Principles of blood cell formation, including the regulation of production, biologic function, and cell culture and recombinant DNA technologies that contribute to our understanding. Stem cells, growth factors, cytokine involvement, gene transfer/gene therapy, and clinical applications.

GRAD G504 Introduction to Research Ethics (2 cr.) Introduction to the basic concepts of research ethics. The course will cover historical development of concern with ethics in science as well as practical information needed by students working in the science today. Format will be lecture and discussion.

GRAD G505 Responsible Conduct of Research (1 cr.) An overview of the rules and standards required for anyone conducting responsible scientific research.

GRAD G720 Stem Cell Biology (2 cr.) This course will cover the self-renewal, proliferation, survival, differentiation, and migration/homing characteristics of hematopoietic and embryonic stem cells, how these functions are regulated by cytokines/chemokines and other external stimuli, and what their clinical capabilities are and might be.

GRAD G728 Fundamentals of Infection and Pathogenesis (1 cr.) This course will cover concepts of host-pathogen interactions, ranging from pathogen entry, growth, and spread in the host to pathogen-mediated injury, immune evasion, pathogen survival strategies, and transmission to new hosts. Basics of bacterial, viral, and parasitic structures will be considered as they relate to pathogenesis.

GRAD G729 Immunology I: Introduction to the Immune System (1 cr.) An introductory biomedical science, lecture-based, core course intended for all incoming basic science graduate doctoral students in the School of Medicine programs or other interested graduate students. The course will cover components of the immune system, development of the immune system, the immune response to pathogens, and immunological disease.

GRAD G817 Molecular Basis of Cell Structure and Function (2 cr.) Organization and function of subcellular structures. Intracellular coordination of cell activities including: protein and RNA processing/trafficking/quality control, chromatin dynamics, and cell division.

GRAD G837 Mammalian DNA Repair and Disease (3 cr.)
P: Consent of instructor. The molecular biology of genetic repair and mutation; emphasis on human systems and human disease states related to DNA repair; mechanisms of DNA repair and regulation of DNA repair in mammalian cells.

GRAD G852 Concepts of Cancer Biology: Signaling Gone Awry (2 cr.) P: Completion of the BioMed I, II, and III courses (G715, G716, G717) or consent of instructor. Fundamentals of cancer biology; the signaling of events that regulate cell growth, survival and differentiation; how mutation/dysregulation of signaling molecules leads to cancer and might be exploited for treatment.

GRAD G865 Fundamental Molecular Biology (3 cr.) P: B800 or equivalent. Principles of molecular structure, function, and biosynthesis; core information regarding prokaryotic and eukaryotic gene continuity and metabolic coordination; introduction to multicellular systems and problems.

**These courses are eligible for a deferred grade.