

# CELL AND MOLECULAR BIOLOGY: GENE THERAPY AND VACCINES, PHD

## Cell and Molecular Biology

The Cell and Molecular Biology Graduate Group (CAMB) is an interdisciplinary graduate program, providing rigorous training in modern cell and molecular biology, preparing students for leadership careers in biomedical research. Within this integrated program are six discipline areas: Cancer Biology (<http://catalog.upenn.edu/graduate/programs/cell-molecular-biology-cancer-biology-phd>); Cell Biology, Physiology, and Metabolism (<http://catalog.upenn.edu/graduate/programs/cell-molecular-biology-cell-biology-physiology-metabolism-phd>); Developmental, Stem Cell and Regenerative Biology (<http://catalog.upenn.edu/graduate/programs/cell-molecular-biology-developmental-stem-cell-regenerative-biology-phd>); Gene Therapy and Vaccines (p. 1); Genetics and Epigenetics (<http://catalog.upenn.edu/graduate/programs/cell-molecular-biology-genetics-epigenetics-phd>); and Microbiology, Virology and Parasitology (<http://catalog.upenn.edu/graduate/programs/cell-molecular-biology-microbiology-virology-parasitology-phd>). Program faculty include more than 300 scientists representing 35 departments from the Perelman School of Medicine, the Schools of Arts and Sciences, Dental Medicine, and Veterinary Medicine, Children's Hospital of Philadelphia, the Wistar Institute and Fox Chase Cancer Center. The research efforts of these scientists are diverse in their focus, experimental system, methodology, and represent the leading edge of basic and translational biomedical science.

Students from colleges and universities around the nation and the world are enrolled in the program, selecting one discipline area based on their scientific interests, yet have access to the full breadth of curricular and research opportunities provided by this large and diverse program. Our students participate in core courses in cell and molecular biology, specialized coursework in one or more discipline areas, and original hypothesis-driven thesis research. Upon completion of the PhD, they pursue successful research careers at top academic institutions, in the biotech and pharmaceutical industries, and in other biomedicine-related career paths.

For more information: <http://www.med.upenn.edu/camb/>

## Gene Therapy and Vaccines

The Gene Therapy and Vaccines Program focuses on the use of animal and human gene transfer for therapeutic purposes and for vaccination. Program faculty conduct research in basic cell biology, molecular biology, developmental biology, molecular physiology, virology and immunology. While the goals of the research are disease-based with the objective of developing prophylactic and therapeutic applications, student training focuses on a basic understanding of disease pathobiology and achieving efficient and effective gene transfer in humans. Students contribute to research of cystic fibrosis, hemophilia, lysosomal storage disease, inherited blindness, cancer, cardiovascular diseases, and immunologic and infectious diseases. Study of vaccines for prophylactic, as well as therapeutic applications are emphasized. Students participate in month research seminar series, as well as present in a bi-weekly research in progress seminar.

For more information: <https://www.med.upenn.edu/camb/gtv.shtml>

View the University's Academic Requirements for PhD Degrees (<http://catalog.upenn.edu/pennbook/academic-rules-phd>).

## Required Courses

Code	Title	Course Units
<b>Coursework</b>		
BIOM 555	Regulation of the Genome	
BIOM 600	Cell Biology	
BIOM 611	Statistics in Experimental Design and Analysis <sup>1</sup>	
CAMB 605	CAMB First Year Seminar	
CAMB 610	Molecular Basis of Gene Therapy and Genome Editing	
CAMB 510	Immunology for CAMB	
or IMUN 506	Immune Mechanisms	
Select one program elective		
Select three electives		
<b>Research</b>		
CAMB 699	Lab Rotation	
CAMB 899	Pre-dissertation Research	
CAMB 995	Dissertation	

<sup>1</sup> Or other statistics course with approval of the Graduate Group.

The degree and major requirements displayed are intended as a guide for students entering in the Fall of 2018 and later. Students should consult with their academic program regarding final certifications and requirements for graduation.

## Sample Plan of Study

Code	Title	Course Units
<b>Year 1</b>		
<i>Fall</i>		
BIOM 600	Cell Biology	
CAMB 605	CAMB First Year Seminar	
CAMB 610	Molecular Basis of Gene Therapy and Genome Editing	
CAMB 699	Lab Rotation	
<i>Spring</i>		
BIOM 555	Regulation of the Genome	
BIOM 611	Statistics in Experimental Design and Analysis	
CAMB 510	Immunology for CAMB	
or IMUN 506	Immune Mechanisms	
CAMB 699	Lab Rotation	
CAMB 699	Lab Rotation	
<i>Summer</i>		
CAMB 899	Pre-dissertation Research	
<b>Year 2</b>		
<i>Fall</i>		
CAMB 899	Pre-dissertation Research	
Program elective		

Additional elective

*Spring*

CAMB 695 Scientific Writing

CAMB 899 Pre-dissertation Research

Elective

Elective

**Year 3 and Beyond**

CAMB 995 Dissertation