



EMORY  
LANEY  
GRADUATE  
SCHOOL



GRADUATE DIVISION OF BIOLOGICAL AND BIOMEDICAL SCIENCES

## MICROBIOLOGY AND MOLECULAR GENETICS

The program in Microbiology and Molecular Genetics (MMG) provides training in the study of microorganisms and the use of molecular genetics to investigate basic problems in microbiology.

Our faculty members have a wide range of expertise and interests, and our program offers a comprehensive education in the biology and molecular biology of microbes including viruses, bacteria, and protozoan pathogens: bacterial genetics and physiology, microbial development, mechanisms of bacterial and viral pathogenesis, molecular biology of gene regulation, antibiotic resistance, and antiviral and vaccine development.

### GOALS OF THE MMG PROGRAM

The central goal of the MMG program is to provide students with the essential training experiences needed to be successful independent investigators in microbiology research. First,

using microbial systems, we teach our students the basic principles of microbiology, biochemistry, molecular biology and molecular genetics. Second, we instruct our students in how to read the original literature and interpret it critically. Our goal is to enable our students to construct hypotheses and to design experiments using contemporary technologies to test these hypotheses. Third, we emphasize training in effective communication, both oral and written.

The program is designed both for students interested in academic careers in research and teaching and for those interested in careers in related aspects of medicine, public health and industry.

### PROFESSIONAL DEVELOPMENT

The Laney Graduate School offers a range of programs that encourages students to develop their professional skills, engage with broader professional communities, and prepare for their careers.

VISIT [GS.EMORY.EDU](https://gs.emory.edu) TO LEARN MORE.

## RESEARCH AREAS

Opportunities for dissertation research are grouped into two broad areas:

### GENE EXPRESSION AND PHYSIOLOGY OF BACTERIA AND VIRUSES

This area studies the transcription of genes involved in antibiotic resistance, virulence, motility and the differentiation of microbes, as well as viral multiplication, viral evolution and host genes influenced by infection. Microbes are used to study fundamental physiological processes including sporulation, antibiotic synthesis and resistance, transport, biofilm formation, bacterial communication systems and metabolism. Research in virology focuses on viruses that are associated with disease in humans, as well as animal models to better understand the interaction of viruses with their hosts.

### MICROBIAL PATHOGENESIS

In this field, important areas of research include the study of genes required for bacterial and viral pathogenesis and the response of the host to infection.

MMG faculty with interests in bacteriology conduct basic research that addresses important, contemporary problems in the areas of microbial physiology (including sporulation, biofilm formation, mechanisms of antibiotic resistance and production and cellular communication systems), microbial genetics, use of microbial genomics to understand mechanisms of virulence and antibiotic resistance and how bacteria evade host defenses.

MMG faculty with interests in virology conduct basic research that addresses important, contemporary problems in the areas of antiviral development, mechanisms of antiviral resistance, viral replication, roles of viruses in oncology, HIV/AIDS, influenza, mechanisms of viral pathogenesis, mechanisms of viral fusion with host cells, use of Cryo-electron microscopy to study viral assembly and trafficking, escape from immune systems and vaccine development.

## RESOURCES AND OPPORTUNITIES

The MMG program draws together resources from a number of institutions, providing students with an unparalleled range of opportunities.

- Faculty members are drawn from departments within the Emory School of Medicine (Biochemistry, Microbiology and Immunology, Medicine, Pathology and Pediatrics), the Rollins School of Public Health, science departments in the Emory College, the Centers for Disease Control and Prevention (located adjacent to the Emory campus) and the Atlanta VA



Third year Ph.D. graduate student, Edgar Sherman, and MMG faculty member, Dr. Elizabeth Wright, analyze a slice from a cryo-electron tomogram of the bacterium *Asticcacaulis biprosthicum* to understand the molecular structure of the holdfast located at the cell pole.

Medical Center.

- The faculty members are well-funded with extramural grant support from federal agencies such as the NIH, National Science Foundation and the Veterans Administration.
- A recent example of such funding is The Antimicrobial Resistance and Therapeutic Discovery Training Program (ARTDTP). ARTDTP is an NIH/NIAID-funded training grant directed by MMG faculty member William M. Shafer. ARTDTP educates the next-generation of scientists combating the growing public health problem of pathogenic microbes that resist antimicrobials used in clinical medicine. ARTDTP-supported trainees are selected after their successful completion of preliminary examinations and participate in specific activities to provide educational and research experiences in antimicrobial resistance and drug development. To learn more, visit <http://antimicrobialtraining.emory.edu/index.html>
- Three research centers sponsor collaborative and interdisciplinary research in key areas for MMG students.
  - Emory Vaccine Center, directed by Professor Rafi Ahmed. To learn more, visit: <http://www.vaccines.emory.edu/>
  - Center for Excellence for Influenza Research and Surveillance (CEIRS). To learn more, visit: <http://www.niaidceirs.org/>
  - Emory Antibiotic Resistance Center (Emory ARC), led by Professors David Weiss and William Shafer. At Emory ARC clinicians and basic scientists work side-by-side to develop novel, interdisciplinary approaches to combat antibiotic resistance. Working in partnership with government and public and private institutions in the U.S. and worldwide, Emory ARC represents a new and critical component of the fight against antibiotic resistance. To learn more, visit: <http://antibiotics.emory.edu/>

All of the necessary equipment and core facilities to conduct cutting-edge research are available to our students.

