Biology (Undergraduate)

The Undergraduate Program in Biology offers courses at all levels of biological organization: molecular, cellular, organismal and population, and concentration programs with varying degrees of multidisciplinary or specialty foci.

There is a vast range of collaborative opportunities for independent study and research under the mentorship of the faculty. Faculty maintain research programs at the cutting edge of their fields including biochemistry, biophysics, cell biology, developmental biology, ecology, evolution, genetics, immunology, molecular biology, neurobiology, physiology, anatomy, artificial organs, microbiology, virology, experimental pathology, and pharmacology. The close administrative relationship with the Alpert Medical School offers additional opportunities for blending fundamental biology and clinical sciences in research projects at the Brown-affiliated hospitals.

The Office of Biology Undergraduate Education is a full service academic resource center, serving a key role for students of the life sciences here. The Office provides individualized advising for students at all levels; oversees student- faculty research collaborations, holds special events and maintains a variety of programs that support and enrich student life.

For further information, please visit: http://www.brown.edu/academics/biology/undergraduate-education/

Biology Concentration Requirements

The Biology concentration invites students to study, in depth and in breadth, the science of life and living matter. Whether pursuing the Bachelor of Arts (A.B.) or Science (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. 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.

The Biology A.B. Concentration Worksheet (https://bue.brown.edu/concentrations/biology-ab/) may be a useful tool for course planning.

Prerequisites: [1]	
CHEM 0330	Equilibrium, Rate, and Structure
CHEM 0350	Organic Chemistry I
MATH 0090	Single Variable Calculus, Part I (or placement. MATH 0050/MATH 0060 may be substituted for MATH 0090.)
One of the following:	
MATH 0100	Single Variable Calculus, Part II (or placement)
MATH 0170	Single Variable Calculus, Part II (Accelerated) (or equivalent placement)
Or a statistics course, to be approved by the concentration advisor.	
Ten Core Courses: [2,3,4]	
BIOL 0200	The Foundation of Living Systems (Required course; AP credit or similar IB or A-levels accepted, placement test available.) 1
Area 1 (Cell/Molecular Biology)	**1**
BIOL 0280	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
BIOL 1515	Conservation in the Genomics Age
BIOL 1810	21st Century Applications in Cell and Molecular Biology
BIOL 1865	Toxicology
NEUR 1020	Principles of Neurobiology
Area 2 (Structure/Function)	**1**
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 1155	Hormones and Behavior
BIOL 1310	Developmental Biology
BIOL 1330	Biology of Reproduction
BIOL 1505	Environmental Physiology
BIOL 1865	Toxicology
BIOL 1885	Human Anatomy and Biomechanics
NEUR 0010	The Brain: An Introduction to Neuroscience
Area 3 (Organismal Biology)	**1**
BIOL 0210	Diversity of Life
BIOL 0380	The Ecology and Evolution of Infectious Disease
BIOL 0410	Invertebrate Zoology
BIOL 0420	Principles of Ecology
BIOL 0430	The Evolution of Plant Diversity
BIOL 0450	Evolutionary Behavioral Ecology
BIOL 0480	Evolutionary Biology
BIOL 1480	Terrestrial Biogeochemistry and the Functioning of Ecosystems
BIOL 1515	Conservation in the Genomics Age
ENVS 0490	Environmental Science in a Changing World
Six additional courses chosen from BIOL and/or NEUR offerings for concentrators. The Core may include up to two related sciences, with advisor approval. The Core must also include a Senior Capstone.	6
SENIOR CAPSTONE: *Only apples to students who have declared in Fall 2019 or later.* To be fulfilled via ONE of the following:	
1. One of the following approved courses: BIOL 1100, 1140, 1150, 1250, 1330, 1515, 1525, 1535, 1555, 1575, 1600, 1820, 1970A.	
2. One semester of independent research/independent study (BIOL 1950 or BIOL 1960).	
Please visit the BUE webpage for more information.	
Total Credits	**10**

[1] AP scores of 4 or 5 may substitute Math courses.

[2] Biology courses for concentration credit include those numbered between 0100 - 2999.

[3] At least two biology and/or neuroscience courses must be at the advanced level (between 1000-2999). Senior Capstone can be used towards one advanced requirement or one lab requirement. 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, a semester can count for one of the three lab course requirements.

[4] No substitutions per above Area list. If a course is listed in more than one area, it may be used to fulfill one area only; the other area must be fulfilled by a different course.

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/.

Standard Program 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 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.

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 all 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 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 crafting their course plan.

The Biology Sc.B. Concentration Worksheet (https://bue.brown.edu/concentrations/biology-scb/) may be a useful tool for course planning.

Prerequisites: [1]		
MATH 0090	Single Variable Calculus, Part I (or placement. MATH 0050/MATH 0060 may be substituted for MATH 0090)	
One of the following:		
MATH 0100	Single Variable Calculus, Part II (or placement)	
or MATH 0170	Single Variable Calculus, Part II (Accelerated)	
or a statistics course to be approved by the concentration advisor		
Each of the following:		
CHEM 0330	Equilibrium, Rate, and Structure (or IB credit)	
CHEM 0350	Organic Chemistry I	
CHEM 0360	Organic Chemistry II	
or BIOL 0280	Biochemistry	
PHYS 0030	Basic Physics A (or equivalent. PHYS 0050 PHYS 0070, or ENGN 0040 may be substituted for PHYS 0030.)	
PHYS 0040	Basic Physics B (or equivalent. PHYS 0060 or ENGN 0510 may be substituted for PHYS 0040.)	
Core Courses: [2,3,4]		
BIOL 0200	The Foundation of Living Systems (or placement)	1
Area 1 (Cell/Molecular Biology)		**1**
BIOL 0280	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	
BIOL 1515	Conservation in the Genomics Age	
BIOL 1810	21st Century Applications in Cell and Molecular Biology	
BIOL 1865	Toxicology	
NEUR 1020	Principles of Neurobiology	
Area 2 (Structure/Function)		**1**
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 1155	Hormones and Behavior	
BIOL 1310	Developmental Biology	
BIOL 1330	Biology of Reproduction	
BIOL 1505	Environmental Physiology	
BIOL 1865	Toxicology	
BIOL 1885	Human Anatomy and Biomechanics	
NEUR 0010	The Brain: An Introduction to Neuroscience	
Area 3 (Organismal Biology)		**1**
BIOL 0210	Diversity of Life	
BIOL 0380	The Ecology and Evolution of Infectious Disease	
BIOL 0410	Invertebrate Zoology	
BIOL 0420	Principles of Ecology	
BIOL 0430	The Evolution of Plant Diversity	
BIOL 0450	Evolutionary Behavioral Ecology	
BIOL 0480	Evolutionary Biology	
BIOL 1480	Terrestrial Biogeochemistry and the Functioning of Ecosystems	
BIOL 1515	Conservation in the Genomics Age	
ENVS 0490	Environmental Science in a Changing World	
Six additional courses chosen from BIOL and/or NEUR offerings for concentrators. The Core may include up to two related sciences, with advisor approval. The Core must also include research. [4]		6
RESEARCH:		
The two semester research requirement may be satisfied by any two of the opportunities listed below. Students may find the following resources useful in planning for research: the annual BUE-PLME Finding, Securing and Succeeding in Research workshop, the BUE Research webpage, and the Sheridan Center's Undergraduate Research & Experiential Opportunities webpage. Following conversation and agreement with the advisor, students articulate the research plan in the ASK declaration (in the designated text box) which is submitted for review and approval by the advisor.		
Choose two:		
BIOL 1950	Directed Research/Independent Study	
BIOL 1960	Directed Research/Independent Study	
NEUR 1970	Independent Study	

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 and interests in the concentration.	
A summer research experience equivalent in scope and scale to work the student would pursue in a Biology independent study course. Examples include UTRAs, LINK awards, approved research programs at other institutions, etc. These experiences do not count as a course in the 10 course core 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.	
Other equivalent opportunities not listed - with approval from the concentration advisor and Dean Achilli.	
Students are encouraged to pursue research related to their track	
TRACK:	
The advanced thematic track consists of three additional biological sciences courses (not including BIOL 1950/1960 research) that form a Track. Tracks include: Immuno/ Pathobiology; Ecology, Evolution and Organismal Biology; Physiology and Biotechnology; Neurobiology; Physical Sciences; Cell and Molecular Biology; Biomedical Informatics. At least two track courses, and preferably all three, must be above 1000-level. Track courses should form a cohesive grouping approved by the concentration advisor.	3
Total Credits	**13**

1 AP scores of 4 or 5 may substitute Math courses.

2 Biology courses for concentration credit include those numbered between 0100-2999.

3 At least two biology and/or neuroscience courses must be at the advanced level (between 1000-2999). At least three of the biology and/ or neuroscience courses must include laboratory or fieldwork. BIOL 1950/ BIOL 1960 can count for one of the three lab course requirements and one advanced course.

4 No substitutions per above Area list. If a course is listed in more than one area, it may be used to fulfill one area only; the other area must be fulfilled by a different course.

Tracks

Biomedical Informatics - BIOL 1535 is required for this track along with 2 additional courses from the following (Additional advanced courses will be considered w/ advisor approval):

BIOL 1555	Methods in Informatics and Data Science for Health
BIOL 1575	Evaluation of Health Information Systems
BIOL 1595	Artificial Intelligence in Health Care

Cell and Molecular Biology

Three courses, for example:	
BIOL 1050	Biology of the Eukaryotic Cell
BIOL 1222A	Current Topics in Functional Genomics
BIOL 1270	Advanced Biochemistry
BIOL 1300	Biomolecular Interactions: Health, Disease and Drug Design
BIOL 1310	Developmental Biology
BIOL 1330	Biology of Reproduction
BIOL 1540	Molecular Genetics
BIOL 1545	Human Genetics and Genomics
BIOL 1580	Metabolism Across Biological Scales: Integrative Physiology and Pathobiology
BIOL 1810	21st Century Applications in Cell and Molecular Biology
BIOL 1820	Environmental Health and Disease
BIOL 1865	Toxicology
BIOL 1970A	Stem Cell Biology

Ecology, Evolution and Organismal Biology

Three courses, for example:	
BIOL 1430	Foundations of Population Genetics
BIOL 1435	Computational Methods for Studying Demographic History with Molecular Data
BIOL 1440	Marine Biology
BIOL 1465	Human Population Genomics
BIOL 1470	Conservation Biology
BIOL 1480	Terrestrial Biogeochemistry and the Functioning of Ecosystems
BIOL 1505	Environmental Physiology
BIOL 1515	Conservation in the Genomics Age
BIOL 1545	Human Genetics and Genomics
BIOL 1800	Animal Locomotion
BIOL 1885	Human Anatomy and Biomechanics
ENVS 1775	Biogeography

Immunobiology

Three courses, for example:	
BIOL 1250	Host-microbiome Interactions in Health and Disease
BIOL 1290	Cancer Biology
BIOL 1295	Fundamentals of Cancer Immunotherapy
BIOL 1520	Innate Immunity
BIOL 1525	Pathogenomics: Analysis, interpretation and applications of microbial genomes
BIOL 1550	Parasitism: Biology and Disease
BIOL 1560	Virology
BIOL 1600	Development of Vaccines to Infectious Diseases

Neurobiology

Three courses, for example:	
BIOL 1100	Cell Physiology and Biophysics
BIOL 1110	Topics in Signal Transduction
BIOL 1260	Physiological Pharmacology
BIOL 1650	Structure of the Nervous System
BIOL 1610	Experimental Neurobiology
NEUR listings 1000-level or above	

Physiology and Biotechnology

Three courses, for example:	
BIOL 1070	Biotechnology and Global Health
BIOL 1090	Polymer Science for Biomaterials
BIOL 1100	Cell Physiology and Biophysics
BIOL 1110	Topics in Signal Transduction
BIOL 1120	Biomaterials
BIOL 1140	Tissue Engineering
BIOL 1150	Stem Cell Engineering
BIOL 1160	Principles of Exercise Physiology
BIOL 1260	Physiological Pharmacology
BIOL 1300	Biomolecular Interactions: Health, Disease and Drug Design
BIOL 1505	Environmental Physiology

BIOL 1580	Metabolism Across Biological Scales: Integrative Physiology and Pathobiology
BIOL 1810	21st Century Applications in Cell and Molecular Biology
BIOL 1820	Environmental Health and Disease
BIOL 1865	Toxicology
BIOL 1885	Human Anatomy and Biomechanics

Physical Sciences

Must be a coherent set of three courses drawn from the Physical Sciences; courses must be above the introductory level and approved by advisor

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 concentrations) with a few specific exceptions (https://college.brown.edu/sites/g/files/dprerj916/files/2022-04/2-Course-Overlap-Exceptions-list-and-rule-for-web.docx).
2. No more than two semesters of directed research may be used as concentration credits. Each does count as an individual core course towards the program, but only carry one lab credit or one 1000-level 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, Toni-Marie Achilli.
1.

