Biology

The Biology concentration invites students to study, in depth and in breadth, the science of life and living matter. Whether pursuing the A.B. or Sc.B. in biology, students can expect to learn broadly in the discipline through a selection of courses in three areas: cell and molecular biology, structure and function, and organismal biology. In addition, students pursuing the Sc.B. complete a thematic track through which they gain an in-depth understanding of a particular subfield (such as, Immunopathology; Ecology and Evolutionary Biology; Physiology/ Biotechnology; Cell and Molecular Biology; Physical Sciences; Marine Biology (through 2016). The concentration also emphasizes practical skills and experimental design. Concentrators are required to take at least 3 courses with a laboratory or fieldwork component. Within all of these requirements, students have a high degree of flexibility and choice. Broad research opportunities are also available across several departments within the basic sciences as well.

Standard program for the A.B. Biology

The concentration program for the A.B. in Biology consists of four prerequisite courses in math, chemistry, and a statistics course as well as ten courses in biological sciences, including at least one course in each of the following three areas: Area 1: Cell/Molecular Biology, Area 2: Structure/Function, and Area 3: Organismal Biology.

**Prerequisites:**

1. **CHEM 0330** Equilibrium, Rate, and Structure
2. **CHEM 0350** Organic Chemistry
3. **MATH 0090** Introductory Calculus, Part I (or placement. MATH 0050/MATH 0060 may be substituted for MATH 0090.)
   
   One of the following:
   1. **MATH 0100** Introductory Calculus, Part II (or placement)
   2. **MATH 0170** Advanced Placement Calculus (or equivalent placement)

   Or a statistics course, to be approved by the concentration advisor.

**Ten Core Courses:**

1. **BIOL 0200** The Foundation of Living Systems (Required course; AP credit or similar IB or A-levels accepted, placement test available.)
2. **BIOL 0280** Introductory Biochemistry
3. **BIOL 0470** Genetics
4. **BIOL 0500** Cell and Molecular Biology
5. **BIOL 0510** Introductory Microbiology
6. **BIOL 0530** Principles of Immunology
7. **BIOL 1050** Biology of the Eukaryotic Cell
8. **BIOL 1310** Developmental Biology
9. **NEUR 1020** Principles of Neurobiology

Area 1 (Cell/Molecular Biology)

- **BIOL 0280** Introductory Biochemistry
- **BIOL 0470** Genetics
- **BIOL 0500** Cell and Molecular Biology
- **BIOL 0510** Introductory Microbiology
- **BIOL 0530** Principles of Immunology
- **BIOL 1050** Biology of the Eukaryotic Cell
- **BIOL 1310** Developmental Biology
- **NEUR 1020** Principles of Neurobiology

Area 2 (Structure/Function)

- **BIOL 0400** Biological Design: Structural Architecture of Organisms
- **BIOL 0410** Invertebrate Zoology
- **BIOL 0440** Inquiry in Plant Biology: Analysis of Plant Growth, Reproduction and Adaptive Responses
- **BIOL 0800** Principles of Physiology
- **BIOL 1120** Biomaterials
- **BIOL 1310** Developmental Biology
- **BIOL 1330** Biology of Reproduction
- **BIOL 1880** Comparative Biology of the Vertebrates
- **NEUR 0010** The Brain: An Introduction to Neuroscience

Area 3 (Organismal Biology)

- **BIOL 0140K** Conservation Medicine
- **BIOL 0210** Diversity of Life
- **BIOL 0350** The Fossil Record: Life through Time on Earth
- **BIOL 0380** The Ecology and Evolution of Infectious Disease
- **BIOL 0410** Invertebrate Zoology
- **BIOL 0415** Microbes in the Environment
- **BIOL 0420** Principles of Ecology
- **BIOL 0430** The Evolution of Plant Diversity
- **BIOL 0480** Evolutionary Biology
- **BIOL 1880** Comparative Biology of the Vertebrates
- **ENVS 0490** Environmental Science in a Changing World

Six additional courses chosen from BIOL and/or NEUR offerings for concentrators. At least two at the advanced (1000-2000) level. The Core may include up to two related sciences, with advisor approval.

