Ph.D. Program in Immunology and Microbial Pathogenesis

Program Requirements

Required Courses		Credits
IMP 505A	Fundamentals of Immunology	2
IMP 505B	Immune System in Health & Disease	2
IMP 530	Infection & Immunity	3
IMP 600	Microbiology	2
IMP 601, 610, 620, 630	Research Rotation (3 usually required)	3 each
IMP 631	Advanced Cellular Immunology	3
IMP 632	Molecular Immunology	3
IMP 655	Advanced topics in Microbial Pathogenesis	3
IMP 712, 722, 732	Current Literature I, II, III	1 each
IMP 910, 920, 930	Dissertation Research	Variable
GC 550	Foundations in Biomedical Sciences	10
GC 640	Research Ethics: The Responsible Conduct of	1
	Research	
GC 730	Planning & Writing a Research Grant	1
NS 740	Applied Statistics in Neuroscience	2

Recommended Elective Courses

BI 535	Biochemistry and Molecular Biology - Metabolism	3 cr.
CB 615	Developmental Biology and Teratology I: Embryology	3 cr.
CB 625	Mechanisms of Development	3 cr.
GC 645	Genomics and Bioinformatics	3 cr.
GE 612	Genetics of Model Organisms	3 cr.
GE 636	Regulation of Cell Cycle & Apoptosis	3 cr.
GE 637	Advanced Human Genetics	3 cr.
GE 651	Pathobiology of Cancer	2 cr.
GE 652	Molecular Basis of Cancer	2 cr.
GC 665	Cell Signaling	4 cr.
NS 700	Cellular Neurophysiology	4 cr.
NS 715	Molecular & Cellular Neuroscience	3 cr.

Course Descriptions / Required Courses

IMP 505 A: Fundamentals of Immunology - 2 Credits (Sykulev)

Credits 2 each

Spring I

Prerequisite: GC 550 or equivalent

A comprehensive course encompassing the major areas of Immunology: innate immunity, immune receptor diversity; antigen processing and presentation; T and B cells. The format for this course will involve both lecture and discussion of specific topics, and students will be encouraged to acquire an understanding of classical and modern immunological concepts through analysis of their experimental bases. Discussion of critical techniques in Immunology will be incorporated throughout the course. Assigned reading.

IMP 505 B: Immune System in Health and Disease – 2 Credits (Sykulev)

Credits 2 each

Prerequisite: GC 550 or equivalent and IMP 505A or equivalent

Spring I

The course discusses the role of the immune system in maintaining health: immune tolerance, microbial immunity; transplantation; tumor immunology. The format for this course will involve both lecture and discussion of specific topics, and students will be encouraged to acquire an understanding of classical and modern immunological concepts through analysis of their experimental bases. Discussion of critical techniques in Immunology will be incorporated throughout the course. Assigned reading.

IMP 530 Infection and Immunity (Hooper)

Credits 3

Spring II

This course provides students with an introduction to the field of microbial immunology. Lectures will focus on immune responses to infectious agents; how pathogenic organisms evade immune-mediated elimination; how immunization protects against infection. Organisms ranging from viruses through bacteria to protozoa, helminths, and arthropods will be studied.

IMP 600 Microbiology (Alugupalli)

Credits 2

Spring I

This course provides students with an introduction to the field of Microbiology. Lectures will focus on particular infectious agents and will discuss pathogenesis, immunology, physiology, cell biology, pharmacology, and molecular biology of these organisms.

IMP 601. 610, 620, 630 Research Rotation in Immunology Pre-entry, I, II, III (Faculty)

Credits 3

Each semester/session: must complete 3 rotations

Students spend time in laboratories of program faculty, discussing the ongoing research projects and conducting experiments. Students are encouraged to read the background literature for the research area and to begin to develop approaches to the problem. These rotations are a prelude to selection of a research advisor.

IMP 631 Advanced Cellular Immunology (Calkins)

Credits 3

Prerequisite: Prerequisite: IMP 505 A and B or equivalent

Spring II in even years only

This course emphasizes current concepts and controversies in ontogeny, cellular interactions, activation and regulation of normal and defective immune responses primarily through discussion of current literature.

IMP 632 Molecular Immunology (J. Zhang)

Credits 3

Spring II in odd years only

This course concentrates on the molecular and genetic basis of lymphocyte receptor signal transduction, activation, and maturation. Emphasis will also be placed on the role of cytokines and interaction molecules for antigen recognition and cytotoxic mechanisms. The immunogenetics of MHC and non-MHC molecules and their impact upon immune responses will also be discussed. Through assigned reading and discussion of notable scientific literature in these areas, students will gain a basic understanding of the current concepts.