Health & Human Biology Concentration Requirements

Health and Human Biology is an interdisciplinary concentration that provides a rigorous foundation in the biological sciences with substantive course work in humanities and social sciences within a subfield of Human Health and Disease. The program includes: background courses, biology core courses, a set of theme courses, and a Senior Capstone activity. Background courses provide the essential foundations in chemistry, mathematics, methods, and basic biology. These support the Biology core, which is comprised of a flexible menu of intermediate and advanced courses. A required portion of the Biology core is Genetics, a cornerstone of human biology and its interface with other fields. The Biology core underscores the related coursework within the Health and Disease Theme.

The Theme courses are social science and humanities courses that form a cohesive, thoughtful grouping. Theme groupings must be approved by the advisor. A required senior capstone course or activity builds on the program's focus.

Program Requirements

REQUIRED BACKGROUND:

Four (4) courses including:		
MATH 0090	Single Variable Calculus, Part I (or equivalent placement)	1
OR		
MATH 0050 & MATH 0060	Analytic Geometry and Calculus and Analytic Geometry and Calculus	
OR		
MATH 0100	Single Variable Calculus, Part II	
or MATH 0170	Single Variable Calculus, Part II (Accelerated)	
CHEM 0330	Equilibrium, Rate, and Structure	1
BIOL 0200	The Foundation of Living Systems	1
Statistics or methods course chosen with advisor's help.		1

CORE PROGRAM:

In addition to the stated background in Chemistry, Math, Biology and Statistics, five (5) Biology plus four (4) coherently-grouped Theme courses, plus a Senior-Year Capstone course or project. (See description of Capstone at link below this table).		
BIOLOGY:		
Five (5) courses, including:		5
Genetics, which can be fulfilled in the following ways:		
BIOL 0470	Genetics	
-OR-		
BIOL 0480 & BIOL 0500	Evolutionary Biology and Cell and Molecular Biology	
-OR-		
BIOL 0480 & BIOL 0510	Evolutionary Biology and Introductory Microbiology	
-OR-		
BIOL 0480 & BIOL 0280	Evolutionary Biology and Biochemistry	
Select one course in structure/function/development such as:		
BIOL 0400	Biological Design: Structural Architecture of Organisms	
BIOL 0800	Principles of Physiology	
BIOL 1310	Developmental Biology	
BIOL 1800	Animal Locomotion	
NEUR 0010	The Brain: An Introduction to Neuroscience	
One course in organismal/population biology such as:		
BIOL 0380	The Ecology and Evolution of Infectious Disease	
BIOL 0410	Invertebrate Zoology	
BIOL 0420	Principles of Ecology	
BIOL 0480	Evolutionary Biology	
BIOL 1470	Conservation Biology	
BIOL 1555	Methods in Informatics and Data Science for Health	
ENVS 0490	Environmental Science in a Changing World	
Or a course from the NEUR 1940 series		
Two Biology or Neuroscience courses. At least one must be at the advanced level.		
THEME: With the advisor's assistance, a theme is chosen and a cohesive set of courses are selected from outside of Biology and Neuroscience.		**4**
No more than TWO courses from a given department may be included in the theme portion		
Students will then select from FOUR theme options: 1) Mind, Brain, Behavior, 2) Planetary Health, 3) Global Health, 4) Social Determinants of Health		
SENIOR CAPSTONE ACTIVITY: Must be conducted during the senior year, fulfilled by one of the following, and related to the students learning goals in the concentration:		**1**
1) Advisor approved senior seminar or advanced course related to the theme		
2) One semester of independent research/independent study (BIOL 1950 or BIOL 1960); in the case of a senior honors thesis, either BIOL 1950 or BIOL 1960 can be used as the capstone.		
3) An appropriate internship with a scholarly context can be used if coupled with independent study mentored by a Brown faculty member the following semester.		
Total Credits		**14**

CAPSTONE: See https://www.brown.edu/academics/biology/undergraduate-education/undergraduate/health-and-human-biology (https://www.brown.edu/academics/biology/undergraduate-education/

undergraduate/health-and-human-biology/) for more information on the Capstone Activity.

HONORS: See more information about Honors at https://www.brown.edu/academics/biology/undergraduate-education/honors-biological-sciences (https://www.brown.edu/academics/biology/undergraduate-education/honors-biological-sciences/).

Applied Mathematics-Biology Concentration Requirements

Biology, the science of all life and living matter, is an incredibly diverse discipline offering students the opportunity to learn about topics ranging from the fundamental chemical reactions that fuel all living organisms to the population dynamics of entire ecosystems all the way to the question of how our brains give rise to the complexities of human cognition and experience. Applied mathematics is an increasingly important component of modern biological investigation. Modern technologies have enabled the creation of vast new biological data sets that often require sophisticated mathematical and statistical models for interpretation and analysis. Advances in computing have similarly enabled the simulation of biological phenomena at increasingly fine levels of detail. Entire subfields, such as bioinformatics and computational neuroscience, have developed around these new paradigms of biological investigation. The foundations of these new fields are inherently mathematical, with a focus on probability, statistical inference, and systems dynamics.

The Applied Mathematics – Biology concentration allows students to develop complementary expertise in biology and applied mathematics. Students will focus their advanced biological coursework in an area of particular interest to them. The applied math requirements emphasize those areas of mathematics that have found widespread use throughout all of the biological sciences. The program culminates in a senior capstone experience that enables students to participate in creative research collaborations with faculty.

Standard program for the Sc.B. degree

Prerequisites – the equivalent of two semesters of single-variable calculus

Single-variable calculus is not an enforced requirement for our concentration, but it is a required prerequisite for many of our courses. At Brown, single-variable calculus consists of MATH 0090 followed by one of MATH 0100, MATH 0170, or MATH 0190.

Requirements – 16 courses [1]		
Mathematical Requirements – 7 courses		
MATH 0180	Multivariable Calculus [2]	1
or MATH 0200	Multivariable Calculus (Physics/Engineering)	
or MATH 0350	Multivariable Calculus With Theory	
MATH 0520	Linear Algebra [2]	1
or MATH 0540	Linear Algebra With Theory	
APMA 0355	Applied Ordinary Differential Equations with Theory [3]	1
APMA 0365	Applied Partial Differential Equations I with Theory [4]	1
APMA 1655	Introduction to Probability and Statistics with Theory [5]	1
APMA 1070	Quantitative Models of Biological Systems	1
APMA 1080	Inference in Genomics and Molecular Biology	1
or NEUR 2110	Statistical Neuroscience	
Scientific Requirements – 7 courses		
One approved course (or course grouping) covering Newtonian mechanics. [6]		1
CHEM 0330	Equilibrium, Rate, and Structure	1
BIOL 0200	The Foundation of Living Systems [7]	1
Two BIOL or NEUR courses. [8]		2
Two 1000-level or higher BIOL or NEUR courses from the same Biology track. [8,9]		2
Additional Requirements – 2 courses		
One approved course in the mathematical, biological, or computational sciences. [10]		1
One approved capstone, senior seminar, or research-related course in the mathematical or biological sciences. [11]		1
Total Credits		**16**

1. A required course may be replaced by a more advanced course with concentration advisor approval. No course may be used to satisfy multiple concentration requirements. Transfer credits and courses receiving placement credit notation can satisfy concentration credit as long as they appear on the Brown internal transcript. Pursuing honors will require 17 courses – these 16 along with two semesters of independent study courses for the honors research project, one of which can be used to satisfy the capstone concentration requirement. For students with multiple concentrations: calculus, linear algebra, one intro CSCI course, and at most two additional courses can be used for concentration credit in the other concentration(s).
2. APMA 0260 can substitute for the multivariable calculus and/or the linear algebra requirements. If it is used as a substitute for both requirements, then students must take one additional approved 1000-level APMA or MATH course not used elsewhere for concentration credit that adheres to the restrictions in footnote 5 and 9 and these additional restrictions: APMA 1910, APMA 1920, MATH 1090, MATH 1910 and research/independent study courses cannot be used.
3. MATH 1110 may be used in place of APMA 0355. If MATH 1110 is used, then the concentration must include at least three 1000-level APMA courses that adhere to the restrictions in footnote 6. These can appear anywhere in the declaration. Students matriculating prior to Fall 2025 can use APMA 0330 or APMA 0350 as a substitute for APMA 0355. Students matriculating in Fall 2025 or later who wish to use APMA 0330 or APMA 0350 must also complete the APMA 0355 online bridgework course and pass the in-person bridgework exam that is offered once per semester.
4. MATH 1120 may be used in place of APMA 0365. If MATH 1120 is used, then the concentration must include at least three 1000-level APMA courses that adhere to the restrictions in footnote 6. These can appear anywhere in the declaration. Students matriculating prior to Fall 2025 can use APMA 0340 or APMA 0360 as a substitute for APMA 0365. Students matriculating in Fall 2025 or later who wish to use APMA 0340 or APMA 0360 must also complete the APMA 0365 online bridgework course and pass the in-person bridgework exam that is offered once per semester.
5. Students matriculating prior to Fall 2025 can use APMA 1650 as a substitute for APMA 1655. Students matriculating in Fall 2025 or later who wish to use APMA 1650 must also complete the APMA 1655 online bridgework course and pass the in-person bridgework exam that is offered once per semester.
6. PHYS 0050 or PHYS 0070 are recommended. The following course(s) are automatically approved: PHYS 0030, PHYS 0050, PHYS 0070, ENGN 0040 + (one of PHYS 0040, PHYS 0060, a score of 3 or higher on any AP Physics, a score of 4 or higher on IB-HL Physics). When considering alternative course(s) a key criterion is whether both statics and dynamics are covered.
7. A BIOL placement test score of 30 or higher may be used in place of BIOL 0200. The placement test score can be found in ASK, in the advising detail view, under the test scores section. This will reduce by 1 credit the number of credits needed to complete the concentration.
8. Mixing BIOL and NEUR courses is fine. Students are encouraged to take at least one laboratory or fieldwork course.
9. The tracks (tracks, not areas) are listed at this link to the Biology Bulletin page (https://bulletin.brown.edu/the-college/concentrations/biol/) at the end of the Biology ScB requirements. The physical sciences track is not allowed. If the biomedical informatics track is used, then one of the courses must be BIOL 1565. Substitutions or the use of 2000-level courses requires approval of the Director of Undergraduate Studies in Biology.