**Total Credits**

- **1** AP scores of 4 or above may substitute Math courses.
- **2** At least two biology and/or neuroscience courses must be at the advanced level (between 1000-2999). Exclusions: BIOL 0920 Series courses, BIOL 1070, & BIOL 1920 series courses. *Courses numbered below BIOL 0100 do not carry concentration credit. At least three of the Biology and/or Neuroscience courses must include laboratory or fieldwork. BIOL 1950/BIOL 1960, (Directed Research) may be included, but is not required. If a lab project, this can count for one of the three lab core requirements, and one advanced course.
- **3** No substitutions per above Area list. If a course is listed in more than one area, it may be used to fulfill one of those, the other must be fulfilled by a different course.
- **4** Biology courses for concentration credit include those numbered greater than 0100 with some exceptions noted within the course descriptions. Courses numbered over 3000 do not count towards Undergraduate requirements either quantity or for concentration.

**Honors:** Honors in biology requires a thesis and presentation based on a research project (conducted via BIOL 1950/BIOL 1960), and quality grades in the concentration. Guidelines and information on faculty research are available in the Office of Biology Undergraduate Education or found at [http://www.brown.edu/academics/biology/undergraduate-education/](http://www.brown.edu/academics/biology/undergraduate-education/)

Program Standard for the Sc.B. Biology

The concentration program for the Sc.B. in Biology consists of seven prerequisite courses in math, chemistry, and physics as well as thirteen to fourteen courses in biological sciences, including courses in each of the following three areas: Area 1: Cell/Molecular Biology, Area 2: Structure/Function, and Area 3: Organismal Biology, and the three-course Track. The biological sciences requirement also requires research (BIOL 1950/BIOL 1960), which should reflect the advanced cluster.

As of the 2014-15 academic year, students pursuing a ScB in Biology have the option to substitute a course for CHEM 0360 (Organic Chemistry) in their background core. For students pursuing the Marine Biology track, an upper level course in Geological Sciences may replace CHEM 0360. For students pursuing all other tracks, BIOL 0280 (Introductory Biochemistry) may serve as the replacement course. Please note that approval from the concentration advisor is required for these background course substitutions. If the student has already declared, then a revised concentration plan must be submitted and approved via the ASK system. If BIOL 0280 is used as a substitute for CHEM 0360, it cannot be counted as a core course, as a laboratory course, or as an Area 1 course. Students planning to apply to medical or graduate school should seek additional advising (such as from the Health Careers Office) in drafting their course plan.

**Prerequisites:**

1. AP scores of 4 or above may substitute Math courses.
2. At least two biology and/or neuroscience courses must be at the advanced level (between 1000-2999). Exclusions: BIOL 0920 series courses, BIOL 1070, & BIOL 1920 series courses. *Courses numbered below BIOL 0100 do not carry concentration credit. At least three of the Biology and/or Neuroscience courses must include laboratory or fieldwork. BIOL 1950/BIOL 1960, (Directed Research) may be included, but is not required. If a lab project, this can count for one of the three lab core requirements, and one advanced course.
3. No substitutions per above Area list. If a course is listed in more than one area, it may be used to fulfill one of those, the other must be fulfilled by a different course.
4. Biology courses for concentration credit include those numbered greater than 0100 with some exceptions noted within the course descriptions. Courses numbered over 3000 do not count towards Undergraduate requirements either quantity or for concentration.

**Honors:** Honors in biology requires a thesis and presentation based on a research project (conducted via BIOL 1950/BIOL 1960), and quality grades in the concentration. Guidelines and information on faculty research are available in the Office of Biology Undergraduate Education or found at [http://www.brown.edu/academics/biology/undergraduate-education/](http://www.brown.edu/academics/biology/undergraduate-education/).
Biology

MATH 0090  Introductory Calculus, Part I (or placement. MATH 0050/MATH 0060 may be substituted for MATH 0090)
MATH 0100  Introductory Calculus, Part II
or MATH 0170  Advanced Placement Calculus
CHEM 0330  Equilibrium, Rate, and Structure (or IB credit)
CHEM 0350  Organic Chemistry
CHEM 0360  Organic Chemistry
or BIOL 0280  Introductory Biochemistry
PHYS 0030  Basic Physics (or equivalent. PHYS 0050 or ENGN 0030 may be substituted for PHYS 0030.)
PHYS 0040  Basic Physics (or equivalent. PHYS 0060 or ENGN 0040 may be substituted for PHYS 0040.)

