



EMORY

L A N E Y  
GRADUATE  
SCHOOL

Graduate Division of  
Biological and Biomedical  
Sciences



Artistic rendering of a mouse with a brain tumor detected by bioluminescence imaging. The mouse is holding a plastic model of an anti-cancer molecule that can be used for its tumor treatment. The background shows a Western blot analyzing the biochemical effects of the molecule in cancer cells.

## Cancer Biology

The Program in Cancer Biology (CB) provides outstanding training opportunities in every aspect of cancer research, from basic to translational research. This includes molecular and cellular biology, genetics and epigenetics, signal transduction, genetic engineering, nanotechnologies, and many other disciplines used to understand the development and progression of cancer. Many different approaches are applied to a range of model systems to address how a normal cell becomes a cancer cell, how cancer progresses to a metastatic state at the molecular level and how our understanding of these mechanisms can be exploited for the design of new cancer therapies or novel ways to apply existing anti-cancer agents in the clinic.

### Goals

The major goal of the CB doctoral program is to provide outstanding training opportunities for future leaders in the different aspects of cancer research in preparation for a diversity of career paths in research, teaching, and medicine from academia to industry. Specific goals include training future independent cancer researchers in various aspects of cancer biology, including basic and translational cancer research. Using appropriate model systems, from in vitro cell culture to modeling in animals, the Cancer Biology program trains students in the study of the various processes associated with cancer biogenesis. At the completion of their training students will be able to design and conduct hypothesis-driven research using state-of-the-art techniques. Students will be able to critically interpret the scientific literature and use effective written and oral communication to present their scientific discoveries.

### Faculty

The Cancer Biology program has a diverse membership including over 10 different departments on the Emory campus, both basic science and clinical. The faculty have a common research interest in cancer, but apply a variety of disciplines including virology, molecular biology, biochemistry, genetics, immunology and cell biology to understand the mechanisms of cancer formation and malignant progression, from basic principles to the development of novel experimental therapeutics.

CREATE NEW KNOWLEDGE

Most of the CB faculty have dual appointments and actively participate in other Graduate Division of Biological and Biomedical Sciences (GDBBS) graduate programs, including Genetics and Molecular Biology (GMB), Immunology and Molecular Pathogenesis (IMP), Biochemistry, Cell and Developmental Biology (BCDB), Microbiology and Molecular Genetics (MMG) among others. Such dual appointments enhance the opportunity for collaboration and increase the exposure of students to different aspects of cancer biology and medicine. A number of our faculty are practicing physicians and many studies utilize patient-derived samples.

CB faculty are outstanding scientists with national and international stature in their fields and a strong track record with the National Cancer Institute, American Cancer Society and other cancer-related funding sources. Our faculty is actively involved in team science and these collaborations are supported by center grants and program projects from the NIH. A complete list of faculty members, with descriptions of research interests and links to publications, is on our website, [www.biomed.emory.edu/PROGRAM\\_SITES/CB](http://www.biomed.emory.edu/PROGRAM_SITES/CB).

Most faculty belong to the Winship Cancer Institute of Emory University, an NCI designated Cancer Center (<http://winshipcancer.emory.edu/>). Many cancer laboratories are located within open spaces that foster a highly collaborative environment among investigators. Since the Winship Cancer Institute's scientific focus groups and the GDBBS programs are both interdisciplinary and interdepartmental, collaborations among investigators from various departments and research areas give both faculty and students the opportunity to explore diverse areas of biomedical research. The innovative research conducted by these programs is shared at weekly seminars and annual symposia. An active invited speaker program further fosters scientific exchange and collaborations at these venues.

## Students

Emory's graduate program in cancer biology accepted its first class in 2011 and currently has 15 graduate students. This group of students were recruited nationally and display both academic and personal diversity. The CB 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 CB admissions coordinator. All students offered admission receive stipend support, a tuition scholarship and health insurance. Additionally, a number of external and internal special fellowships are available for top applicants and three of our current students hold such prestigious fellowships. The program and GDBBS also recognize meritorious students with awards for their academic and research performance at an annual celebration. Our website is updated quarterly and features profiles of our current students and the faculty with whom they are performing their research.

## Research areas

The CB doctoral program provides outstanding training in three main research areas.

