Graduate Division of Biological and Biomedical Sciences

Immunology and Molecular Pathogenesis

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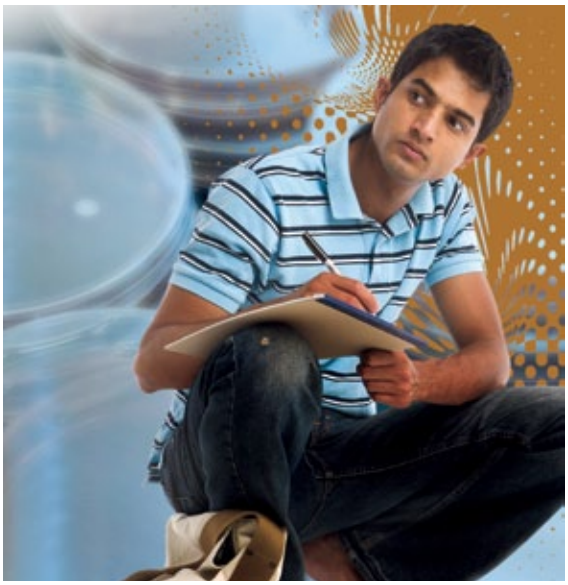


The Immunology and Molecular Pathogenesis (IMP) program offers exceptional interdisciplinary training in molecular and cellular immunology and the role of the immune system in the pathogenesis of infectious disease. The IMP program provides students with a unique opportunity to study all aspects of pathogenesis, ranging from basic immunology to the molecular biology of viral, bacterial, and protozoal pathogens.

Opportunities for dissertation research include many subjects in the fields of immunology and pathogenesis, along with overlapping areas of fundamental cell biology and molecular biology. The research programs of the faculty members use a wide range of experimental approaches in immunobiology, molecular and cell biology, pathobiology, and genetics. In addition, a number of IMP program faculty work at the interface between basic and applied research (i.e., translational research including vaccine development, transplantation, and autoimmunity).

A number of faculty in Emory's IMP program collaborate extensively with scientists at the U.S. Centers for Disease Control and Prevention (CDC), which is located directly adjacent to Emory. The CDC is the world leader in uncovering new diseases and identifying infectious agents. It has strong basic science programs in molecular pathogenesis covering a broad range of microbes, including viruses, bacteria, fungi, and parasites. Several CDC scientists are faculty members in the IMP program.

Training Areas

The IMP doctoral program provides outstanding training in three areas.

IMMUNOBIOLOGY encompasses the basic mechanisms of immune mediated responses. Within this area, research projects investigate the mechanisms of antigen presentation, inflammatory processes, TCR/ligand interactions, cytokine receptor and TLR signal transduction, mucosal immunity, autoimmunity, immunological tolerance, and transplantation immunology.

PATHOGENESIS OF INFECTIOUS DISEASE concentrates on (a) fundamental events by which microbes invade the host, establish themselves, and avoid the immune system, (b) elucidation of innate and adaptive immune responses to bacterial, protozoal, and viral infections, and (c) vaccine development.

MOLECULAR VIROLOGY focuses on viral packaging, the structure/function relationships of viral proteins, viral replication, and effects of viruses on cellular proliferation, transformation and apoptosis.

A number of IMP faculty member research projects extend across several of these areas, providing students ample opportunities for exceptional interdisciplinary training.

Seminar Series

IMP program students and faculty attend two regular weekly seminar series.

The Faculty Seminar Series features invited speakers from around the nation, presenting their latest research to students, postdoctoral fellows, and faculty in the IMP program. This series enables both faculty and students to stay current with progress in their own and related fields. Students select one outside speaker each year and have ample opportunities to interact with the invited speakers.

Some recent visitors and topics include:

- Liu Yong-Jun, MD Anderson Cancer Center: *Dendritic Cells in Linking Innate and Adaptive Immunity*
- Trinchieri Giorgio, NIH: *Innate Resistance, Inflammation and Cancer*
- Leslie Berger, University of Massachusetts: *Early Programming of T cell Differentiation*
- Michael Gale, University of Washington *Control of innate antiviral defenses during hepatitis C infection*
- Hirohito Kita, Mayo Clinic :*Epithelium and Immune Cell Interaction in Th2-type Immunity*

The *Research-In-Progress Seminars* are devoted to student presentations of their ongoing research. These seminars are held throughout the academic year and are attended by students, postdocs, and faculty. They serve as a supportive environment for students to acquire experience in the essential skill of sharing ongoing research with professional colleagues. They are also an important way for the audience to learn from their colleagues' work.