## CURRICULUM

The MMG curriculum is flexible and allows students to enroll in elective classes that will best meet their educational needs. Most students complete their degree in approximately 5 to 6 years.

### COURSEWORK

In the first year, all students take four required courses: Introduction to Prokaryotic Genetics; Basic Biomedical & Biological Sciences OR Concepts of Immunology; Virology; and Introductory Graduate Seminar, a course that features seminars from invited guests in the field, MMG Faculty and MMG students. In the second year, students benefit from the course Hypothesis Design and Scientific Writing. They also select elective courses throughout the first 2-3 years that enhance their education and support their research and continue to attend the seminar course.

In addition to these course requirements, first and second year students participate in Colloquium in Microbiology, which involves student-led informal presentations and discussions of current papers and research.

Finally, incoming students also attend an Introduction to Research series, in which all faculty members in the program present and discuss their laboratories and current research projects. This provides a useful guide for organization of laboratory rotations.

### LAB ROTATIONS

Following the Introduction to Research series, the students begin the first of three research rotations, designed to provide exposure to different areas and to varied techniques, and to enable students to choose a laboratory for their thesis research. These rotations of approximately 8 weeks each are generally completed at the end of Spring semester.

## RESEARCH

After completing rotations, students select their laboratory for dissertation research and begin to develop a research project of their own. Towards the end of the second year, each student prepares an NIH-style research proposal that relates to their thesis project. This is submitted to the faculty thesis committee chosen by the student, and along with the oral discussion of this proposal and relevant background material, serves as the Ph.D. qualifying exam.

In years 3 and above, students present a 25-minute oral progress report to the faculty and students as part of the regular MMG seminar series that takes place on Monday afternoons. Each student presents at least two times prior to graduation, providing additional opportunities for students to become effective at scientific communication.

## TRAINING IN TEACHING

Scientists are often also teachers, whether in formal education or in the process of presenting to lay persons. At Emory, all doctoral students receive training 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

The 45 members of the MMG faculty are diverse in their research interests in the disciplines of bacteriology and virology, with special interests in the molecular biology and genetics of bacteria and viruses, mechanisms of microbial pathogenesis, basic principles of microbial physiology, and viral replication.

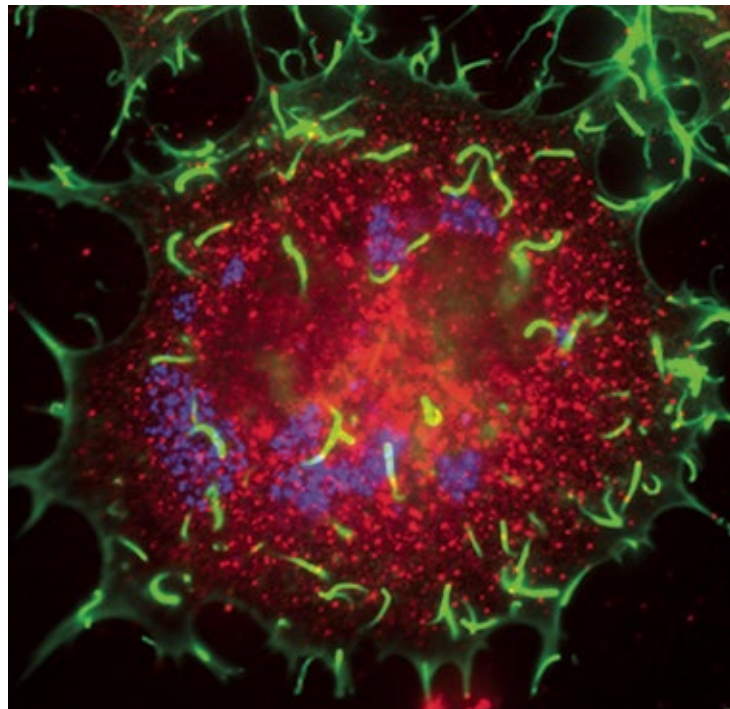
Most of the MMG faculty have dual appointments and actively participate in other GDBBS graduate programs, including Genetics and Molecular Biology, Immunology and Molecular Pathogenesis, Biochemistry, Cell and Developmental Biology and Population Biology, Ecology and Evolution. Such dual appointments enhance the opportunity for collaborations and increase the exposure of students to different aspects of contemporary issues in microbiology, biology and medicine.

