

# 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 (<https://upenn-curr.courseleaf.com/graduate/programs/cell-molecular-biology-cancer-biology-phd/>); Cell Biology, Physiology, and Metabolism (<https://upenn-curr.courseleaf.com/graduate/programs/cell-molecular-biology-cell-biology-physiology-metabolism-phd/>); Developmental, Stem Cell and Regenerative Biology (<https://upenn-curr.courseleaf.com/graduate/programs/cell-molecular-biology-developmental-stem-cell-regenerative-biology-phd/>); Gene Therapy and Vaccines (<https://upenn-curr.courseleaf.com/graduate/programs/cell-molecular-biology-gene-therapy-vaccines-phd/>); Genetics and Epigenetics (<https://upenn-curr.courseleaf.com/graduate/programs/cell-molecular-biology-genetics-epigenetics-phd/>); and Microbiology, Virology and Parasitology (<https://upenn-curr.courseleaf.com/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> (<https://www.med.upenn.edu/camb/gtv.shtml/>)

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

## Required Courses

| Code                        | Title                                  | Course Units |
|-----------------------------|--|--------------|
| <b>Coursework</b>           |  |              |
| BIOM 5550                   | Regulation of the Genome               |              |
| BIOM 6000                   | Cell Biology                           |              |
| BIOM 6100                   | Foundations in Statistics <sup>1</sup> |              |
| CAMB 6050                   | CAMB First Year Seminar                |              |
| CAMB 6100                   | Molecular Basis of Genetic Therapies   |              |
| CAMB 5100                   | Immunology for CAMB                    |              |
|                             | or IMUN 5060 Immune Mechanisms         |              |
| Select one program elective |  |              |
| Select three electives      |  |              |
| <b>Research</b>             |  |              |
| CAMB 6990                   | Lab Rotation                           |              |
| CAMB 8990                   | Pre-Dissertation Lab Rot               |              |
| CAMB 9950                   | 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 2023 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 6000     | Cell Biology                         |              |
| CAMB 6050     | CAMB First Year Seminar              |              |
| CAMB 6100     | Molecular Basis of Genetic Therapies |              |
| CAMB 6990     | Lab Rotation                         |              |
| <i>Spring</i> |                                      |              |
| BIOM 5550     | Regulation of the Genome             |              |
| BIOM 6100     | Foundations in Statistics            |              |
| CAMB 5100     | Immunology for CAMB                  |              |
|               | or IMUN 506 Immune Mechanisms        |              |
| CAMB 6990     | Lab Rotation                         |              |
| CAMB 6990     | Lab Rotation                         |              |
| <i>Summer</i> |                                      |              |
| CAMB 8990     | Pre-Dissertation Lab Rot             |              |
| <b>Year 2</b> |                                      |              |

*Fall*

CAMB 8990 Pre-Dissertation Lab Rot

Program elective

Additional elective

*Spring*

CAMB 6950 Scientific Writing

CAMB 8990 Pre-Dissertation Lab Rot

Elective

Elective

**Year 3 and Beyond**

CAMB 9950 Dissertation