[10] 1000-level courses in APMA, BIOL, CSCI, MATH, NEUR are automatically approved, including APMA 1910, APMA 1920. Research/independent study courses cannot be used. At most one of APMA 1910, MATH 1090, MATH 1910, at most one of APMA 1001, MATH 1000, MATH 1001, and at most one of APMA 1650, APMA 1655, CSCI 1450, MATH 1210, MATH 1610 can be used for concentration credit. Concentrators are strongly encouraged to use this requirement to develop their computer programming skills and to do so before the end of sophomore semester. Many upper-level APMA courses, including APMA 1080, require exposure to programming as a prerequisite. The following courses are automatically approved for this purpose: APMA 0160, APMA 0200, CSCI 0111, CSCI 0150, CSCI 0170, CSCI 0190, CSCI 0200, CPSY 0950 , EEPS 0250.

[11] The following options can be used to satisfy this requirement
(a) A pre-approved course that satisfies the APMA Sc.B. capstone requirement: currently APMA 1360, APMA 193*/194* (where * is any combination of numbers and letters; these are the APMA senior seminars).
(b) A pre-approved course that satisfies the Biology A.B. capstone requirement: currently BIOL 1100, BIOL 1140, BIOL 1150, BIOL 1250, BIOL 1330, BIOL 1515, BIOL 1525, BIOL 1555, BIOL 1565, BIOL 1575, BIOL 1600, BIOL 1820, BIOL 1970. Courses over the 2000 level may be used with approval of the Director of Undergraduate Studies in Biology.
(c) A directed research/independent study course from the APMA 1970/APMA 1971, BIOL 1950/BIOL 1960, or NEUR 1970 series that is used for undergraduate research. For students pursuing honors in APMA-Bio, one of the two required semesters of independent study courses can be used.
(d) A directed research/independent study course in a related discipline (i.e. STEM disciplines, ENVS, PHP, etc.) that is used for undergraduate research if the project is relevant to the student's learning goals in the concentration and with approval from the concentration advisor.
(e) An upper-level course related to the concentration (usually a 1000-level or higher APMA or BIOL course) in addition to a research experience equivalent in scope and scale to work the student would pursue in an Applied Math or Biology research-related independent study course. Examples include UTRAs, LINK awards, REUs, research programs at other institutions, the APMA Directed Reading Program, etc. This requires approval from the concentration advisor and appropriate documentation that should be uploaded to ASK.
(f) Other equivalent opportunities not listed, with approval from the concentration advisor. Documentation should be uploaded to ASK.

Professional Track

The requirements for all undergraduate professional tracks within concentrations are standardized and additional information can be found here:

https://bulletin.brown.edu/undergradproftrack/

Honors

Concentrators that demonstrate excellence in grades and in undergraduate research can be awarded departmental honors. Honors students with primary advisors in Applied Math should follow the guidelines, requirements, and deadlines for honors as described in the bulletin for Applied Math concentrators (https://bulletin.brown.edu/the-college/concentrations/apma/) and as published on the APMA departmental website (https://appliedmath.brown.edu/academics/undergraduate-program/honors/). Honors students with primary advisors in Biomed should follow the guidelines, requirements, and deadlines for honors as described in the bulletin for Biology concentrators (https://bulletin.brown.edu/the-college/concentrations/biol/) and as published on the Biology departmental website (https://bue.brown.edu/academics/honors/). Students wishing to do honors research with a non-APMA or Biomed advisor should contact the Directors of Undergraduate Studies in APMA and Biology to discuss options.

Biochemistry & Molecular Biology Concentration Requirements

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 these may be fulfilled with AP credits.

Three courses in mathematics including two courses in MATH 0090/0100 or MATH 0170/0180 with a third class in statistics, math, or computer science [1]		3
Options for statistics courses include: [1]		
APMA 0650	Introduction to Probability and Statistics	
APMA 1650	Introduction to Probability and Statistics with Calculus	
APMA 1655	Introduction to Probability and Statistics with Theory [3]	
BIOL 0495	Statistical Analysis of Biological Data	
CPSY 0900	Statistical Methods	
PHP 1501	Essentials of Data Analysis	
PHP 1510	Principles of Biostatistics and Data Analysis	
Two courses in physics, typically: [1]		2
PHYS 0030	Basic Physics A	
or PHYS 0050	Foundations of Mechanics	
or ENGN 0040	Engineering Statics and Dynamics	
PHYS 0040	Basic Physics B	
or PHYS 0060	Foundations of Electromagnetism and Modern Physics	
Three courses in physical and organic chemistry:		3
CHEM 0330	Equilibrium, Rate, and Structure	
CHEM 0350	Organic Chemistry I	
CHEM 0360	Organic Chemistry II	
One course in biophysical chemistry:		1
CHEM 0400	Biophysical and Bioinorganic Chemistry	
Four courses in biochemistry:		4
BIOL 0280	Biochemistry	
BIOL 0285	Inquiry in Biochemistry: From Gene to Protein Function	
Plus two of three upper level biochemistry courses:		
BIOL 1270	Advanced Biochemistry	
or CHEM 1230	Chemical Biology	
or CHEM 1240	Biochemistry	
The two semester research requirement may be satisfied by any two of the following. Students should discuss alternative arrangements or special situations directly with their concentration advisor to obtain prior approval.		2

Students should aim to complete this requirement in their junior year at the latest to maximize their ability to find a lab able to host them. Finding a lab involves reaching out to professors directly to inquire about research possibilities in their lab prior to receiving an override code for registration for BIOL1950/1960 or Chem 0980/0980S/0981.

BIOL 1950	Directed Research/Independent Study
BIOL 1960	Directed Research/Independent Study
CHEM 0980	Undergraduate Research
CHEM 0980S	Undergraduate Research - Writing Designated and Mandatory S/NC
CHEM 0981	Undergraduate Research - Writing Designated

A summer research experience with faculty in Biology or Chemistry at Brown equivalent or greater in scope and scale to work the student would pursue in a Biology or Chemistry independent study course to satisfy one semester of the research requirement.

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. 5

Applied Mathematics Electives:

APMA 0330	Methods of Applied Mathematics I
APMA 0410	Mathematical Methods in the Brain Sciences
APMA 0650	Introduction to Probability and Statistics

Biology Electives:

BIOL 0030	Principles of Nutrition
BIOL 0150D	Techniques in Regenerative Medicine: Cells, Scaffolds and Staining
BIOL 0170	Biotechnology in Medicine
BIOL 0190R	Phage Hunters
BIOL 0200	The Foundation of Living Systems
BIOL 0380	The Ecology and Evolution of Infectious Disease
BIOL 0415	Microbes in the Environment
BIOL 0440	Inquiry in Plant Biology: Analysis of Plant Growth, Reproduction and Adaptive Responses
BIOL 0470	Genetics
BIOL 0500	Cell and Molecular Biology
BIOL 0510	Introductory Microbiology
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 1120	Biomaterials
BIOL 1150	Stem Cell Engineering
BIOL 1200	Protein Biophysics and Structure
BIOL 1210	Synthetic Biological Systems
BIOL 1222A	Current Topics in Functional Genomics
BIOL 1260	Physiological Pharmacology
BIOL 1290	Cancer Biology
BIOL 1300	Biomolecular Interactions: Health, Disease and Drug Design
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
BIOL 2350	The Biology of Aging

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
CHEM 1560H	Chemical Glycobiology
CHEM 1560N	Organometallic Chemistry
CHEM 2410	Organic Mechanisms
CHEM 2420	Organic Reactions

Computer Science Electives:

CSCI 0080	A First Byte of Computer Science
CSCI 0111	Computing Foundations: Data
CSCI 0150	Introduction to Object-Oriented Programming and Computer Science
CSCI 0160	Introduction to Algorithms and Data Structures
CSCI 0170	Computer Science: An Integrated Introduction
CSCI 0180	Computer Science: An Integrated Introduction
CSCI 0190	Accelerated Introduction to Computer Science
CSCI 1810	Computational Molecular Biology

Engineering Electives:

ENGN 0410	Materials Science

Neuroscience Electives: [2]

NEUR 0010	The Brain: An Introduction to Neuroscience
NEUR 1020	Principles of Neurobiology
NEUR 1030	Neural Systems
NEUR 1040	Introduction to Neurogenetics
NEUR 1670	Neuropharmacology and Synaptic Transmission
NEUR 1740	The Diseased Brain: Mechanisms of Neurological and Psychiatric Disorders

Physics Electives:

PHYS 0160	Introduction to Relativity, Waves and Quantum Physics

Public Health Electives:

PHP 1501	Essentials of Data Analysis

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.

3 Students may opt to enroll in APMA 1655 for more in depth coverage of APMA 1650.

Honors Requirements for Biochemistry

All ScB Biochemistry concentrators are candidates for Honors; no separate application is necessary.

The requirements for Honors in Biochemistry are:

* Students must have a majority of either As or S with distinction grades in concentration courses.

* Two semesters of Independent Study (CHEM 0980, CHEM 0980S, CHEM 0981, BIOL 1950, or BIOL 1960). 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.

* An oral presentation of the thesis in a fifteen-minute senior talk followed by a five-minute question and answer period.

Biomedical Engineering Concentration Requirements

Biomedical Engineering (https://engineering.brown.edu/undergraduate/(https://engineering.brown.edu/undergraduate/concentrations/biomedical-engineering/)concentrations/biomedical-engineering/ (https://engineering.brown.edu/undergraduate/concentrations/biomedical-engineering/)) is a dynamic and growing field based upon the application of the tools of engineering to the subject matter of biology and medicine. The undergraduate program in biomedical engineering is an interdisciplinary concentration structured as a joint program between the Division of Biology and Medicine and the School of Engineering. Students can take courses from and do research with faculty from engineering, the various departments of biology, and the Brown-affiliated hospitals in Rhode Island. The Biomedical Engineering (BME) concentration shares much of the core with the other engineering programs, but the program's primary emphasis is on the fundamentals of biomedical engineering, while also allowing students to personalize their curriculum. Biomedical engineers design new drugs, genetically engineer organisms, and devise new medical devices and instruments. They also use their understanding of biology to advance synthetic and naturally-derived materials and products. BME students learn to apply the principles of engineering and science, along with problem solving skills and critical thinking to a broad spectrum of engineering problems. Further, BME is a sound foundation for lifelong education with its emphasis on the use of teamwork, effective communication skills, and an understanding of broad social, ethical, economic and environmental consequences. The biomedical engineering curriculum at Brown prepares students for careers in biomedical engineering and biotechnology, as well as careers in diverse areas such as medicine, law, business, and health care delivery.

