Genomics and computational biology are now at the center of biomedical research. These disciplines take a holistic approach to ask about the origins, functions, and interactions of whole systems, using both experimental and theoretical work. Therefore, these studies require knowledge, skills, and, most importantly, synthesis and integration of biology, computer science, mathematics, statistics, and engineering.

This synthesis and integration requires a new generation of scientists that thrives in cross-disciplinary research. This can include molecular, cellular, and organismal biology (including genetics), mathematics, statistics, chemistry, and engineering. The goal of the GCB program is to train students that are experts in one or more of these disciplines and well versed in the others. We provide a comprehensive training program in Genomics and Computational Biology that gives students a broad foundation in the biological and quantitative sciences along with practical experience in computational and experimental genomics. The knowledge gained in this program will serve students in their careers as technology progresses.

For more information: https://www.med.upenn.edu/gcb/

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

### Required Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Course Units</th>
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<tbody>
<tr>
<td>GCB 5330</td>
<td>Statistics for Genomics and Biomedical Informatics</td>
<td></td>
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<tr>
<td>GCB 5340</td>
<td>Experimental Genome Science</td>
<td></td>
</tr>
<tr>
<td>GCB 5360</td>
<td>Fundamentals of Computational Biology</td>
<td></td>
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<tr>
<td>GCB 6990</td>
<td>Lab Rotation</td>
<td></td>
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<tr>
<td></td>
<td>Biology course (BIOM 5550 or CAMB 5500)</td>
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<td></td>
<td>Approach elective</td>
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<td></td>
<td>Biological Specialty elective</td>
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<tr>
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<td>Select three additional electives</td>
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<tr>
<td>CIS 5200</td>
<td>Machine Learning</td>
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### Year 1

#### Fall
- GCB 5330  Statistics for Genomics and Biomedical Informatics
- GCB 5340  Experimental Genome Science
- GCB 5360  Fundamentals of Computational Biology
- GCB 6990  Lab Rotation

#### Spring
- Biology course (BIOM 5550 or CAMB 5500)
- Elective
- Elective

#### Summer
- GCB 6990  Lab Rotation

### Year 2

#### Fall
- CIS 5190  Applied Machine Learning
- GCB 8990  Pre-Dissertation Research
- CIS 5200  Machine Learning
- Elective

#### Spring
- GCB 8990  Pre-Dissertation Research
- Elective
- Elective

### Year 3 and Beyond

- GCB 9950  Dissertation

The degree and major requirements displayed are intended as a guide for students entering in the Fall of 2022 and later. Students should consult with their academic program regarding final certifications and requirements for graduation.