Certain MMG faculty are also members of the Emory Vaccine Center, the Center for AIDS Research, the Southeastern Research Center of Excellence in Biodefense and Emerging Infectious Diseases, or the Center of Excellence for Influenza Research Center and Surveillance.

A complete list of faculty members, with descriptions of research interests and links to publications is on our website: [http://biomed.emory.edu/PROGRAM\\_SITES/MMG/about-us/faculty.html](http://biomed.emory.edu/PROGRAM_SITES/MMG/about-us/faculty.html)

## STUDENTS

The career opportunities that are now available for Ph.D.s in microbiology are substantial and the goal of the MMG faculty is to guide the students in



establishing a scientific foundation so that the students can be successful life-long learners. Graduates of the MMG program pursue many different career pathways and post-graduate training opportunities or employment.

- Some students continue their basic science training by conducting post-doctoral research at universities or in government laboratories. Recent MMG graduates have undertaken postdoctoral research at Princeton University, Harvard University, Yale University, the University of Washington, Oxford University, the Centers for Disease Control and Prevention (CDC), the NIH and FDA.
- Other students continue their formal education by attending medical, law or public health schools.
- Others take up professional positions ranging from university professorships to private sector scientific work. MMG graduates are presently faculty members in Microbiology and Immunology departments at universities, staff scientists at the CDC and NIH, scientists employed by biotechnology firms and large pharmaceutical companies, practicing physicians or lawyers, or involved in scientific journalism enterprises.

## CONTACT INFORMATION:

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**About Emory:**

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 and ranks at or near the top of institutions for students with NIH predoctoral fellowships. Emory is recognized as a leader in higher education in sustainability and has won numerous awards. The Best Colleges has placed Emory in the top 10 in the nation in the categories of greenest universities and the most beautiful college campuses.

The Graduate Division of Biological and Biomedical Sciences (GDBBS) has around 400 graduate students in eight interdisciplinary Ph.D. programs:

- Biochemistry, Cell and Developmental Biology
- Cancer Biology
- Genetics and Molecular Biology
- Immunology and Molecular Pathogenesis
- Microbiology and Molecular Genetics
- Molecular and Systems Pharmacology
- Neuroscience
- 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:

- American Cancer Society
- the U.S. Centers for Disease Control and Prevention
- Children's Healthcare of Atlanta, Inc.
- Emory College
- the Robert W. Woodruff Health Sciences Center
- the Rollins School of Public Health
- The Carter Center
- Veterans Administration Medical Center, Atlanta
- the Winship Cancer Institute
- the Yerkes National Primate Research Center

Financial support includes a tuition scholarship, health insurance and a competitive stipend (\$30,000 for the 2017 – 2018 academic year). Funding is guaranteed as long as the student is making satisfactory progress toward their degree. The average time to degree is typically around 5.5 to 6 years. Training is interdisciplinary and students have the flexibility to perform their thesis work with GDBBS faculty outside their chosen program. Students typically perform three rotations before affiliating with a faculty member for their dissertation research.

**The application deadline is December 1st for the following fall semester.**



Requests for Additional Information:

Recruitment and Admissions  
 James T. Laney School of Graduate Studies  
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 201 Dowman Drive  
 Atlanta, GA 30322

(404) 727-2547  
 gdbbs@emory.edu

biomed.emory.edu  
 biomed.emory.edu/program\_sites/mmg



**LANEY GRADUATE SCHOOL DEGREE PROGRAMS**

Anthropology	<i>Genetics and Molecular Biology</i>	Biomedical Engineering	Development Practice	Health Services Research and Health Policy	Nursing
Art History	<i>Immunology and Molecular Pathogenesis</i>	Biostatistics	Economics	Hispanic Studies	Nutrition and Health Sciences
Behavioral Sciences and Health Education	<i>Microbiology and Molecular Genetics</i>	Business	English	History	Philosophy
Bioethics	<i>Molecular and Systems Pharmacology</i>	Chemistry	Environmental Health Sciences	Islamic Civilizations Studies	Physics
Biological and Biomedical Sciences	<i>Neuroscience</i>	Clinical Psychology	Environmental Sciences	Mathematics	Political Science
<i>Biochemistry, Cell and Developmental Biology</i>	<i>Population Biology, Ecology, and Evolution</i>	Cognition and Development (Psychology)	Epidemiology	MD/PhD	Religion
<i>Cancer Biology</i>		Comparative Literature	Film and Media Studies	Music	Sociology
		Computer Science and Informatics	French	Neuroscience and Animal Behavior (Psychology)	Women's, Gender, and Sexuality Studies