The Sc.B. program in Biomedical Engineering is accredited by the Engineering Accreditation Commission of ABET http://www.abet.org/. It is jointly offered by the School of Engineering and the Division of Biology and Medicine as an interdisciplinary concentration designed for students interested in applying the methods and tools of engineering to the life sciences and medicine. Alumni of the Biomedical Engineering (BME) program will achieve one or more of these program educational objectives (PEOs) within five (5) years of graduation: (1) Serve society through work or advanced study in a broad range of fields including, but not limited to, medicine, healthcare, industry, government, and academia; (2) Apply their deeply creative and versatile biomedical engineering education to solve a broad spectrum of engineering and societal challenges; and (3) Contribute as role models, mentors, or leaders in their fields. The student outcomes of this program are the ABET (1) - (7) Student Outcomes as defined by the ABET Criteria for Accrediting Engineering Programs, available online at http://www.abet.org/accreditation-criteria-policies-documents/. The Biomedical Engineering concentration shares much of the core with the other engineering programs and is structured to include more science courses and electives that introduce cutting edge areas in the field of BME.

The requirements regarding Mathematics, Advanced Placement, Transfer Credit, Substitutions for Required Courses, and Humanities and Social Science Courses are identical to those of the Sc.B. degree programs in Engineering. Please refer to the Engineering section of the University Bulletin (https://bulletin.brown.edu/engineering/) for explicit guidelines.

Standard program for the Sc.B. degree

1. Core Courses		
ENGN 0030	Introduction to Engineering	1
or ENGN 0032	Introduction to Engineering: Design	
ENGN 0040	Engineering Statics and Dynamics	1
ENGN 0510	Electricity and Magnetism	1
or ENGN 0520	Electrical Circuits and Signals	
ENGN 0720	Thermodynamics	1
ENGN 0810	Fluid Mechanics	1
CHEM 0330	Equilibrium, Rate, and Structure	1
MATH 0190	Single Variable Calculus, Part II (Physics/ Engineering)	1
or MATH 0100	Single Variable Calculus, Part II	
CHEM 0350	Organic Chemistry I	1
MATH 0200	Multivariable Calculus (Physics/ Engineering)	1
or MATH 0180	Multivariable Calculus	
or MATH 0350	Multivariable Calculus With Theory	
APMA 0350	Applied Ordinary Differential Equations [1]	1
APMA 1650	Introduction to Probability and Statistics with Calculus	1
or BIOL 0495	Statistical Analysis of Biological Data	
or PHP 1510	Principles of Biostatistics and Data Analysis	
or APMA 1655	Introduction to Probability and Statistics with Theory	
2. Upper Level Biomedical Engineering Curriculum		
ENGN 1110	Transport and Biotransport Processes	1
ENGN 1210	Biomechanics	1
ENGN 1230	Instrumentation Design	1
ENGN 1490	Biomaterials	1
BIOL 0800	Principles of Physiology	1
3. Additional Biomedical Engineering Electives: Complete at least 3 courses from the following groups; other upper-level courses are subject to Concentration Advisor approval.		**3**
Select one or two of the following:		
CSCI 1810	Computational Molecular Biology	
or CSCI 1820	Algorithmic Foundations of Computational Biology	
ENGN 0500	Digital Computing Systems	
ENGN 1220	Neuroengineering	
ENGN 1510	Nanoengineering and Nanomedicine	
ENGN 1520	Cardiovascular Engineering	
ENGN 1550	Recent Advances in Biomedical Engineering	
ENGN 1740	Computer Aided Visualization and Design	
ENGN 1930B	Biomedical Optics	
ENGN 1945	Immunoengineering	
ENGN 2625	Optical Microscopy: Fundamentals and Applications	
ENGN 2910S	Cancer Nanotechnology	
ENGN 2911R	Analytical Modeling for Biomechanical and Biomedical Systems	
ENGN 2912R	Implantable Devices	
BIOL 1140	Tissue Engineering	
BIOL 1150	Stem Cell Engineering	
BIOL 2110	Drug and Gene Delivery	

At least one or two more courses from:

BIOL 0280	Biochemistry	
BIOL 0470	Genetics	
BIOL 0500	Cell and Molecular Biology	
BIOL 0510	Introductory Microbiology	
BIOL 0530	Principles of Immunology	
BIOL 1090	Polymer Science for Biomaterials	
BIOL 1100	Cell Physiology and Biophysics	
BIOL 1555	Methods in Informatics and Data Science for Health	
APMA 1070	Quantitative Models of Biological Systems	
CHEM 0360	Organic Chemistry II	
ENGN 2910G	Topics in Translational Research and Technologies	
NEUR 1020	Principles of Neurobiology	
NEUR 1440	Mechanisms and Meaning of Neural Dynamics	
PHYS 1610	Biological Physics	
BIOL 1810	21st Century Applications in Cell and Molecular Biology	
4. Capstone Design [2]		
ENGN 1240	Biomedical Engineering Design and Innovation	1
ENGN 1250	Biomedical Engineering Design and Innovation II	1
5. General Education Requirement: At least four approved courses must be taken in the humanities and social sciences.		
Total Credits		**21**

1 Students who completed APMA 0330 and/or APMA 0340 prior to academic year 2021-22 may count these as satisfying the APMA 0350 and/or APMA 0360 requirements.

2 In some **rare cases**, Independent Study may be substituted, subject to Concentration Advisor approval.

Professional Track

The requirements for all undergraduate professional tracks within concentrations are standardized and additional information can be found here:

https://bulletin.brown.edu/undergradproftrack/

Biophysics Concentration Requirements

Biophysics is a quantitative science at the intersection of the life and physical sciences. It requires a significant level of competence in physics, chemistry, biology and math as reflected in the concentration requirements. Students should work with their concentration advisor to develop a focused academic plan that complements the required research component of the concentration and allows students to develop analytical and quantitative skills.

Student Goals:
Students in this concentration will:

- Explore the relationship between biological and physical principles by successfully completing foundational courses in biology, physics, math and chemistry
- Gain an in-depth knowledge of the interdisciplinary nature of life and physical sciences by selecting and successfully completing advanced courses in biology, physics, math, chemistry or related fields
- Develop skills to identify and analyze critical questions central to biophysics
- Apply quantitative methods to problems at the interface of life and physical sciences
- Complete a research project with a faculty advisor that focuses on a particular theme or problem in the field of biophysics where students apply knowledge gained throughout the curriculum.

Additional detailed information about the field of Biophysics may be found at: https://www.brown.edu/academics/biology/undergraduate-education/undergraduate/biophysics (https://www.brown.edu/academics/biology/undergraduate-education/undergraduate/biophysics/)

Standard program for the Sc.B. degree

Physics		
One of the following series:		2
PHYS 0030 & PHYS 0040	Basic Physics A and Basic Physics B [1]	
PHYS 0050 & PHYS 0060	Foundations of Mechanics and Foundations of Electromagnetism and Modern Physics	
PHYS 0070 & PHYS 0160	Analytical Mechanics and Introduction to Relativity, Waves and Quantum Physics	
PHYS 0470	Electricity and Magnetism	1
Chemisty		
CHEM 0330	Equilibrium, Rate, and Structure	1
CHEM 0350	Organic Chemistry I	1
Select one other advanced Chemistry Course		1
Math		
MATH 0090	Single Variable Calculus, Part I (or equivalent)	1
MATH 0100	Single Variable Calculus, Part II (or equivalent)	1
MATH 0180	Multivariable Calculus (or equivalent)	1
Biology		
BIOL 0200	The Foundation of Living Systems (or equivalent)	1
Select four additional biology or neuroscience courses chosen with approval of the advisor.		4
Directed Research: Students must take two semesters of research which may be satisfied by any of the opportunities listed below:		**2**
Directed Research in Biology (BIOL 1950/BIOL 1960), Chemistry (CHEM 0970/CHEM 0980), or Physics (PHYS 1980)		
A summer research experience in equivalent scope and scale to an independent study, but this would not count as course credit toward the concentration		
Electives: Four electives in biology, physics, math/applied math, chemistry, neuroscience, engineering or computer science; at least 2 courses must be above the introductory level [2]		**4**
Total Credits		**20**

1 The PHYS 0050/0060 or 0070/0160 sequences are preferred to PHYS 0030/0040.

2 Sample electives can be found on the Biology Undergraduate Education page (https://www.brown.edu/academics/biology/undergraduate-education/undergraduate/biophysics/).

Computational Biology Concentration Requirements

Computational biology involves the analysis and discovery of biological phenomena using computational tools, and the algorithmic design and analysis of such tools. The field is widely defined and includes foundations in computer science, applied mathematics, statistics, biochemistry,

molecular biology, genetics, ecology, evolution, anatomy, neuroscience, and visualization.

Students may pursue a Bachelor of Arts or a Bachelor of Science. Students pursuing the ScB have the option of electing a concentration in Computational Biology with one of three focus areas: Computer Sciences, Biological Sciences, or Applied Mathematics & Statistics. Both programs require a senior capstone experience that pairs students and faculty in creative research collaborations.

Standard program for the A.B. degree

Please see the bottom of the page for more information regarding the University Writing Requirement, the Capstone Experience, and the Computational Biology Honors Program.

Standard program for the A.B. degree

Please review the footnotes for clarifying details and see the bottom of the page for more information regarding the Capstone Experience and the Computational Biology Honors Program.

Prerequisites (0-3 courses)		
Students must complete or place out of these prerequisites.		
MATH 0100	Single Variable Calculus, Part II	
or MATH 0170	Single Variable Calculus, Part II (Accelerated)	
APMA 0260	Linear Algebra and Multivariable Calculus for Applied Mathematicians [1]	
or MATH 0180	Multivariable Calculus	
or MATH 0200	Multivariable Calculus (Physics/Engineering)	
or MATH 0350	Multivariable Calculus With Theory	
BIOL 0200	The Foundation of Living Systems	
General Core Requirements: Biology		**2**
BIOL 0470	Genetics	
BIOL 0280	Biochemistry	
or BIOL 0500	Cell and Molecular Biology	
General Core Requirements: Chemistry		**1**
CHEM 0330	Equilibrium, Rate, and Structure	
or CHEM 0350	Organic Chemistry I	
General Core Requirements: Computer Science		**2**
Choose one of the following groupings of introductory courses:		
Group A		
CSCI 0111 & CSCI 0200	Computing Foundations: Data and Program Design with Data Structures and Algorithms	
Group B		
CSCI 0150 & CSCI 0200	Introduction to Object-Oriented Programming and Computer Science and Program Design with Data Structures and Algorithms	
Group C		
CSCI 0170 & CSCI 0200	Computer Science: An Integrated Introduction and Program Design with Data Structures and Algorithms	
Group D		
CSCI 0190 & CSCI 0200	Accelerated Introduction to Computer Science and Program Design with Data Structures and Algorithms (or any full-credit computer science course above CSCI 0190)	
General Core Requirements: Probability & Statistics [2]		**1**
APMA 1650	Introduction to Probability and Statistics with Calculus	
or APMA 1655	Introduction to Probability and Statistics with Theory	
or CSCI 1450	Advanced Introduction to Probability for Computing and Data Science	
or MATH 1210	Probability	
Comp Bio Core Course Requirements		**4**
CSCI 1810	Computational Molecular Biology	
APMA 1080	Inference in Genomics and Molecular Biology [2]	
AND two of the following:		
APMA 1070	Quantitative Models of Biological Systems	
APMA 1660	Statistical Inference II	
APMA 1690	Computational Probability and Statistics	
BIOL 1222A	Current Topics in Functional Genomics	
BIOL 1430	Foundations of Population Genetics	
BIOL 1435	Computational Methods for Studying Demographic History with Molecular Data	
BIOL 1525	Pathogenomics: Analysis, interpretation and applications of microbial genomes	
BIOL 1545	Human Genetics and Genomics	
BIOL 1555	Methods in Informatics and Data Science for Health	
BIOL 1575	Evaluation of Health Information Systems	
CSCI 1420	Machine Learning	
CSCI 1470	Deep Learning	
CSCI 1820	Algorithmic Foundations of Computational Biology	
PHP 1510	Principles of Biostatistics and Data Analysis	
PHP 1560	Using R for Data Analysis	
Additional 1000+ level course with concentration advisor approval		
Capstone Experience		**1**
Students enrolled in the computational biology concentration will complete a research project in their senior year under faculty supervision (i.e: BIOL 1950/1960, CSCI 1970, APMA 1970). The themes of such projects evolve with the field and the technology, but should represent a synthesis of the various specialties of the program. The requirements are either one semester of reading and research with a CCMB Faculty member or approved advisor resulting in an advanced research project or a 2000-level Computational Biology course that covers an advanced topic within the Computational Biology field and includes an advanced research component. [3]		
Total Credits		**11**

1. These courses are prerequisites for APMA 1655. Students who matriculate in or after Fall 2025 will be required to take APMA 1655 as a prerequisite for APMA 1080 and will therefore need to complete or place out of one of these courses.
2. APMA 1655 will be a prerequisite for APMA 1080 starting in Fall 2025. Current concentrators (as of Spring 2025) may still take APMA 1080 with APMA 1650 as their prerequisite but APMA 1655 is encouraged. Students matriculating in Fall 2025 or later will need to take APMA 1655 before taking APMA 1080.
3. Some 2000-level courses are not available to undergraduate students due to department restrictions but have 1000-level equivalents (such as BIOL 1545/2545) that can count for capstone credit with approval from the instructor and the student's faculty advisor. Please reach out to the CCMB Academic Programs Coordinator for more information.

