



EMORY
LANEY
GRADUATE
SCHOOL



GRADUATE DIVISION OF BIOLOGICAL AND BIOMEDICAL SCIENCES

GENETICS AND MOLECULAR BIOLOGY

The opportunities in the fields of genetics and molecular biology are amazing. The wealth of genetic data and the potential to use this information for developing novel medical therapies and diagnostic procedures is unprecedented. With this in mind, the goal and philosophy of the doctoral program in Genetics and Molecular Biology (GMB) is to provide both broad based and in depth training in genetics and epigenetics, and their related disciplines of bioinformatics, biochemistry, and cell and developmental biology. This combined education is designed to develop the scientific leaders of the twenty-first century.

RESEARCH FOCI

The GMB program offers six core areas of genetics and molecular biology research. Within the areas described below, model genetic systems—bacteria, yeast, *C. elegans*, *Drosophila*, zebrafish, and the mouse—are used to explore genetic and molecular biology principles.

EPIGENETIC REGULATION OF GENE EXPRESSION

Understanding the molecular and genetic mechanisms that

regulate genes is fundamental to all areas of biology. Molecular, genetic, and biochemical tools are used to investigate how gene expression is regulated, how epigenetic mechanisms guide embryonic development, and how defects in these processes contribute to human disease. A broad range of systems are studied, including the human immune system; visual system genes; dosage compensation in *Drosophila*; the role of oncogenes and tumor suppressors on gene expression; and bacterial differentiation and pathogenesis.

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.

GENETICS OF DEVELOPMENT AND DIFFERENTIATION

Most organisms undergo developmental programs to form or adapt to their environment. Research opportunities in this area include elucidating the genetic programs and circuitry in bacterial sporulation, muscle development, sperm development, germ cell specification and renewal, development of the nervous system and the eye, and sex determination.

CANCER GENETICS AND HUMAN DISEASE

Cancer is a genetic disease—alterations in genome integrity ultimately drive cell transformation and tumor formation. GMB cancer investigators are members of the Winship Cancer Institute, which enables comprehensive training from the “bench to the clinic.” Research topics include understanding cancer formation and malignant progression using bioinformatics and sequencing technologies, DNA methylation and epigenetic mechanisms of human carcinogenesis, genetic regulation of cell cycle control, and apoptosis. Specific areas of focus include brain, prostate, breast, head and neck, skin, and gastro-intestinal cancers.

HUMAN AND MEDICAL GENETICS

Interactions between the clinical and public health faculty, diagnostic laboratories, and basic scientists offer a unique opportunity to study patient populations, identify and understand the basis of inherited disease, and to develop novel treatments for such disorders. GMB laboratories conduct numerous research programs, including studies of inborn errors of metabolism, chromosomal disorders (e.g., Down syndrome, intellectual disability), single gene disorders (e.g., fragile X syndrome, Huntington disease), and multifactorial disorders (e.g., dementia, epilepsy, autism, infertility, schizophrenia, and bipolar disease). Opportunities also exist for students to attend weekly genetic clinics and genetic counseling sessions.

BIOINFORMATICS AND COMPARATIVE GENOMICS

The sequencing of the human and other genomes initiated a great opportunity in scientific investigation. In this focus, students use the current databases and collect and develop their own data sets to understand the basis of evolution, the dissemination of disease and variations that occur with disease genes, the identification of disease traits, and the predictive nature of complex genomic analyses. Students have access to state-of-the-art facilities to investigate gene expression profiles, copy number variation, genetic polymorphisms, and transcription-factor occupancy across the genome.

GENOME STABILITY, REPLICATION AND REPAIR

The stability of genomes and their ability to exchange information is critical to the survival and evolution of all organisms. This exciting area includes studies that examine the mechanisms and regulation of DNA replication, the mechanisms of genetic recombination, and the repair of DNA damage caused by mutagenic agents and the environment. How epigenetic mechanisms contribute to DNA repair and help maintain genome integrity are also a focus of GMB faculty research.

FACULTY

GMB faculty are drawn from departments within the Emory School of Medicine and the Department of Biology, representing a wide range of expertise and research areas.

The program is part of the Graduate Division of Biological and Biomedical Sciences and enjoys close working relationships with students and faculty in the Division’s other programs (see final page).

A complete list of GMB faculty members, with links to publications, grants and other information, is on our website, http://biomed.emory.edu/PROGRAM_SITES/GMB/about-us/faculty.html

STUDENTS

The GMB program invites applications from students with education and experience in genetics, biology, biochemistry, chemistry, molecular biology, or a related field. Applicants with other backgrounds should contact the GMB Admissions Director. The GMB program has an average of ~50 students enrolled and actively engaged in dissertation research.

