The Concentration in Biochemistry and Biophysics recognizes enduring trends in interdisciplinary science, by establishing in the curriculum a formal program of classroom and laboratory training at the interface between the physical, chemical and biological sciences.

LEARNING GOALS

• Identify, formulate, and solve complex problems at the interface of biology and the physical sciences using state-of-the-art equipment and techniques.

• Apply knowledge of chemistry, biology, physics and mathematics to develop a coherent understanding of biological processes and solve problems in living organisms or in vitro systems derived from biological specimens.

• Learn to search, read and interpret original scientific literature, both for research and for ongoing learning.

• Recognize enduring trends in interdisciplinary science, while navigating the program of classroom and laboratory training at the interface between the physical and biological sciences.

• (For biochemistry) study the importance of biological macromolecules at all levels of the natural sciences, including the cell, the organ, the organism, and larger ecological systems.

• Examine and analyze natural phenomena at the appropriate level(s) (molecular, cellular, organismal and/or ecological), using a variety of methods informed by evolutionary theory.

• Communicate findings (either verbally and/or via written expression) effectively and clearly to diverse audiences.

CURRICULUM

All concentrators must complete a major in biology, chemistry or physics while taking additional coursework that spans mathematics and all of these natural science disciplines. The concentration requirements provide guidance for students while allowing considerable leeway for tailoring the program to specific interests. All concentrators take a required core curriculum as well as advanced coursework that is integrated with the major program.

We describe below only the four more popular programs of study within the concentration.

Students interested in other options, such as a concentration in both biochemistry and biophysics, should consult with the faculty representatives listed above to design a course of study encompassing the required courses and any proposed substitutions. However, students may not obtain both a chemistry minor and a biochemistry concentration, or both a physics minor and a biophysics concentration.

CONCENTRATION REQUIREMENTS

Biochemistry/Biophysics Core Curriculum (required of all):

• BIOL 200 (Cell Structure and Function; full-year course).

• One semester of BIOL 300 (Laboratory in Biochemistry and Molecular Biology, cross-listed as CHEM 300) or BIOC 390 (Laboratory in Biochemical Research).

• CHEM 112 (Chemical Dynamics).

• One semester mathematics course numbered 118 (Calculus II) or higher.

• PHYS 105 and 106, or 101 and 102 (two semesters of Introductory Physics), or the Bryn Mawr equivalents.

If students do not take these courses at Haverford or Bryn Mawr, they must have the substitute course(s) approved for college credit by the relevant departments. Beyond this foundation, students must take the following advanced interdisciplinary coursework:

Biology Major with a Biochemistry Concentration:

Biology majors seeking a biochemistry concentration must complete the biochemistry/biophysics core curriculum (see above) as well as the following additional requirements:

• CHEM 111 or 113 or 115 (Chemical Structure and Bonding), 112 (Chemical Dynamics), 222 and 225 (Organic Chemistry).

• CHEM 304 (Statistical Thermodynamics and Kinetics) or 305 (Quantum Chemistry).

• CHEM 301 or 302 (Laboratory in Chemical Structure and Reactivity) or BIOC 390
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(Laboratory in Biochemical Research).

- Two half-semester advanced courses with significant biochemistry content: CHEM 351 (Bioinorganic Chemistry), 352 (Topics in Biophysical Chemistry), 357 (Topics in Bioorganic Chemistry) and 359 (Topics in Protein Chemistry); majors may take topics courses multiple times with different topics.

- Two half-semester courses with significant biochemistry content: BIOL 301 (Genetics), 302 (Cell Architecture), 303 (Structure and Function of Macromolecules), 304 (Biochemistry: Metabolic Basis of Disease), 306 (Inter- and Intra-Cellular Communication), 308 (Immunology), 310 (Molecular Microbiology), 314 (Photosynthesis), 351 (Molecular Motors and Biological Nano-Machines); 354 (Molecular Virology), 357 (Topics in Protein Science). Students may use courses meeting concentration requirements for the biology major in lieu of one semester of BIOL 300.

Biology Major with a Biophysics Concentration:
Biology majors seeking a biophysics concentration must complete the biochemistry/biophysics core curriculum (see above) as well as the following additional requirements:

- MATH 121 (Calculus III) or 216 (Advanced Calculus).
- PHYS 213 (Waves and Optics), 211 (Laboratory in Electronics, Waves and Optics); half-credit course), and 301 (Advanced Laboratory in Modern Physics).
- PHYS 214 (Quantum Mechanics) or CHEM 305 (Quantum Chemistry).
- PHYS 303 (Statistical Physics) or CHEM 304 (Statistical Thermodynamics and Kinetics).
- A 300-level course in biophysics approved by the concentration coordinating committee.

- Two half-semester courses with significant Biophysics content: BIOL 301 (Advanced Genetic Analysis), 302 (Cell Architecture), 303 (Structure and Function of Macromolecules), 304 (Biochemistry: Metabolic Basis of Disease), and 306 (Inter- and Intra-Cellular Communication), 308 (Immunology), 310 (Molecular Microbiology), 314 (Photosynthesis), 351 (Molecular Motors and Biological Nano-Machines); and 357 (Topics in Protein Science). Students may use courses meeting concentration requirements for the biology major in lieu of one semester of BIOL 300.

Chemistry Major with a Biochemistry Area of Concentration:
Chemistry majors desiring a biochemistry area of concentration must complete the biochemistry/biophysics core curriculum (see above) as well as the following additional requirements:

- Two half-semester courses with significant biochemistry content: CHEM 351 (Bioinorganic Chemistry), 352 (Topics in Biophysical Chemistry), 357 (Topics in Bioorganic Chemistry) and 359: Topics in Protein Chemistry. Majors may take topics courses multiple times with different topics.

- Two half-semester courses with significant biochemistry content: BIOL 301 (Genetics), 302 (Cell Architecture), 303 (Structure and Function of Macromolecules), 304 (Biochemistry: Metabolic Basis of Disease), 306 (Inter- and Intra-Cellular Communication), 308 (Immunology), 310 (Molecular Microbiology), 314 (Photosynthesis), 351 (Molecular Motors and Biological Nano-Machines); 357 (Topics in Protein Science). Students may use courses meeting concentration requirements for the chemistry major in lieu of either CHEM 301 or 302.

Physics Major with a Biophysics Area of Concentration:
Physics majors desiring a biophysics area of concentration must complete the biochemistry/biophysics core curriculum (see above) as well as two half-semester courses with significant biophysics content:

- BIOL 301 (Genetics), 302 (Cell Architecture), 303 (Structure and Function of Macromolecules), 304 (Biochemistry: Metabolic Basis of Disease), 306 (Inter- and Intra-Cellular Communication), 308 (Immunology), 310 (Molecular Microbiology), 314 (Photosynthesis), 351 (Molecular Motors and Biological Nano-Machines); and 357 (Topics in Protein Science).

Students may use 300-level biology courses meeting concentration requirements for the physics major in lieu of one or two of the six required 300-level physics courses.
CONCENTRATION
COORDINATING COMMITTEE

Karin Åkerfeldt
Professor of Chemistry

Suzanne Amador Kane
Associate Professor of Physics

Casey Londergan
Associate Professor of Chemistry

Judith Owen
Elizabeth Ufford Green Professor of Natural Sciences and Professor of Biology

Robert Scarrow
Professor of Chemistry

Walter Smith
Professor of Physics