Capstone Experience:

Students enrolled in the computational biology concentration will complete a research project in their senior year under faculty supervision. The themes of such projects evolve with the field and the technology, but should represent a synthesis of the various specialties of the program. The requirements are either one semester of reading and research

with a CCMB Faculty member or approved advisor, or a 2000-level Computational Biology course.

Honors:

In order to be considered a candidate for honors, students will be expected to maintain an outstanding record. Students must have a majority of either As or S with distinction grades in concentration courses. In addition, students should take at least one semester, and are strongly encouraged to take 2 semesters semesters, of reading and research with a CCMB faculty member or approved advisor. In addition, students should take at least one semester, and are strongly encouraged to take 2 semesters of reading and research with a CCMB faculty member or approved advisor.

Students seeking honors are advised to choose a Thesis Advisor prior to the end of their Junior year. Students must complete the Comp Bio Honors Registration form (https://docs.google.com/forms/d/e/1FAIpQLSe5jZSIwNdZqCFOWTPVQN7PQUM1aMmrZOOdLxox9DVuCjkDZw/viewform/) and submit their honors proposal to ccmb@brown.edu by the first Friday in October of their senior year. Students must submit a honors thesis in April of their senior year and present a public defense of their theses to the CCMB community. More information about the honors guidelines and deadlines can be found here: https://ccmb.brown.edu/academics/undergraduate-program/honors-designation. Any deviation from these rules must be approved by ~~the~~ director of undergraduate studies, in consultation with the student's advisor.

Standard program for the Sc.B. degree

Please see the bottom of the page for more information regarding the University Writing Requirement, the Capstone Experience, and the Computational Biology Honors Program.

Standard program for the Sc.B. degree

Please review the footnotes for clarifying details and see the bottom of the page for more information regarding the Capstone Experience and the Computational Biology Honors Program.

Prerequisites (0-3 courses)		
Students must complete or place out of these prerequisites.		
MATH 0100	Single Variable Calculus, Part II (or equivalent)	
or MATH 0170	Single Variable Calculus, Part II (Accelerated)	
APMA 0260	Linear Algebra and Multivariable Calculus for Applied Mathematicians [1]	
or MATH 0180	Multivariable Calculus	
or MATH 0200	Multivariable Calculus (Physics/Engineering)	
or MATH 0350	Multivariable Calculus With Theory	
BIOL 0200	The Foundation of Living Systems (or equivalent)	
General Core Course Requirements: Biology		**2**
BIOL 0470	Genetics (prerequisite BIOL 0200 or equivalent)	
BIOL 0280	Biochemistry	
or BIOL 0500	Cell and Molecular Biology	
General Core Requirements: Chemistry		**1**
CHEM 0330	Equilibrium, Rate, and Structure	
or CHEM 0350	Organic Chemistry I	
General Core Requirements: Computer Science		**3**
CSCI 0220	Introduction to Discrete Structures and Probability	
AND complete one of the following groupings of introductory courses:		
Group A		
CSCI 0111 & CSCI 0200	Computing Foundations: Data and Program Design with Data Structures and Algorithms	
Group B		
CSCI 0150 & CSCI 0200	Introduction to Object-Oriented Programming and Computer Science and Program Design with Data Structures and Algorithms	
Group C		
CSCI 0170 & CSCI 0200	Computer Science: An Integrated Introduction and Program Design with Data Structures and Algorithms	
Group D		
CSCI 0190 & CSCI 0200	Accelerated Introduction to Computer Science and Program Design with Data Structures and Algorithms (or any full-credit computer science course above CSCI 0190)	
General Core Requirements: Probability & Statistics [2]		**1**
APMA 1650	Introduction to Probability and Statistics with Calculus	
or APMA 1655	Introduction to Probability and Statistics with Theory	
or CSCI 1450	Advanced Introduction to Probability for Computing and Data Science	
or MATH 1210	Probability	
General Core Requirements: Computational Biology		**2**
APMA 1080	Inference in Genomics and Molecular Biology [2]	
CSCI 1810	Computational Molecular Biology	
Six Courses in One Track		**6**
Choose one of 3 tracks: Computer Science, Biological Sciences, or Applied Mathematics and Statistics. See track requirements below.		
Capstone Experience		**1**
Students enrolled in the computational biology concentration will complete a research project in their senior year under faculty supervision (i.e: BIOL 1950/1960, CSCI 1970, APMA 1970). The themes of such projects evolve with the field and the technology, but should represent a synthesis of the various specialties of the program. The requirements are either one semester of reading and research with a CCMB Faculty member or approved advisor resulting in an advanced research project or a 2000-level Computational Biology course that covers an advanced topic within the Computational Biology field and includes an advanced research component. [3]		
Total Credits		**16**

1. These courses are prerequisites for APMA 1655. Students who matriculate in or after Fall 2025 will be required to take APMA 1655 as a prerequisite for APMA 1080 and will therefore need to complete or place out of one of these courses.
2. APMA 1655 will be a prerequisite for APMA 1080 starting in Fall 2025. Current concentrators (as of Spring 2025) may still take APMA 1080 with APMA 1650 as their prerequisite but APMA 1655 is encouraged. Students matriculating in Fall 2025 or later will need to take APMA 1655 before taking APMA 1080.
3. Some 2000-level courses are not available to undergraduate students due to department restrictions but have 1000-level equivalents (such as BIOL 1545/2545) that can count for capstone credit with approval from the instructor and the student's faculty advisor. Please reach out to the CCMB Academic Programs Coordinator for more information.

Tracks

Please review the prerequisites required for the courses below in CAB. Students should also be aware of the requirements for enrolling in a given CSCI course, which can be found on the Computer Science website.

Computer Science Track:

Three of the following:		3
CSCI 1230	Introduction to Computer Graphics	
CSCI 1270	Database Management Systems	
CSCI 1411	Foundations of AI	
CSCI 1420	Machine Learning	
CSCI 1430	Computer Vision	
CSCI 1470	Deep Learning	
CSCI 1820	Algorithmic Foundations of Computational Biology	
CSCI 2952G	Deep Learning in Genomics	
or other 1000+ level Computer Science course approved by the concentration advisor.		
Three of the following:		3
APMA 1070	Quantitative Models of Biological Systems	
APMA 1660	Statistical Inference II	
APMA 1690	Computational Probability and Statistics	
BIOL 1430	Foundations of Population Genetics	
BIOL 1435	Computational Methods for Studying Demographic History with Molecular Data	
BIOL 1555	Methods in Informatics and Data Science for Health	
CPSY 1492	Computational Cognitive Neuroscience	
CSCI 0320 & CSCI 0330	Introduction to Software Engineering and Introduction to Computer Systems [1]	
CSCI 1550	Probabilistic Methods in Computer Science	
CSCI 1570	Design and Analysis of Algorithms	
PHP 1510	Principles of Biostatistics and Data Analysis	
PHP 1560	Using R for Data Analysis	
or another 1000+ level computational course approved by the concentration advisor.		
Total Credits		**6**

[1] Both CSCI 0320 **and** CSCI 0330 need to be taken to fulfill one of the six course requirements in this track.

Biological Sciences track

At least four 1000+ level courses comprising a coherent theme related to Computational Biology. Examples of themes include: Biochemistry, Ecology, Evolution, Genomics, Immunology, or Neurobiology. Other themes can be approved by your concentration advisor.		4
AND two courses from the following:		2
APMA 1660	Statistical Inference II	
APMA 1690	Computational Probability and Statistics	
BIOL 1222A	Current Topics in Functional Genomics	
BIOL 1250	Host-microbiome Interactions in Health and Disease	
BIOL 1430	Foundations of Population Genetics	
BIOL 1435	Computational Methods for Studying Demographic History with Molecular Data	
BIOL 1525	Pathogenomics: Analysis, interpretation and applications of microbial genomes	
CSCI 1420	Machine Learning	
CSCI 1470	Deep Learning	
CSCI 1820	Algorithmic Foundations of Computational Biology	
PHP 1560	Using R for Data Analysis	
or other 1000+ level Computational Biology course approved by concentration advisor.		
Total Credits		**6**

Applied Mathematics & Statistics Track:

At least three courses from the following:		3
APMA 0350 & APMA 0360	Applied Ordinary Differential Equations and Applied Partial Differential Equations I [1]	
APMA 1070	Quantitative Models of Biological Systems	
APMA 1660	Statistical Inference II	
APMA 1690	Computational Probability and Statistics	
APMA 1740	Recent Applications of Probability and Statistics	
PHP 1510	Principles of Biostatistics and Data Analysis	
PHP 1560	Using R for Data Analysis	
At least three of the following:		3
BIOL 1222A	Current Topics in Functional Genomics	
BIOL 1430	Foundations of Population Genetics	
BIOL 1435	Computational Methods for Studying Demographic History with Molecular Data	
BIOL 1555	Methods in Informatics and Data Science for Health	
CSCI 1411	Foundations of AI	
CSCI 1420	Machine Learning	
CSCI 1470	Deep Learning	
CSCI 1820	Algorithmic Foundations of Computational Biology	
PHP 1855	Infectious Disease Modeling	
or other 1000+ level Computational Biology course approved by concentration advisor.		
Total Credits		**6**

[1] Students must take both courses in this set (APMA 0350 & APMA 0360) to fulfill one of the six course requirements.

Capstone Experience:

Students enrolled in the computational biology concentration will complete a research project in their senior year under faculty supervision. The themes of such projects evolve with the field and the technology, but should represent a synthesis of the various specialties of the program. The requirements are either one semester of reading and research with a CCMB Faculty member or approved advisor, or a 2000-level Computational Biology course.