IMP students have also organized a journal club that meets biweekly, and which is attended by both students and faculty.

Community, Resources and Opportunities

The IMP program provides a supportive and collaborative environment that encourages and supports innovative research. Students can work with and learn from not only the IMP faculty, but also from over 300 faculty members in the Graduate Division of Biological and Biomedical Sciences. These professors, their graduate students and postdocs, and the many labs they operate are Emory's greatest resource.

In addition, the Emory community has numerous facilities that provide reagents and expertise for immunological projects. Within the School of Medicine are core facilities to support research projects, including Flow Cytometry, Transgenic Mice, Microchemical and Proteomics, and Bioinformatics. State of the art animal facilities at several locations on campus house multiple species, including a large population of non-human primates at the Yerkes National Primate Research Center. The Yerkes Center also houses the Emory Vaccine Center, directed by Rafi Ahmed, Ph.D., who is an IMP faculty member.

The proximity and close relationship between the IMP program and CDC provides a unique opportunity to interact with scientists and public health officials at the frontier of international vaccine research efforts.

Faculty

The faculty of the IMP program are members of nine basic science or clinical departments in the School of Medicine, the Biology Department of Emory College, the Yerkes National Primate Research Center, and the CDC. There are many interactions among program faculty, including collaborative research projects, joint research group meetings, and joint participation with students and faculty in the other doctoral programs of the Graduate Division of Biological and Biomedical Sciences.

A complete list of IMP program faculty members, with links to publications, laboratories and other infor-mation, is available on the IMP program website at *www.biomed.emory.edu/program_sites/imp*.

Students

The IMP program welcomes applications from individuals with science-based undergraduate degrees, and highly values graduate training in immunology, virology and biological sciences. Applicants with other backgrounds should contact the recruitment coordinator to discuss the appropriateness of the program.

Our website has information about our current students, including research projects. Here is a sample of recent graduates and their dissertation projects:

- Amma Semenya (2009): *Merozoite invasion of erythrocytes: revealing functional characteristics of the Plasmodium knowlesi normocyte binding proteins*
- Phillip Swanson (2009): *Discovery and characterization of a novel antiviral CD8 T cell response*
- Lisa Gargano (2009): *Role of innate immunity during a gammaherpes virus 68 infection*
- Shana Coley (2009): *Opposing roles of interferon gamma in transplantation under costimulation blockade*

Graduates of the IMP program work in academia, government, and the private sector. Recent graduates have successfully competed for faculty positions at Wake Forest University, UT Southwestern Medical Center, the University of Virginia, the University of Georgia, and the University of Utah in Salt Lake City, and post-doctoral positions at the National Institutes of Health, the University of Washington in Seattle, the University of Pennsylvania, the Massachusetts Institute of Technology, and The Scripps Research Institute.

Curriculum

Students usually complete the program in 5 or 6 years, though students who arrive with an advanced degree (MS, MPH, etc.) may complete it in a shorter time.

The curriculum is designed to develop a solid basis of knowledge in immunology and virology, a deep expertise in a specialty, strong research skills, and the ability to integrate their specialty and research with issues from other areas in immunology and pathogenesis.

Year 1 Students take a common sequence of courses in biochemistry, cell biology, immunology, and virology.

Students complete three 8-10 week laboratory rotations. These provide opportunities for students to participate in active research projects in different areas and to become acquainted with faculty members who may become mentors and advisors. Students have the option of beginning their laboratory rotations in the summer prior to the first semester.

By the end of Spring semester, students select a dissertation mentor.

Year 2 Students take three advanced level immunology/pathogenesis seminar courses and one elective course.

At the end of the Spring semester, students take a comprehensive oral examination to assess their grounding in immunology/pathogenesis concepts and experimental design.

Also at the end of Spring semester, students select a thesis committee that will guide the preparation of a dissertation proposal.

Year 3 With the guidance of the dissertation mentor and the thesis committee, students develop the expertise and skills needed to carry out dissertation research project.

By the end of Fall semester, in conjunction with their thesis mentor, students submit a National Institutes of Health application grant-style thesis proposal, to be presented and approved by their thesis committee.

Years 4+ Students conduct original scholarly dissertation research, publish manuscripts, and complete a written and oral thesis defense.

At this stage, students are encouraged to present their research at regional and national scientific meetings.