IMP 655 Advanced Topics in Microbial Pathogenesis (Schnell)

Credits 3

Spring II

This advanced course will present examples of how pathogens cause disease in their hosts and emphasize the molecular mechanisms of pathogenesis for the three major types of microbial pathogens: bacteria, parasites, and viruses. Basic course work in Microbiology, Immunology, and Cell Biology is a prerequisite for this course.

IMP 712, 722, 732 Current Literature in Immunology I, II, III (McGettigan, Rahman)

Credits 1 each

Fall, Spring I, Spring II

A weekly presentation and discussion of recent literature in Immunology for students and faculty. Students will present on a rotating basis and are encouraged to participate in the general discussion.

IMP 910, 920, 930 Dissertation Research (Faculty)

Credits variable

Fall, Spring, Summer

Under the supervision of a member of the graduate faculty and guidance of a thesis research committee, the student will learn research design, methodology, and experimental techniques relevant to the graduate program. Research leading to the doctoral thesis is a major requirement for the Ph.D. degree and will occupy a dominant part of the student's time and attention.

GC 550 Foundations of Biomedical Sciences (Jaynes)

Credits 10

Fall

This course is designed to provide a basic knowledge of biochemistry, genetics, molecular biology and cellular biology to the beginning student. The primary goal is to convey knowledge of the molecular and cellular mechanisms controlling cell, tissue and organ system function using material drawn from biochemistry, cell biology, genetics, pharmacology and physiology. The course will familiarize the student with the powerful technologies used in scientific research and will train the student in the communication of science through informal sessions on evaluation of published literature, scientific writing, oral presentations, and information retrieval.

GC 640 Research Ethics: The Responsible Conduct of Research (Flynn)

Credits 1

Fall, Spring I

This graduate seminar course is designed to familiarize students with the ethical dilemmas inherent to the conduct of research. Topics to be discussed include codes of ethical behavior, research design, conflicts of interest, informed con-sent and the appropriate use of animals. The student will be required to prepare a paper on the analysis of one or more case studies.

GC 730 Planning and Writing a Research Grant (Grunwald)

Credits 1

Fall

This course is designed to provide students with instruction and practical experience in the art of planning and writing a research grant proposal. Students will become familiar with the structure of a research grant, including the development of the major sections of a grant proposal such as specific aims, background and significance, and experimental design. Development of the experimental design section will include approaches to discussion of experimental rationale, detailed research methods, expected results and interpretations, and potential pitfalls and alternatives. Students will also learn about the peer review process and how to critique a grant proposal. NIH-style grants will serve as the model for this course, although the general principles of grant organization and writing will be applicable to all research grants. Students will gain practical experience by sequential production of three written documents: (1) an NIH-style Specific Aims Page, (2) a Research Plan based upon expansion and development of one specific aim, and (3) an NIH-style critique of a grant proposal.

NS 740 Applied Statistics in Neuroscience (Sterling)

Credits 2

Prerequisite: GC 550 or equivalent

Spring II

This course serves as a graduate level introduction into applied data analytic strategies focused in the neurosciences. An understanding of hypothesis testing, the relationship of design and analysis, and the interpretation of statistical tests of significance will be strongly emphasized. Methods for collecting and organizing study data, including an introduction to data analytic software such as SPSS and SAS, will be discussed. The ultimate objective of the proposed course is to provide graduate level neuroscience students will sufficient skill to independently enact various forms of data analysis.

Course Descriptions / Elective Courses

BI 535 Biochemistry and Molecular Biology - Metabolism (Cingolani)

Credits 3

Spring II

The topics covered include the catabolic and anabolic pathways of carbohydrate, lipid, and amino acid metabolism and their biochemical interrelationships and regulation. Also addressed will be research directed at understanding the biochemical basis of a few selected diseases, as well as current research efforts in the field of metabolic regulation. Assigned reading.

CB 615 Developmental Biology I - Embryology (Grunwald/Philp)

Credits 3

Fall

Embryogenesis encompasses development of an organism from fertilization to birth. This course will describe the fundamental and historical concepts of morphogenesis, and cell differentiation as they pertain to the early embryo, body axis formation, and development and maturation of the major organ systems, including the placenta. Emphasis will be placed on comprehensive descriptions of developmental systems.