Honors:

Honors:

In order to be considered a candidate for honors, students will be expected to maintain an outstanding record. Students must have a majority of either As or S with distinction grades in concentration courses. In addition, students should take at least one semester, and are strongly encouraged to take 2 semesters semesters, of reading and research with a CCMB faculty member or approved advisor. In addition, students should take at least one semester, and are strongly encouraged to take 2 semesters of reading and research with a CCMB faculty member or approved advisor.

Students seeking honors are advised to choose a Thesis Advisor prior to the end of their Junior year. Students must complete the Comp Bio Honors Registration form and submit their honors proposal to ccmb@brown.edu by the first Friday in October of their senior year. Students must submit a honors thesis in April of their senior year and present a public defense of their theses to the CCMB community. More information about the honors guidelines and deadlines can be found here: https://ccmb.brown.edu/academics/undergraduate-

program/honors-designation. Any deviation from these rules must be approved by the director of undergraduate studies, in consultation with the student's advisor.

Courses

BIOL 0030. Principles of Nutrition.
Introduces the basic principles of human nutrition, and the application of these principles to the specific needs of humans, and the role of nutrition in chronic diseases. Provides an overview of the nutrients and their use by the human body. Also examines the role of nutrients in specific functions and disease states of the body. Not for biology concentration credit. Enrollment limited to 100.

BIOL 0040. Nutrition for Fitness and Physical Activity.
Reviews the role of nutrition in physical activity and health. It is designed to provide the student with the information and skills needed to translate nutrition and physical activity recommendations into guidelines for both the athlete for maximal performance and the non-athlete to improve both health and body weight. Students will learn the use of the energy yielding nutrition in physical activity and how food choices can influence both athletic performance and long-term health through the effect on risk factors for chronic diseases. **Prerequisite: BIOL 0030.** Enrollment limited to 20. Instructor permission required.

BIOL 0060. Introduction to Human Physiology.
An introduction to human physiology aimed primarily at undergraduates who have minimal to no Biology background or who are not concentrating in biology. Acquire a basic understanding of the physiological mechanisms that allow for the running of each major organ systems. Topics include basic cardiovascular, respiratory, urinary, digestive, endocrine, and neuromuscular function, as well as aspects of reproduction and exercise physiology. Not for biology concentration credit. Lab.

BIOL 0080. Biotechnology Management.
An examination of the pharmaceutical, biotechnology, and medical product industries: what they are, how they function, whence they originate, and various perspectives on why some succeed and others fail. Pathways from lab-bench to marketplace are described as are the pervasive influences of the FDA, patent office, and courts. Extensive reading; emphasis on oral presentation. Primarily intended for students planning a career in biomedical industry. Not for biology concentration credit. Enrollment limited to 20.

Spr	BIOL0080	S01	20307	T	4:00-6:30(16)	(B. Bready)

BIOL 0100. Living Biology at Brown and Beyond.
BIOL0100 is a first year seminar designed for aspiring biology program students. The course introduces students to the people and opportunities in Brown's Biology Program and fosters academic and soft skill development. Students will practice a range of laboratory methods used in molecular biology while examining the ways in which those methods are used in research and in the development of medical treatments. Students will hone their writing skills, learn to effectively read primary STEM literature, and consider how various disciplines in Biology come together to tackle critical global problems such as global environmental change and emerging infectious disease. BIOL 0100 is best suited for students with minimal experience in the biological sciences.

Spr	BIOL0100	S01	20180	W	3:00-5:30(10)	(K. Monteiro)

BIOL 0110. Fake Math: Analyzing the Misuse of Quantitative Concepts.
From the Scarecrow in the Wizard of Oz to the White House, quantitative errors are made and put forth. This course will present, discuss, and challenge students to analyze misused quantitative concepts. These errors will be taken from misapplied logic; inappropriate use of numbers; graphical inaccuracies and manipulations; cognitive illusions; self-fulfilling prophecies; the wrong-but-often-relied-upon Law of Small Numbers; conditional probability; correlation, confounding, and causality; hazards of data mining; circular reasoning; and basic misuses of statistics. Introductory concepts of classical logic, probability, and statistics will be presented and reviewed, and examples of their misuse will be discussed and evaluated.

BIOL 0140B. Communicating Science: Biological Illustration.
This Sophomore Seminar is an immersion practicum that conjoins art and science. Employing a series of techniques, students will learn the protocols of scientific rendering in an intensive hands-on approach. Field trips will include the RISD Nature Lab, the Brown Greenhouse, and John Hay collection of biomedical and botanical folios. Media will include graphite/ carbon dust; pen and ink (stipple, line); coquille board; scratch-board, colored pencil, watercolor and polymer clay. Course will be driven by project presentations focused on communicating science through illustration. Not for concentration credit in Biological Sciences programs. Instructor permission required; enrollment 10 students. 1/2 credit.

BIOL 0140K. Conservation Medicine.
How have fruit bats contributed to the emergence of Nipah virus in Malaysia? Is an infectious cancer going to drive the Tasmanian Devil to extinction? Will a warmer world be a sicker world? We will consider these and additional topics at the intersection of global change biology and infectious disease emergence in this course. The course should be of interest to pre-med, general biology and environmental studies concentrators seeking interdisciplinary learning classroom experience. This will satisfy "Area 3" organismal biology concentration requirement for Biology/Health-Human Biology. Expected background: BIOL 0200 or equivalent placement. Enrollment limited to 12 sophomores. Instructor permission required.

BIOL 0140T. Communicating Science Through Visual Media.
This class, offered jointly by professors at RISD and Brown, will explore the pedagogy and practice of using visual media to convey scientific concepts. The goal of this course will be to assess examples of existing material and create new animations/video that fill an educational need and make science engaging and accessible. Class time will be comprised of lectures, labs, screenings, discussions, critiques and exercises. After an introduction to teaching pedagogy and the basics of animation and visual design, small student teams will be paired with science faculty mentors to create videos and animations that explain scientific concepts.

BIOL 0150A. Techniques and Analyses using DNA-Based Biotechnology.
Students will study and practice a range of methods used in molecular biology while examining the ways in which those tools are used in research and in the development of medical treatments. This experience, combined with the reading and discussion of selected papers from the primary literature, fosters development of a skill set critically important for the modern day biology student. Expected background: high school Biology course. Enrollment limited to 10 first year students. Instructor permission required. Half-credit course. S/NC.

BIOL 0150B. Statistical Computing for Biology.
Modern biological research is a data rich endeavor, necessitating strong quantitative and computational skills to interpret the results of experimental and observational studies. In this course we will explore the application of statistics and modeling in biological research and environmental science. Topics covered will include basic probability, experimental design, sampling, hypothesis testing and mathematical models for prediction. No prior statistics knowledge is assumed. Enrollment limited to 10 first year and sophomore students. Instructor permission, based on a portfolio review. This is a half-credit course. S/NC

BIOL 0150C. Introduction to Ethnopharmacology.
Plant secondary metabolites are currently the subject of much research interest when investigating new target compounds for potential medicine from natural products. New leads for drugs and phytomedicines from plants and plant parts have been increasing at a rapid rate especially by the pharmaceutical industry. Many plants have been selected and collected for their specific secondary compounds and healing powers by ethnobotanists in the field. Students will gain hands on experience identifying medicinal plants, laboratory equipment, sampling procedures, field tests and extraction techniques of secondary metabolites by high throughput screening methods. Enrollment limited to 10 FYS. Instructor permission required.

BIOL 0150D. Techniques in Regenerative Medicine: Cells, Scaffolds and Staining.
Regenerative Medicine, also known as Tissue Engineering, is the process of creating living, functional tissues to repair or replace native tissue or organ functions that have been lost due to disease or congenital defects. As such, it is a prominent scientific discipline that can either "stand alone" or complement material-based research efforts in the areas of device design, drug delivery, diagnostics and pharmaceuticals. Students will develop proficiencies in basic cell culture techniques, early stage tissue regeneration strategies and histochemical characterization of mammalian cell constructs. Enrollment limited to 10 first year students. Instructor permission required. Half-credit course. S/NC.

BIOL 0160. Plants, Food, and People.
Examines the selection, breeding, cultivation and uses of food plants. Discusses the effects on agriculture of pathogens, climate change, and loss of biodiversity. Considers whether enough food can be produced for a world population of potentially 10 billion, while sustaining biodiversity and environmental quality. Enrollment limited to 50.

BIOL 0170. Biotechnology in Medicine.
Introduces undergraduates to the main technological advances currently dominating the practice of medicine. Provides an overview of the objectives, techniques, and problems related to the application of biomedical technology to the diagnosis and treatment of disease and the contemporary health care industry. Topics include: pharmaceutical development and formulation; organ replacement by prosthesis and transplantation; medical imaging; tissue engineering, therapeutic cloning, regenerative medicine; stem cells; societal, economic, and ethical issues. This course does carry Biology concentration credit.

Fall	BIOL0170	S01	10338	TTh	10:30-11:50(13)	(T. Achilli)

BIOL 0180. The Biology of AIDS.
AIDS represents an example of the vulnerability of humans to new infectious agents. We will review some human infectious diseases including small pox yellow fever and influenza, and then explore AIDS/HIV. First characterized in 1981, AIDS became the leading cause of death in U.S. males aged 25-44 within a decade. We will examine what factors make HIV such a potent pathogen. The course is intended for students beginning in biology. Expected: BIOL 0200, or equivalent placement. This course *does* carry Biology concentration credit.

BIOL 0190. Phage Hunters.
Phage Hunters is a one-semester FYS class geared towards providing first-year students with hands on laboratory experience and a general background in molecular biology. Student applications are submitted in the summer and admitted students will receive overrides to register before the end of shopping period. You will isolate, cultivate, and purify a bacteriophage from the local environment. Lab work includes isolation and purification of your own phage, DNA isolation and restriction mapping, and PCR to characterize the phage. There will be a series of lectures that introduce concepts in bacteriology, virology, genetics, and molecular biology. One bacteriophage will be selected among the purified isolates and its genome will be sequenced. If time allows, you will annotate the sequenced genome, which entails identifying all the protein-coding sequences found within the bacteriophage using computational approaches. Instructor permission required. Admittance based on applications

Fall	BIOL0190	S01	18699	M	3:00-5:30(03)	(Y. Zhou)
Fall	BIOL0190	L01	18700	W	1:00-5:00	(Y. Zhou)
Fall	BIOL0190	L02	18701	F	1:00-5:00	(Y. Zhou)

BIOL 0190E. Botanical Roots of Modern Medicine.
This course will explore a variety of medicinal plants found throughout the world, the diverse cultures that use them in their daily lives and the scientific underpinnings of their medicinal uses. In conjunction with readings, students will gain a hands-on approach in lab, observing, identifying and growing these plants. Enrollment limited to 19. Students MUST register for the lecture section and the lab.

BIOL 0190F. Darwinian Medicine.
Explores evolutionary explanations of why we get sick, and how this can shape, or misshape, our interpretations of medicine. Draws on evolutionary genetics, population biology, molecular biology and physiology. This course will build on evolutionary biology and then focus on disease processes such as infection, aging, cancer, allergy, diabetes, and obesity. Enrollment limited to 19 first year students.

Fall	BIOL0190F	S01	10233	TTh	1:00-2:20(06)	(M. Tatar)

BIOL 0190P. Pride and Prejudice in the Development of Scientific Theories.
We will examine how the pace and shape of scientific progress is affected by the social/cultural context and the "personality" of the individual. We will look into how the interplay between society and the individual affects how scientific theories arise, are presented, are debated and are accepted. The course will initially focus on Charles Darwin and his theory of Natural Selection using the biography of Adrian Desmond and James Moore, "Darwin: The Life of a Tormented Evolutionist." Enrollment limited to 19 first year students.