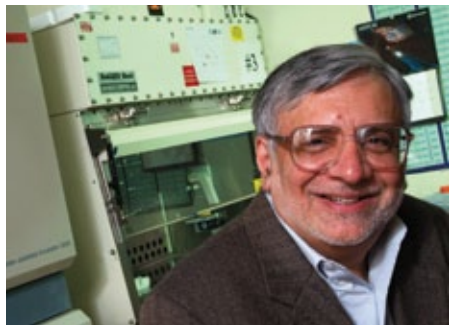
Our website lists required courses and recommended electives.

Training in Teaching

The central focus of Ph.D. training in the IMP program is training investigators and scholars. This training also includes preparation in the art of teaching peers, colleagues, and less experienced students in science. Hence, all students participate in a program of training and experience in pedagogy and other elements of teaching, through the Teaching Assistant Training and Teaching Opportunity Program (TATTO) administered by the Graduate School.

After a brief summer workshop (usually before the second year), students are assigned by the Graduate Division of Biological and Biomedical Sciences to assist a faculty member as a lecturer, laboratory instructor or discussion leader for one semester. The Graduate Division offers additional TATTO courses, as well as additional teaching opportunities.

Faculty Profile



Rafi Ahmed, Ph.D., Director of the Emory Vaccine Center, Professor of Microbiology and Immunology, and Georgia Research Alliance Eminent Scholar. Dr. Ahmed is one of the world's leading experts and world-renowned lecturers on T cell memory resulting from viral infection or vaccination. Dr. Ahmed's research efforts are directed towards understanding the mechanisms of immunological memory and using this knowledge to develop new and more effective vaccines against emerging diseases. As Director of the Emory Vaccine Center, he oversees efforts to create new technologies that will make our most challenging problems such as AIDS, malaria, tuberculosis, influenza, and respiratory viruses a thing of the past.

Among his many honors, Dr. Ahmed recently received the 45th Annual J.S. and H.R. Blumenthal Memorial Lectureship (Minneapolis, MN), the Dean's Distinguished Faculty Lecture and Award (Emory University School of Medicine), and the Thomas J. Matthews Endowed Lectureship (Durham, NC). Recently, The *Faculty of 1000 Biology* named a paper by Dr. Ahmed as one of the "All-Time Top 10" most interesting scientific papers. The article, "Restoring Function in Exhausted CD8 T Cells During Chronic Viral Infection," was published in the February 09, 2006 issue of *Nature*. An IMP graduate student was first author on this paper.

About the GDBBS

Emory University is one of the major biological research and medical referral centers in the Southeast and is among the fastest growing Medical Centers in the United States. Emory is consistently ranked in the top 20 institutions nationally for NIH research support. Emory was recently named one of the 25 "New Ivies" by *Newsweek*, a testament to its quality and dedication to education.

The Graduate Division of Biological and Biomedical Sciences (GDBBS) has over 460 graduate students in eight interdisciplinary Ph.D. programs:

- Biochemistry, Cell and Developmental Biology
- Genetics and Molecular Biology
- Immunology and Molecular Pathogenesis
- Microbiology and Molecular Genetics
- Molecular and Systems Pharmacology
- Neuroscience
- Nutrition and Health Sciences
- Population Biology, Ecology and Evolution

Over 330 world-renowned researchers mentor students admitted to these programs, giving them a unique opportunity to train with faculty at:

- the American Cancer Society
- the U.S. Centers for Disease Control and Prevention
- Emory College
- the Robert W. Woodruff Health Sciences Center
- the Rollins School of Public Health
- The Carter Center
- the Winship Cancer Institute
- the Yerkes National Primate Research Center

Financial support includes a tuition scholarship, health insurance and stipend ($24,500 for the 2009 – 2010 academic year). Funding is guaranteed as long as the student is making satisfactory progress toward their degree. The average time to degree is about 5.5 years. Training is interdisciplinary and students have the flexibility to work with GDBBS faculty outside their program. Students typically perform three rotations before affiliating with a faculty member for their dissertation research.

The application deadline is January 3rd for the following fall semester.

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Requests for Additional Information:

RECRUITMENT AND ADMISSIONS

Graduate Division of
Biological and Biomedical Sciences
Emory University
1462 Clifton Road, Suite 314
Atlanta, GA 30322

(404) 727-2545 (direct line)
gdbbs@emory.edu

http://www.biomed.emory.edu
http://www.biomed.emory.edu/program_sites/imp