CB 625 Mechanisms of Development (Menko/Walker)

Credits 3

Spring I

This course builds on topics covered in GC550 and applies them to mechanisms of cell differentiation and development. There is a strong emphasis on cell biology, biochemistry and genetics as student explore such dynamic cell processes as polarity, communication, migration, signaling, and morphogenesis. This course is designed to help develop student skills in analyzing and presenting papers; each didactic lecture is accompanied by a student run analysis of a relevant paper from the literature. There also is an intensive grant writing component to this course through which students are provided with one on one faculty assistance during each phase of their writing process.

GC 645 Genomics and Bioinformatics (Vadigepalli)

Credits 3

Spring II

To provide students with an overview and understanding of the utility of genomic-scale data in a biomedical setting and the computational and analytical tools used with these high dimensional data sets. Various topics will be covered leading to the highly integrated state of the art approaches in use today. Lecture materials will be combined with hands on tutorials and weekly projects in an integrated fashion. Several guest presentations from on campus experts will supplement the course content. Students should gain a broad working knowledge of the issues and capabilities of genomics, bioinformatics and their inegration.

GC 665 Cell Signaling (Covarrubias/Wedegaertner)

Credits 4

Spring I

This course will focus on the regulation of cell function through an understanding of signal transduction mechanisms. Emphasis will be placed on cell biology aspects of signaling pathways, structure-function of signaling proteins, dysregulation of signaling pathways in disease and the mechanism of action of drugs that target signaling proteins.

GE 636 Regulation of Cell Cycle and Apoptosis (Calabretta)

Credits 3

Fall

Factors controlling cell growth and mechanisms initiating cell proliferation will be discussed. Foremost will be a consideration of proto-oncogenes and their role in the regulation of cell cycle traverse. Mechanisms of proto-oncogene activation to oncogenes and the role of oncogenes and suppressor genes in uncontrolled cell proliferation and cell transformation will be discussed via a consideration of original papers and student presentations. Assigned reading.

GE 637 Advanced Human Genetics (Siracusa)

Credits 3

Spring II

This is a team taught human genetics course that assumes a basis knowledge of molecular biology, molecular genetics and classical genetics. It covers a wide range of topics from clinical cytogenetics, mendelian genetics with examples of specific diseases, population genetics and multifactorial inheritance, to physical mapping, genome informatics, mutation detection and more diseases that exemplify certain genetic principles. Finally, functional genomics, including DNA microarray analyses and applications and SNPs (single nucleotide polymorphisms) and applications are introduced.

GE 651 Pathobiology of Cancer (Rui)

Credits 2

Spring I

The course covers the classification of human cancers, characteristics of neoplastic cells, epidemiology of cancers, causes of cancer, experimental carcinogenesis and the immune response against neoplastic cells. Lectures and discussions are held on these individual topics. Assigned readings.

GE 652 Molecular Basis of Cancer (Nevalainen)

Credits 2

Spring I

This advanced seminar course emphasizes the molecular and genetic basis of neoplasia, including oncogene activation, tumor suppressor genes, chromosomal translocation and deletions. Models of multistep tumorigenesis in transgenic mice.

NS 700 Cellular Neurophysiology (O'Leary)

Credits 4

Spring I

a graduate lecture/seminar/ laboratory survey course that introduces students to concepts and experimental approaches in the neurosciences. The course will provide students with an understanding of the structure and function of the nervous systems at the cellular and systems levels, including an introduction to the organization of nerve cells and tissues, principles of neurophysiology and neuropharmacology, organization and function of motor and sensory systems, and central integration. This is obtained through a combination of didactic lectures as well as hands on laboratory sessions during two two-hour class sessions per week

NS 715 Molecular and Cellular Neuroscience (Merry)

Credits 3

Spring II

This course provides a detailed analysis of molecular and cellular neuroscience through the combination of didactic lectures and journal artical based discussions. An emphasis will be placed on approaches used to investigate questions in several general ideas, including developmental neuroscience, cellular signaling, second messengers and the molecular genetic basis of behavior and disease. Lectures and discussion of primary literature expand on and deepen understanding in particular areas of molecular and cellular neuroscience introduced Neuro I. In addition a section on molecular genetic control of neurologic function and behavior will introduce new concepts and approaches to the study of neuronal dysfunction and disease. The inclusion of primary literature in the course promotes an understanding of analytical approaches to questions in neuroscience as well as critical scientific thinking. The primary literature also makes more accesible to students many of the techniques used in molecular and cellular neuroscience. Moreover the combination of didactic and discussion sessions for each topic allows the integration of knowledge acquisition with an analytical assessment of experimental molecular and cellular neuroscience.