Fall	BIOL0190P	S01	10209	TTh	2:30-3:50(12)	(S. Helfand)

BIOL 0190Q. Climate Change and Species Extinction.
In this course students will go beyond the headlines and delve into the science to explore the impact of climate change on species extinction. Students will explore the integration of science and technology through traditional textbooks, primary literature, open source databases, simulations, and discussions. Students will investigate the impact of climate change on species distribution, ecology, and behavior through interactive, inquiry-based, collaborative classroom investigations. Students will learn to integrate information from a variety of sources and disciplines and share their ideas through classroom discussion, written assignments, and oral presentations. Enrollment limited to 19 first year students.

BIOL 0190R. Phage Hunters, Part I.
A research-based lab class for freshmen; both semesters are required in the sequence. Students will isolate and characterize a bacteriophage viruses found in the soil. Lab work includes isolation and purification of your own phage, DNA isolation and restriction mapping, and PCR to characterize the phage. Several phage will be selected for genome sequencing, and will be annotated during the second semester. Instructor permission required. Admittance based on applications submitted online. Limited to 19 freshmen.

BIOL 0190S. Phage Hunters, Part II.
A research-based laboratory/class for freshmen; both semesters are required. Students will isolate and characterize a bacteriophage viruses found in the soil. Lab work includes isolation and purification of your own phage, DNA isolation and restriction mapping, and EM characterization of your phage. Several phages will be selected for genome sequencing over Winter Recess, and annotated in the spring. One hour of lecture/discussion, and 3 hours lab per week. Expected: AP Biology or equivalent, HS chemistry, and permission of the instructor. Students are expected to take fall and spring courses in the sequence. Enrollment limited to 19 first-year students. Instructor permission.

BIOL 0190T. Bioinformatics: A Practical Introduction.
The amount of biological sequence data has grown at an exponential pace and spurred the development of computational tools that allow biologists to use this information. Students will become familiar with useful bioinformatics tools used by researchers. The course will introduce concepts of information transfer in biological molecules, storage in public databases, and how to use tools to access this information and organize it meaningfully. We will explore tools for studying whole genomes, including high-throughput sequencing data to assemble genomes and mapping subsets. Students will gain hands-on experience using these tools. Expected: AP credit or equivalent placement for BIOL 0200.

BIOL 0190U. The Lives of Plants.
This course examines the lives of plants through their development, structure, function, reproduction, and responses to environmental conditions. Enrollment limited to 19 first year students.

BIOL 0200. The Foundation of Living Systems.
A broad overview of biological systems, emphasizing patterns and processes that form the basis of life. Explores essentials of biochemistry, molecular, and cellular biology and their relationship to the larger issues of ecology, evolution, and development. Examines current research trends in biology and their influence on culture. Appropriate for all students interested in biology. Serves as a gateway course to much of the intermediate and advanced curriculum. Placement tests are offered (contact Jody_Hall@brown.edu); AP scores of 4 or 5 are equivalent to BIOL 0200, and place a student out of this course. Students will be assigned to a lab time during the second week of class.

Fall	BIOL0200	S01	10210	MWF	9:00-9:50(09)	(W. Holmes)

BIOL 0210. Diversity of Life.
This course will explore biological diversity – the number of taxa, and the functions, and processes that support life – from the perspectives of ecology and evolutionary biology. It will draw on examples and case studies from the geological record, functional morphology, the evolution of organ systems in vertebrates, genomics, behavior and sexual selection in birds and invertebrates. Overarching themes will emphasize that taxonomic diversity is an emergent property of complex life on Earth, and the importance of diversity of biological functions and processes in generating and maintaining taxonomic diversity. The course is open to all students.

Fall	BIOL0210	S01	10234	MWF	11:00-11:50(16)	(J. Kellner)

BIOL 0220. Discovering Novel Protein Folding Phenotypes of Wild Yeast.
Yeast species have been used by humans for over millennia in food and drink preparation. However, they are also a powerful model system to tease out the genetic and molecular details of protein folding. Research labs utilize yeast as a model system to study several cellular mechanisms, but this entire body of work comes from just two different yeast strains. And yet, wild yeast grow everywhere in our everyday environments outside of the research lab; nature has provided rich genetic diversity among these yeast species that go unstudied in a research setting. In this COEX course, you will investigate novel protein-folding phenotypes in these unidentified wild yeast strains.

Fall	BIOL0220	S01	18651	TTh	1:00-4:00	(W. Holmes)

BIOL 0280. Biochemistry.
Lectures and recitation sections explore the mechanisms involved in the principles of macromolecular structure and function, the organization and regulation of pathways for intermediary metabolism, and the transfer of information from genes to proteins. Expected background: Cell and Molecular Biology (BIOL 0500) or another intermediate level course providing background in molecular level thinking, e.g. BIOL 0470, BIOL 0530 or NEUR 1020.

Spr	BIOL0280	S01	20181	TTh	1:00-2:20(08)	(W. Holmes)

BIOL 0285. Inquiry in Biochemistry: From Gene to Protein Function.
In this inquiry-based research course, students work in teams to formulate and test a hypothesis about how a change in genetic sequence affects enzyme function. Students will cultivate skills in scientific visualization, experimental design, data analysis, and laboratory techniques in molecular biology and biochemistry. In discussion, students will learn scientific writing through peer editing and iterative revisions to write a full scientific paper. This course is WRIT designated and will prepare students for writing an honors thesis. Expected: Students have previously taken or be concurrently enrolled in BIOL 0280. Enrollment in one lab section and one discussion section is required.

Spr	BIOL0285	S01	20182	M	1:00-5:00	(W. Holmes)
Spr	BIOL0285	S02	20183	Th	2:30-6:30	(W. Holmes)
Spr	BIOL0285	C01	25415	T	4:00-5:00	(W. Holmes)

BIOL 0300. Endocrinology.
A basic examination of endocrinology with emphasis on hormone biosynthesis, mechanism of action, physiological roles, and endocrine pathology. Topics include: mechanism of action of steroid, amine, and peptide hormones; neuroendocrinology; reproductive endocrinology; and endocrinology of metabolism and calcium homeostasis. It is expected that students have taken BIOL 0200 (or equivalent) and CHEM 0350.

BIOL 0320. Vertebrate Embryology.
Introduction to the developmental anatomy of vertebrate embryos, including humans, in an evolutionary context, through lecture, discussion and microscope slide study. Gametogenesis through germ layers and their organ system derivatives. Expected: BIOL 0200, or equivalent placement, or AP Biology score of 4 or 5. Limited to 18 freshmen and 18 sophomores. Students MUST register for the lecture section and the lab.

BIOL 0350. The Fossil Record: Life through Time on Earth.
Course is designed for students with prior background in geology or evolutionary biology and who want to learn more about the fossil record, the origins of modern biodiversity and ecosystem structure, and interaction between organisms, and the geological and chemical cycles on the Earth. Lectures will cover major time periods during which animals and plants lived, as well as focusing on major transitions in the evolution of life on Earth. This course will fulfill requirements in both the geology/biology and evolutionary biology concentrations. Expected: BIOL 0210, GEOL 0240 or equivalent. Instructor permission, enrollment limited to 20 sophomores/juniors; register for course/lab.

BIOL 0380. The Ecology and Evolution of Infectious Disease.
Infectious diseases remain among the leading causes of death worldwide, and this burden is disproportionately borne by children living in low- and middle-income countries. Thus management of infectious disease remains a critical intellectual challenge in the 21st century. This course will develop and apply ecological and evolutionary theory to infectious microbes (and their hosts) via the detailed examination of a number of case studies. This will be accomplished by a combination of lectures, discussions, and readings drawn mainly from the primary literature. Assessment will be based on biweekly problem sets, two midterms and one final exam. Expected: BIOL 0200, BIOL 0210 or equivalent.

Fall	BIOL0380	S01	10235	MWF	10:00-10:50(14)	'To Be Arranged'

BIOL 0390. Vertebrate Evolution and Diversity.
An overview of vertebrate evolution that not only covers historical events, but also introduces various scientific concepts and modes of thought. Topics include past and present biodiversity, convergent evolution, biogeography, competition, continental drift, climatic change over time, the notion of evolution as progress, and a whole-animal approach to understanding evolutionary events. Enrollment limited to 50.

BIOL 0400. Biological Design: Structural Architecture of Organisms.
Many questions about the workings of living creatures can be answered by joining math, physics, and biology. We will identify basic physical science concepts that help biologists understand the structure and function of animals, plants, and microorganisms, and use these to study how the physical world constrains and facilitates the evolution of the extraordinary design and diversity of organisms. For first and second year students; others by permission. Recommended background: BIOL 0200, or equivalent. Enrollment limited to 40. Instructor permission required.

BIOL 0410. Invertebrate Zoology.
A survey of invertebrate animals emphasizing evolutionary patterns and ecological relationships. Functional morphology, physiology, reproduction, development, and behavior of invertebrates will be examined. Laboratory exercises and two separate day-long field trips provide firsthand experience with the animals. Expected: BIOL 0200 or equivalent. Enrollment limited to 44. Students MUST register for the lecture section and a lab.

Fall	BIOL0410	S01	10236	TTh	9:00-10:20(05)	(P. Ewanchuk)
Fall	BIOL0410	L01	16809	W	1:00-3:50	(P. Ewanchuk)

BIOL 0415. Microbes in the Environment.
Examines the diversity of microbial life in the environment. Surveys key services that microbes perform on land and sea, including biodegradation of contaminants in the environment and ecosystem processes related to climate change. Examines biological interactions of symbioses, quorum sensing, and antibiotic production in a ecological context. Explores the genomic mechanisms explaining phylogeny and life history strategies in microbes. Demonstrate knowledge of the diversity of microbes in the environment and benefits in an ecological/evolutionary context. Lecture based, two fieldtrips to expand appreciation for microbial ecology. BIOL 0200 or equivalent placement; CHEM 0330. Enrollment limited to 20 sophomores, juniors and seniors.

BIOL 0420. Principles of Ecology.
The principles, concepts, and controversies involved in the study of the distribution and abundance of plant and animal populations and their integration into natural communities. Emphasizes interactions among organisms and the hierarchical nature of ecological processes affecting individuals, populations, and communities. Expected: BIOL 0200 (or equivalent) and MATH 0090. Lectures and weekly discussion.

Spr	BIOL0420	S01	20207	TTh	9:00-10:20(05)	(E. Caves)

BIOL 0430. The Evolution of Plant Diversity.
Examines the evolutionary history of plants from a phylogenetic perspective. Introduces the principles of phylogenetics and the use of phylogenies to understand organismal evolution. Highlights major trends in plant evolution over the past 400 million years. Lectures survey major plant lineages, with special focus on flowering plants. Weekly labs and assignments stress basic plant anatomy and morphology, identification, and learning to recognize and appreciate the abundance, diversity, and uses of plants in daily life. Expected: BIOL 0200 (or equivalent placement).

BIOL 0440. Inquiry in Plant Biology: Analysis of Plant Growth, Reproduction and Adaptive Responses.
This course focuses on what plants do and how they do it. Introduces the biology of plants, their growth and development, structural features, and their cellular and organismal responses to key stimuli. Examines physiological, reproductive and developmental strategies throughout the plant life cycle and in relation to environmental challenges. During laboratory section meetings, students pursue inquiry-based group research projects addressing novel questions about mechanisms that control plant growth and development. Laboratory section is required. Prerequisites: One Brown course with laboratory section in either Biology or Chemistry. Enrollment limited to 24 students.

