Biophysics

Biophysics is a quantitative science that requires a significant level of competence in physics, chemistry, mathematics, and biology. These areas therefore form the required background coursework for this program, and serve as a springboard to an advanced focus, developed in consultation with a concentration advisor. Advanced focus may include structure-function relations of macromolecules, biomechanics of cell cytoskeleton, biotechnology for drug and gene delivery, molecular mechanisms of membrane transport, sensory signal transduction, for examples. The program also requires a capstone research project that reflects this focus and may be drawn from collaborative research opportunities offered by faculty in biology, chemistry, or physics departments.

Additional detailed information about the field of Biophysics may be found at: [http://www.biophysics.org/AboutUs/Biophysics/tabid/517/Default.aspx](http://www.biophysics.org/AboutUs/Biophysics/tabid/517/Default.aspx).

### Standard program for the Sc.B. degree

#### Requirements

Select one of the following Series:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 0050</td>
<td>Foundations of Mechanics and Electromagnetism</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 0060</td>
<td>Foundations of Electromagnetism and Modern Physics</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 0070</td>
<td>Analytical Mechanics</td>
<td></td>
</tr>
<tr>
<td>PHYS 0160</td>
<td>Introduction to Relativity, Waves and Quantum Physics</td>
<td></td>
</tr>
<tr>
<td>PHYS 0470</td>
<td>Electricity and Magnetism</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 0330</td>
<td>Equilibrium, Rate, and Structure</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 0350</td>
<td>Organic Chemistry</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 0360</td>
<td>Organic Chemistry</td>
<td>1</td>
</tr>
</tbody>
</table>

Select one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 0400</td>
<td>Biophysical and Bioinorganic Chemistry</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 1140</td>
<td>Physical Chemistry: Quantum Chemistry</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 1530</td>
<td>Thermodynamics and Statistical Mechanics</td>
<td></td>
</tr>
<tr>
<td>PHYS 1610</td>
<td>Biological Physics</td>
<td>1</td>
</tr>
<tr>
<td>MATH 0100</td>
<td>Introductory Calculus, Part II (or equivalent)</td>
<td>1</td>
</tr>
<tr>
<td>MATH 0180</td>
<td>Intermediate Calculus (or equivalent)</td>
<td>1</td>
</tr>
<tr>
<td>BIOL 0200</td>
<td>The Foundation of Living Systems</td>
<td>1</td>
</tr>
</tbody>
</table>

Select two additional biology courses chosen with approval of the concentration advisor:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 0500</td>
<td>Cell Biology</td>
<td></td>
</tr>
<tr>
<td>BIOL 1050</td>
<td>Biology of the Eukaryotic Cell</td>
<td></td>
</tr>
<tr>
<td>BIOL 1200</td>
<td>Protein Biophysics and Structure</td>
<td></td>
</tr>
<tr>
<td>BIOL 0800</td>
<td>Principles of Physiology</td>
<td></td>
</tr>
<tr>
<td>BIOL 1100</td>
<td>Cell Physiology and Biophysics</td>
<td></td>
</tr>
<tr>
<td>BIOL 1190</td>
<td>Synaptic Transmission and Plasticity</td>
<td></td>
</tr>
<tr>
<td>NEUR 1020</td>
<td>Principles of Neurobiology</td>
<td></td>
</tr>
</tbody>
</table>

#### Cell Biology

- BIOL 0500: Cell and Molecular Biology
- BIOL 1050: Biology of the Eukaryotic Cell
- BIOL 1200: Protein Biophysics and Structure

#### Physiology

- BIOL 0800: Principles of Physiology
- BIOL 1100: Cell Physiology and Biophysics
- BIOL 1190: Synaptic Transmission and Plasticity
- NEUR 1020: Principles of Neurobiology

#### Pharmacology

- BIOL 1260: Physiological Pharmacology

#### Biotechnology

- BIOL 1090: Polymer Science for Biomaterials
- BIOL 1120: Biomaterials
- BIOL 1140: Tissue Engineering

Select six additional intermediate or advanced level courses, chosen from biology (e.g., biochemistry, genetics, physiology, physics, chemistry, and/or computer sciences and mathematics). Examples include:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 0280</td>
<td>Biochemistry</td>
<td></td>
</tr>
</tbody>
</table>

#### Applied Mathematics

Select two additional intermediate or advanced level courses chosen with approval of the concentration advisor.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1230</td>
<td>Chemical Biology</td>
<td></td>
</tr>
<tr>
<td>CHEM 1450</td>
<td>Advanced Organic Chemistry</td>
<td></td>
</tr>
</tbody>
</table>

A course from the CHEM 1560 series

Directed Research: Students must take one semester (two recommended) which may be satisfied by any of the opportunities listed below:

- Directed Research in Biology (BIOL 1950/BIOL 1960), Chemistry Undergraduate Research (CHEM 0970/CHEM 0980), Physics Senior Conference Course (PHYS 1990), or Independent study course in a related discipline (i.e. STEM disciplines, ENVS, PHP, etc.) if the project is relevant to the student’s learning goals in the concentration.

A summer research experience equivalent in scope and scale to work the student would pursue in an independent study course. Examples include UTRAs, LINK awards, approved research programs at other institutions, etc. These experiences do not count as a course in total course requirement, but they can be used to satisfy the one semester of the research requirement. Advisors will work with students to review these experiences - drawing on a range of potential materials including a written summary of the experience, formal work plans, materials produced (i.e. presentations/papers), and in some cases a letter from the supporting advisor.

The following COEX courses: BIOL 0190R, BIOL 0190S, BIOL 0285, BIOL 0440, BIOL 0600, BIOL 0940G, BIOL 1515, BIOL 1555; NEUR 1630, or CLPS 1195. New COEX courses will be considered as they are developed and offered at Brown, and as relevant to the concentration.

Other equivalent opportunities not listed - with approval from the concentration advisor and Dean Smith

### Total Credits

19