Our website features student research project titles, awards, research presentations, publications, and the GMB seminar listing. Student accomplishments are also featured on the GMB Facebook Page: www.facebook.com/Emory.Genetics.and.Molecular.Biology.PhD

PREPARATION FOR SUCCESSFUL CAREERS

Students graduating from the GMB program find ample postdoctoral opportunities across the United States and Europe. Most of our graduates have gone on to successful careers in academic, government, or pharmaceutical research positions. Others have used their education to pursue educational, editorships, intellectual property, legal and science administration professions.



Faculty member, Meleah Hickman, and graduate student, Ogie Avramovska, discuss how chromosome dynamics in pathogenic yeast contribute to genome plasticity, which facilitate adaptation to antifungal drugs and other environmental stresses.

CURRICULUM

The GMB curriculum is divided into classroom coursework and research.

The comprehensive curriculum ensures that students receive broad training in genetics and molecular biology. Required coursework covers basic and advanced genetics, biochemistry, cellular biology, biostatistics, and model genetic systems. In the second year and beyond, students focus on dissertation research in their thesis laboratory but also receive formal training in hypothesis design and scientific writing through a comprehensive peer-reviewed grant-writing course. Additional electives enable students to specialize in a field of interest. Some favorite elective topics include bioinformatics, cancer genetics, developmental genetics, epidemiology, and epigenetics. A detailed list of courses offered is available on our website.

The mainstay of the educational experience is independent student research. To select a laboratory and mentor, GMB students spend two months in three different laboratories during the first year. As students develop their own questions in their areas of interest, they can investigate them using cutting edge technologies with state-of-the-art equipment and resources. Interactions with their mentor and dissertation committee serve to guide the student's project to completion.

The GMB program sponsors activities to enhance knowledge and to develop interactions and collaborations between students and faculty. Some of these activities include a seminar series, journal club, and program retreat.

SEMINARS

To provide breadth and to bring new knowledge into the program, the GMB program sponsors a robust outside speaker seminar program. Students have an opportunity to meet with the visiting scientists and discuss their work. A student research-in-progress presentation series provides feedback to the students about their research plan and an opportunity for the students to gain oral presentation skills.

CLUBS

Laboratory groups with shared research interests meet in monthly and biweekly clubs to discuss the hottest topics in their laboratories. Some of these clubs include: the Chromatin Interest Group; Cancer Genetics and Genome Instability; the Emory Fly Group; the Worm Club; and the Yeast Group.

TRAINING IN TEACHING

As scientists we are also teachers, whether in formal education or just in the process of presenting our work and field 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 Laney Graduate School.

After a brief summer workshop (usually before the second year), students assist a faculty member as a lecturer, laboratory instructor or discussion leader for one semester. Numerous other opportunities for gaining experience in teaching during graduate training are available through both the Graduate Division of Biological and Biomedical Sciences and Emory College of Arts and Sciences.

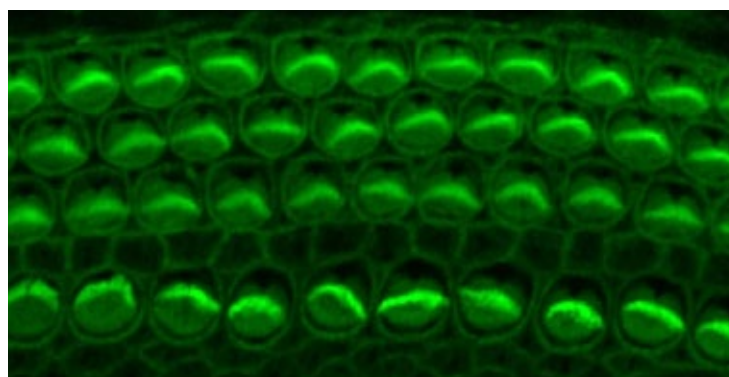
Top to bottom:

Graduate students, Josh Bell and Brindar Sandhu, discuss a recent experimental result. Josh studies how genome-wide epigenetic marks regulate gene expression in breast cancer cells.

Brindar's project is focused on how the chemical environment of a cell can obscure enzyme evolution.

Hair cell development within the inner ear is highly patterned. Cochleae from embryonic (E18.5) mice were stained with phalloidin to visualize F-actin in the developing ear.

Graduate student, Annie McPherson, works with Drs. Anita Corbett and Paul Doetsch to define mechanisms of DNA repair that protect genome integrity.



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 National Primate Research Center

Financial support includes a tuition scholarship, health insurance and a competitive stipend. 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

(404) 727-2547
gdbbs@emory.edu

biomed.emory.edu
biomed.emory.edu/program_sites/gmb

LANEY GRADUATE SCHOOL DEGREE PROGRAMS

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

*The Graduate Division of Biological and Biomedical Sciences is home to eight interdisciplinary graduate programs.