Biochemistry & Molecular Biology

How does life work at the molecular level? This question is at the core of the concentration program Biochemistry and Molecular Biology. In earlier years of this discipline, the focus was on structure and function of proteins, nucleic acids, lipids, carbohydrates and small molecules such as vitamins. Today the logical approach and tools of biochemical science are being expanded to new areas in neuroscience, developmental biology, immunology, pharmacology and synthetic biology (the design of analogs of biological systems). Training in biochemistry begins with a foundation in mathematics, physics, chemistry and biology. Some courses offered in other departments, including engineering, geology and computer science, are also useful. A key component of this program is the year of hands-on research carried out in collaboration with a faculty member here at Brown. Faculty sponsors are drawn from both the Chemistry Department and the Division of Biology and Medicine, and include basic science and clinical faculty.

Standard program for the Sc.B. degree

Students must take twenty courses in biology, chemistry, mathematics, and physics, including the following core requirements, some of which may be fulfilled with AP credits. Students are expected to take courses that will count toward the concentration ABC/NC. Students should discuss the S/NC option with their concentration advisor if circumstances warrant consideration. Students should not register S/NC for a concentration course without advisor pre-approval.

Three courses in mathematics, statistics and/or computer science, typically including MATH 0090, MATH 0100, or equivalent:

- Two courses in physics, typically:
  - PHYS 0030 Basic Physics A
  - PHYS 0050 Foundations of Mechanics
  - PHYS 0040 Basic Physics B
  - PHYS 0060 Foundations of Electromagnetism and Modern Physics
  - ENGN 0030 Introduction to Engineering
  - ENGN 0040 Dynamics and Vibrations

Three courses in physical and organic chemistry:

- CHEM 0330 Equilibrium, Rate, and Structure
- CHEM 0350/0360 Organic Chemistry

One course in biophysical or related chemistry:

- CHEM 0500 Inorganic Chemistry
- GEOL 1660 Instrumental Analysis with Environmental Applications

Four courses in biochemistry:

- BIOL 0280 Biochemistry
- BIOL 0285 Inquiry in Biochemistry: From Gene to Protein Function
- BIOL 1270 Advanced Biochemistry
- BIOL 1290 Cancer Biology (2)
- CHEM 1230 Chemical Biology
- CHEM 1240 Biochemistry
- CHEM 1280 Computational Molecular Biology
- CHEM 1450 Advanced Organic Chemistry

Plus two of three upper level biochemistry courses:

- BIOL 0290/0291 Advanced Biochemistry
- BIOL 1270 Advanced Biochemistry
- CHEM 1250 Advanced Biochemistry
- CHEM 1260 Advanced Biochemistry
- CHEM 1280 Computational Molecular Biology
- CHEM 1450 Advanced Organic Chemistry

Select two semester courses of independent research approved by a concentration advisor:

- BIOL 1590/1600 Directed Research/Independent Study
- CHEM 0970/0980 Undergraduate Research

Suggested Elective Courses:

Students are required to take five courses from the chart below or, with approval from a concentration advisor, from any science or mathematics course relevant to biochemistry, cell and molecular biology.

Biology Electives:

- BIOL 0200 The Foundation of Living Systems
- BIOL 0380 The Ecology and Evolution of Infectious Disease
- BIOL 0415 Microbes in the Environment
- BIOL 0470 Genetics
- BIOL 0500 Cell and Molecular Biology
- BIOL 0530 Principles of Immunology
- BIOL 0800 Principles of Physiology
- BIOL 1050 Biology of the Eukaryotic Cell
- BIOL 1090 Polymer Science for Biomaterials
- BIOL 1100 Cell Physiology and Biophysics
- BIOL 1110 Topics in Signal Transduction
- BIOL 1200 Protein Biophysics and Structure
- BIOL 1210 Synthetic Biological Systems
- BIOL 1260 Physiological Pharmacology
- BIOL 1290 Cancer Biology
- BIOL 1310 Developmental Biology
- BIOL 1330 Biology of Reproduction
- BIOL 1520 Innate Immunity
- BIOL 1540 Molecular Genetics
- BIOL 1560 Virology
- BIOL 1600 Development of Vaccines to Infectious Diseases
- BIOL 2110 Drug and Gene Delivery

Neuroscience Electives:

- NEUR 0010 The Brain: An Introduction to Neuroscience
- NEUR 0050 Biology of Hearing
- NEUR 1020 Principles of Neurobiology
- NEUR 1040 Introduction to Neurogenetics
- NEUR 1670 Neuropharmacology and Synaptic Transmission

Chemistry Electives:

- CHEM 0500 Inorganic Chemistry
- CHEM 1140 Physical Chemistry: Quantum Chemistry
- CHEM 1150 Physical Chemistry: Thermodynamics and Statistical Mechanics
- CHEM 1220 Computational Tools in Biochemistry and Chemical Biology
- CHEM 1230 Chemical Biology
- CHEM 1240 Biochemistry
- CHEM 1450 Advanced Organic Chemistry

Computer Science Electives:

- CSCI 1810 Computational Molecular Biology

Total Credits: 20

1 Note that the mathematics and physics requirements may be satisfied by Advanced Placement credit.

2 or any NEUR course in Cell, Genetics, Molecular Biology, or Development.

Honors Requirements for Biochemistry

All ScB Biochemistry concentrators are candidates for Honors; no separate application is necessary. The requirements for Honors in Biochemistry are:
* A strong grade record in concentration courses. This means a grade point average for the concentration that is higher than 3.25.
* Two semesters of Independent Study (CHEM 0970, CHEM 0980 or equivalent. Guidelines and requirements associated with Independent Study are in the Undergraduate Concentration Handbook which can be found at the department website (http://www.brown.edu/academics/chemistry/undergraduate).
* A Thesis in a form approved by the research advisor, and recommended by the research advisor. Additional information about thesis guidelines will be provided by the Concentration Advisor in the first half of the fall semester.
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This document should contain certain fonts with restrictive licenses. For this draft, substitutions were made using less legally restrictive fonts. Specifically:

Helvetica was used instead of Arial.

The editor may contact Leepfrog for a draft with the correct fonts in place.