### Cancer Genetics and Genomics

Research in this area focuses on genetic and epigenetic alterations that ultimately result in cancer initiation and progression. This includes the study of DNA damage managing systems, including DNA repair, and DNA damage recognition. DNA damage includes damage induced by mutagens, as well as chromosome instability and aneuploidy triggered

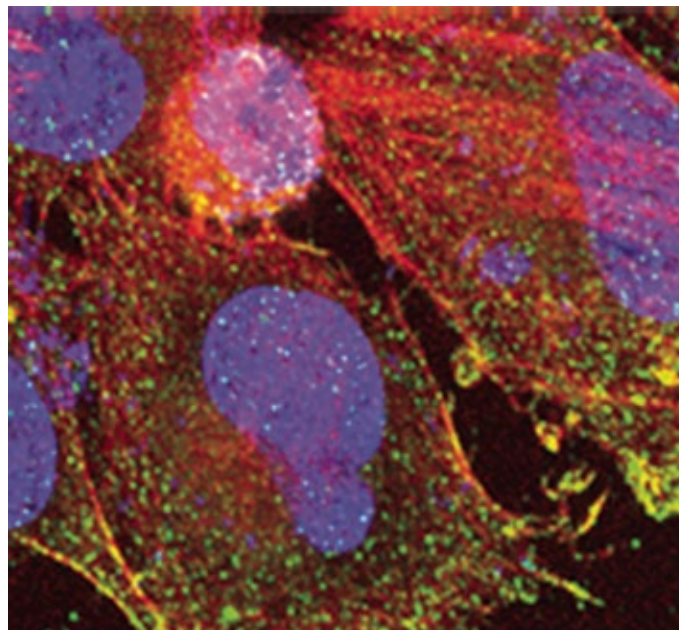


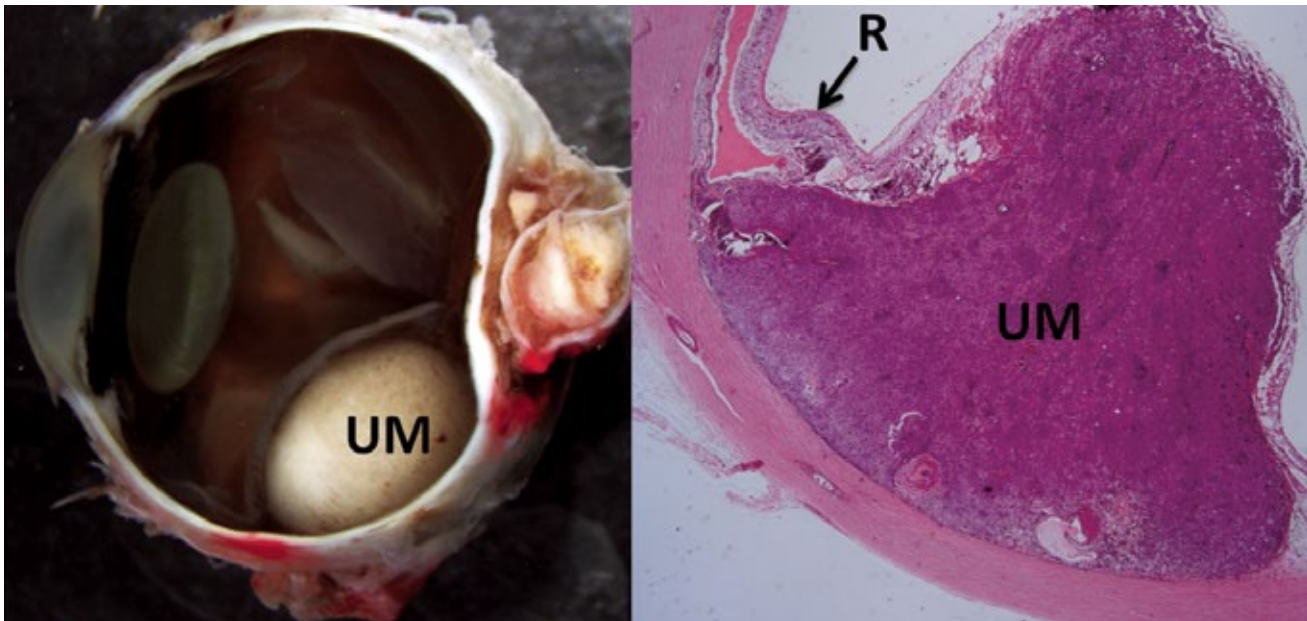
Image of migrating lung cancer cells stained by immunofluorescence for actin (red), nucleus (blue), and a tumor suppressor (green).



by oncogenes and tumor suppressors. The epigenetics components of this research include transcription factors, DNA methylation, and chromatin modifications leading to dysregulated transcription, an important component of tumor biogenesis. Complementary investigations use cancer genomics, in which the changes in gene expression, DNA methylation, mutations, amplifications, and deletions are examined on a global scale to understand the mechanisms of cancer initiation and progression.