Core Courses: 2, 3
BIOL 0200  The Foundation of Living Systems (or placement) 1

The Area requirement must be fulfilled by taking at least one course in 3 each of these groups:

Area 1 (Cell/Molecular Biology)
BIOL 0280  Introductory Biochemistry
BIOL 0470  Genetics
BIOL 0500  Cell and Molecular Biology
BIOL 0510  Introductory Microbiology
BIOL 0530  Principles of Immunology
BIOL 1050  Biology of the Eukaryotic Cell
BIOL 1310  Developmental Biology
NEUR 1020  Principles of Neurobiology

Area 2 (Structure/Function)
BIOL 0400  Biological Design: Structural Architecture of Organisms
BIOL 0410  Invertebrate Zoology
BIOL 0440  Inquiry in Plant Biology: Analysis of Plant Growth, Reproduction and Adaptive Responses
BIOL 0800  Principles of Physiology
BIOL 1120  Biomaterials
BIOL 1310  Developmental Biology
BIOL 1330  Biology of Reproduction
BIOL 1880  Comparative Biology of the Vertebrates
NEUR 0010  The Brain: An Introduction to Neuroscience

Area 3 (Organismal Biology)
BIOL 0140K  Conservation Medicine
BIOL 0210  Diversity of Life
BIOL 0350  The Fossil Record: Life through Time on Earth
BIOL 0370 - Experimental Evolution
BIOL 0410  Invertebrate Zoology
BIOL 0415  Microbes in the Environment
BIOL 0420  Principles of Ecology
BIOL 0430  The Evolution of Plant Diversity
BIOL 0480  Evolutionary Biology
BIOL 1880  Comparative Biology of the Vertebrates
ENV 0490  Environmental Science in a Changing World

Five additional courses chosen from BIOL and/or NEUR offerings for concentrators. Alternatively, students may include up to two related (non-BIOL/NEUR) sciences suitable for science concentrators. 3

RESEARCH: 5
Typically, two courses in Track is advanced level research (BIOL 1950,1960).

TRACK: 1-2

The Track consists of three additional biological sciences courses (not including BIOL 1950/1960 research) that form a Track. Tracks include: Immuno/Pathobiology; Ecology and Evolutionary Biology; Physiology and Biotechnology; Neurobiology; Physical Sciences; Marine Biology; Cell and Molecular Biology. 6

Total Credits 13-14

1 AP scores of 4 or 5 may substitute Math courses.
2 At least two biology and/or neuroscience courses numbered at the 1000 or 2000 level. EXCLUSIONS: BIOL 0920 series courses, BIOL 1070, or BIOL 1920 series courses. *Courses numbered below BIOL 0100 do not carry concentration credit. At least three of the biology and/or neuroscience courses must include laboratory or fieldwork. No substitutions per above Area lists. If a course is listed in more than one area, it may be used to fulfill one of those; the other must be fulfilled by a different course
3 Biology courses for concentration credit include those numbered greater than 0100 with some exceptions noted within the course descriptions. Courses numbered over 3000 do not count towards Undergraduate requirements either quantity or for concentration.
4 See listing at http://biology.brown.edu/bug/ for options. Related sciences must be above prerequisite level, and suitable for science concentrators.
5 If substantial research is carried out away from Brown, it must be approved by an appropriate Brown BioMed faculty member but does not carry course credit toward the Core program.
6 At least two, and preferably all three, must be above 1000-level. Courses used for the cluster, must be approved by an advisor and/or Associate Dean of Biology, Katherine Smith.

Honors: Honors in biology requires a thesis and presentation based on a research project (usually conducted via BIOL 1950/BIOL 1960), and quality grades in the concentration. Guidelines and information on faculty research are available in the Office of Biology Undergraduate Education or at http://www.brown.edu/academics/biology/undergraduate-education/.

Stipulations for Biology Programs:
1. For double concentrations, no more than two courses may overlap (i.e., be used to meet requirements of both) programs, prerequisites excepted.
2. No more than two semesters of directed research may be used as concentration credits. Each does count as an individual core towards the program, but only carry one lab credit towards the three required.
3. A limited number of transfer or study abroad courses may be used within the program, subject to approval of advisor, and Associate Dean of Biology, Katherine Smith.
4 AP scores of 4 or 5 may substitute Math courses.
5 Related sciences must be above prerequisite level, and suitable for science concentrators.