### Cancer Signal Transduction

Research in this area concentrates on the signaling events by which cancer cells establish themselves in the host organism and form neoplastic tissue. The biological mechanisms by which cancer cells proliferate, overcome apoptosis, develop self-sufficiency from growth factors, evade the immune system, become invasive and metastatic, and induce tumor vasculature are studied along with other hallmarks of cancer.



Enucleated eye contains a uveal melanoma (UM) growing beneath the retina (R). Ongoing research in cancer biology is studying the mechanism of uveal melanoma spread from the eye to the Liver. Left, gross dissection; right, histological section.

### Cancer Therapeutics

Research in this area utilizes the knowledge acquired from the study of cancer formation to develop novel therapeutics. Our research teams interrogate diverse molecular targets to discover various anti-cancer drugs, and test those drugs in animal models with the goal of establishing clinical trials. Research approaches include signaling pathway investigation, medicinal chemistry, natural product manipulation, pharmacology, high throughput screening technology for small molecular discovery, biomarker-driven clinical trial design, pathology, and biostatistical evaluation.

A number of CB faculty member research projects extend across several of these areas, providing students with ample opportunities for exceptional interdisciplinary training. Particular strengths in organ-specific cancer research are found in breast, lung, prostate, head and neck cancer, brain tumors, hematopoietic malignancies and many others.

### Resources and opportunities

The Winship Cancer Institute of Emory University, a National Cancer Institute designated Cancer Center, is a great resource for graduate students in the graduate program in Cancer Biology. The Institute hosts weekly seminars in which Emory faculty and leaders in cancer research from various institutions present their novel findings. The Institute also sponsors a yearly scientific symposium in which various research focus groups sponsor scientists of international stature. An important component of the symposium is a career development workshop. There is a weekly Elkin Cancer Biology lecture series hosting scientists from around the country, and members within the Institute also host the annual Jean Sindab Triple Negative Breast Cancer Symposium. Additional cancer-related seminars are presented on a weekly basis throughout the School of Medicine, the various GDBBS programs, and departments at Emory University. CB faculty members are well-funded by several agencies, including the Georgia Cancer Coalition, American Cancer Society, the Leukemia and Lymphoma Society, NASA, the Department of Defense, the Komen Foundation,

and NIH grants, including R01s, P01s and SP0RE grants. Faculty actively publish in major journals in cancer biology. The Institute also has several on site shared resource laboratories to facilitate research, including cores in biostatistics and bioinformatics, imaging, cancer genomics, pathology, and tissue banking. In addition, the Institute actively participates in drug development and clinical trials, facilitating bench to bedside translation.

### Curriculum

During their first year, students will rotate through at least three independent laboratories. Those rotations allow students to acquire experimental knowledge in various disciplines addressing cancer biology. At the end of these rotations, students select a laboratory for their dissertation research. Required courses are typically completed by the second year. Courses include Basic Biological and Biomedical Sciences, Introductory Graduate Seminar, Values in Science & Bioethics, Cancer Biology, Advanced Graduate Seminar, Hypothesis Design and Grant Writing, Cancer Pharmacology, Advanced Graduate Research, Cancer Clinical Colloquium. Elective courses include Eukaryotic Chromosome Organization/Function, Human Genetics, Bioinformatics, Population Biology and Evolution of Disease, Genetic Epidemiology, and the Certificate Program in Translational Research.

### Teaching

Because teaching is an integral part of academic research, all Emory students are required to be involved in 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.

## 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. Emory was also ranked as having the sixth most beautiful campus in the nation by *The Best Colleges*.

The Graduate Division of Biological and Biomedical Sciences (GDBBS) has over 460 graduate students in nine 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
- 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:

- 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 a competitive stipend (\$28,000 for the 2012 – 2013 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 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.**

## Laney Graduate School Degree Programs

Anthropology  
 Art History  
 Behavioral Sciences and Health Education  
 Bioethics  
 Biological and Biomedical Sciences  
 Biochemistry, Cell and Developmental Biology  
 Cancer 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  
 Biomedical Engineering  
 Biostatistics  
 Business  
 Chemistry  
 Clinical Psychology  
 Cognition and Development (Psychology)  
 Comparative Literature  
 Computer Science and Informatics  
 Development Practice  
 Economics  
 Educational Studies  
 English  
 Environmental Health Sciences  
 Epidemiology  
 Film Studies  
 French  
 History  
 Graduate Institute of the Liberal Arts  
 Health Services Research and Health Policy  
 Islamic Civilizations Studies  
 Mathematics  
 MD/PhD  
 Music  
 Neuroscience and Animal Behavior (Psychology)  
 Nursing  
 Philosophy  
 Physics  
 Political Science  
 Religion  
 Sociology  
 Spanish  
 Women's, Gender, and Sexuality Studies



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