BIOL 0450. Evolutionary Behavioral Ecology.
An exploration of the ecological and evolutionary principles that define animal behavior in the natural world. We will focus mostly on the field of behavioral ecology, including important phenomena like avoiding predators, obtaining food, finding mates, producing offspring, living in groups, and solving problems. In doing so, we will combine ideas and principles from the disciplines of ecology, systematics, physiology, and economics.

BIOL 0455. Coastal Ecology and Conservation.
Will enable to students to master fundamental ecological concepts and understand how this knowledge can be used to inform coastal conservation and management. Case studies from New England and elsewhere, field trips to rocky shores, salt marshes and coastal ecosystems enable students to develop scientific skills and experience the challenges of coastal conservation science. The course is aimed at freshmen and sophomores. Expected background: BIOL 0200 or equivalent placement. Enrollment limited to 10 students, and written permission required. Email (Mark_Bertness@brown.edu) to receive course application (due May 1). Admitted students register for the course in September.

BIOL 0460. Insect Biology.
Focuses on characteristics that make insects unique and why more insect species have been described than all other organisms combined; the opportunity to investigate diversity and adaptation; their abundance, small size, and short lifespans; their importance as agents of biocontrol pollination, agricultural pests, and disease vectors. Expected: BIOL 0200 or equivalent. Enrollment limited to 20. Students MUST register for lecture AND lab. Primarily for freshmen and sophomores.

BIOL 0470. Genetics.
We'll learn about genetic phenomena at the molecular, cellular, organismal, and population levels. Topics include: transmission of genes and chromosomes, mutation, structure and regulation of the expression of genes, genomics, genetic engineering, and evolutionary genetics. One laboratory session (mandatory) and several problem set solving sessions (optional) per week. Expected: BIOL 0200 (or equivalent placement). (Students should not plan to take BIOL 0470 after 1540.)

Fall	BIOL0470	S01	10211	TTh	10:30-11:50(13)	(M. Johnson)

BIOL 0480. Evolutionary Biology.
A broad introduction to the patterns and processes of evolution at diverse levels of biological organization. Topics covered include natural selection, adaptation, speciation, systematics, macroevolution, mass extinction events, and human evolution. Students will be given the opportunity to do their 23andMe ancestry analyses as a means of integrating the topics that span genomics to human variation. Weekly discussion sections involve active learning simulations and discussions of papers from the primary literature. Occasional problem sets involve computer exercises with population genetics and phylogeny reconstruction. Expected: BIOL 0200 (or equivalent placement).

Fall	BIOL0480	S01	10237	MWF	9:00-9:50(09)	'To Be Arranged'
Fall	BIOL0480	S02	16843	Arranged		'To Be Arranged'

BIOL 0495. Statistical Analysis of Biological Data.
A first course in probability distributions and the use of statistical methods for biological data. Topics covered will include describing data, statistical inference (hypothesis tests and confidence intervals), analyzing associations, and methods for categorical data (contingency tables and odds ratios). Methods will be applied to data drawn from areas of biological inquiry. For statistics or related science credit in Biology programs. Expected background: BIOL 0200 or equivalent, math equivalent to MATH 0100. This course is for related science credit only in Biological Sciences concentration programs.

Spr	BIOL0495	S01	26407	TTh	2:30-3:50(11)	(S. Ramachandran)
Spr	BIOL0495	C01	26409	M	6:00-8:00PM	(S. Ramachandran)
Spr	BIOL0495	C02	26410	T	8:00PM-10:00PM	(S. Ramachandran)
Spr	BIOL0495	C03	26411	W	6:00-8:00PM	(S. Ramachandran)

BIOL 0500. Cell and Molecular Biology.
This course examines the structure and function of the basic unit of an organism, the cell. An experimental approach is used to examine cellular functions, ranging from gene transcription, cell division and protein secretion, to cell motility, and signal transduction. Relevance to health and disease will be considered. Expected: BIOL 0200 (or equivalent advanced placement biology 4/5).

Spr	BIOL0500	S01	20184	MW	3:00-4:20(10)	(K. Mowry)

BIOL 0510. Introductory Microbiology.
Introduces role of microbes in our understanding of biology at the cellular and molecular level. Focuses on microbial significance for infectious disease, public health, genetics, biotechnology, and biogeochemical cycles. Laboratory involves basic microbiological techniques and selection and manipulation of microbes. Expected: BIOL 0200 (or equivalent placement). Students MUST register for the lecture section and the lab. Enrollment limited to 108.

Spr	BIOL0510	S01	20171	MW	3:00-4:20(10)	(A. Dugan)

BIOL 0530. Principles of Immunology.
Introduction to experimental and theoretical foundations of immunology. Focuses on concepts, landmark experiments and recent advances. Topics include innate and adaptive immunity; structure/function of antibody molecules and T cell receptors; regulation of immune responses through cellular interactions. Applications of concepts to medically significant issues (vaccines, transplantation, inflammation, autoimmunity, cancer, HIV/AIDS) are discussed. Interpretative analysis of experimental data is emphasized. Expected background: BIOL 0200 or equivalent placement credit.

Fall	BIOL0530	S01	10197	TTh	2:30-3:50(12)	(A. Dugan)
Fall	BIOL0530	C01	16849	Su	12:00-12:50	(A. Dugan)
Fall	BIOL0530	C02	16850	Su	2:00-2:50	(A. Dugan)
Fall	BIOL0530	C03	16851	M	6:00-6:50	(A. Dugan)
Fall	BIOL0530	C04	16852	M	7:00-7:50	(A. Dugan)
Fall	BIOL0530	C05	16853	M	8:00PM-8:50PM	(A. Dugan)
Fall	BIOL0530	C06	16854	T	7:00-7:50	(A. Dugan)
Fall	BIOL0530	C07	16855	T	8:30PM-9:20PM	(A. Dugan)
Fall	BIOL0530	C08	16856	W	6:00-6:50	(A. Dugan)
Fall	BIOL0530	C09	16857	W	7:00-7:50	(A. Dugan)
Fall	BIOL0530	C10	16858	Th	6:40-7:30	(A. Dugan)
Fall	BIOL0530	C11	16859	Th	7:00-7:50	(A. Dugan)
Fall	BIOL0530	C12	16860	Th	8:00PM-8:50PM	(A. Dugan)

BIOL 0600. Genetic Screening in Model Organisms.
Using gene silencing (RNAi) in the nemotode C. elegans, students will identify genetic modifiers of proteins with roles in aging by reverse genetics. Analyzing the effect of knocking down genes on the level of aging-related proteins tagged with fluorophores (GFP, RFP, etc.). Students will use function-specific RNAi libraries (transcription factors, kinases, etc) established in our lab. Students will evaluate the effect of genetic modifiers on proteostasis and lifespan, also familiarize C. elegans work and appreciating the use of model organisms, the students will master microscopy, genetic crosses, gene silencing, and molecular and biochemical readout assays such as qPCR and immunoblotting. Expected: BIOL 0200 or equivalent.

BIOL 0610. Modeling Human Disease Using Stem Cells.
In this COEX and CBLR course, students will have the opportunity to develop their own hypothesis-driven research question with a focus on pluripotent stem cell biology and Alzheimer's Disease (AD). Understanding how to manipulate pluripotent stem cells is vital in studying normal developmental processes and what goes awry in a disease. Students in this course will propose and carry out their own research project utilizing human iPSCs to further understand pathological cellular states associated with AD using patient lines. The research project will be developed at the beginning of the semester with in-lab work carrying out the proposed set of experiments, analyzing the data and presenting the results in a scientific poster session. Students will also be able to translate the biology of the disease to clinical experiences, community outreach, and patient interactions in the surrounding community. For advanced undergraduates.

Spr	BIOL0610	S01	20306	WF	1:00-4:00	(C. Toth)

BIOL 0620. Fermentation to Publication: Experimental Food Microbiology.
Fermentation is a natural metabolic process crucial in food production worldwide. To understand the art and science of fermentation, we need to delve into the complex interplay of polymicrobial communities, where multiple microbial species interact, collaborate, and compete to produce the fermented product. In this CURE (Course-based Undergraduate Research Experience) class, students will jointly conduct a novel research project on the role of polymicrobial communities in fermentation. Each year, we will conduct new experiments to answer an innovative scientific question. They will then run data analysis and draft a paper for publication. In addition to the lab and writing component, the class will incorporate a lecture-based session and student-led presentations about the science/research of other types of fermented foods. The class will culminate in a written final project where students will propose and outline a novel experiment for next year.

Spr	BIOL0620	S01	26567	TW	1:00-2:30	(P. Belenky)

BIOL 0800. Principles of Physiology.
Introduction to the function of organ systems with an emphasis on human physiology, includes basic concepts in cell and organ system physiology as well as fundamentals of modern trends in physiological science, emphasizes the application of physical and chemical principles to organ function at both the cellular and systemic levels. Expected: BIOL 0200 or equivalent.

Spr	BIOL0800	S01	25420	TTh	10:30-11:50(09)	(J. Stein)

BIOL 0860. Diet and Chronic Disease.
This course addresses the relationship of food to the development and treatment of chronic diseases. Chronic diseases discussed are obesity, dyslipidemia/heart disease, diabetes mellitus, cancers and osteoporosis. Dietary recommendations for these diseases are critically assessed. Geared toward students interested in nutrition, medicine, and public health. Prerequisites: BIOL 0030, plus permission of the instructor. Enrollment limited to 20.

BIOL 0920A. Controversies in Medicine.
Why and how do controversies in medicine emerge at specific moments in time? Why do scientists come to different conclusions based on the same data? Does it matter how we interpret controversies? This sophomore-level seminar critically analyzes contemporary controversies in medicine and public health. Using a case study approach, we will examine the social and political assumptions that inform important controversies. Questions related to the relationship between science, media, activism, and health inequality will be woven into the case studies. Enrollment limited to 20 sophomores. (For theme, not biology, credit in Health and Human Health and Biology only.)

BIOL 0940A. Viral Epidemics.
This sophomore seminar will examine epidemics (outbreaks) of viral infections from a historical perspective. We will also cover current literature and up to the minute news accounts of infectious disease related outbreaks occurring around the globe. The major focus will be on virus related diseases but any microbial outbreak in the news will be explored. The seminar will cover basic aspects of microbial pathogenesis so students can gain an appreciation of microbial host interactions. Essential writing skills will also be developed. Enrollment limited to 20 sophomore students.

Fall	BIOL0940A	S01	10214	Th	4:00-6:30(04)	(W. Atwood)

BIOL 0940B. Sophomore Seminars in Biology: Life in a Shell.
This Sophomore seminar is an examination of broad themes in whole animal physiology with an emphasis on environmental adaptations. The foundation of the course will be the instructor's recent book "Life in a Shell: A Physiologist's View of Turtle." A consideration of this iconic animal's novel biological traits will lead into comparisons with our own biology and that of other animals. Topics: respiration, circulation, metabolic rate, buoyancy control, overwintering, migration, reproduction, and bone structure and function. Relevant original research papers will be used. Mandatory S/NC; enrollment of 20 students; override required. Expected: BIOL 0200 or equivalent placement credit.

BIOL 0940C. Sophomore Seminar: Insect Biology.
Focuses on characteristics that make insects unique and why more insect species have been described than all other organisms combined; the opportunity to investigate diversity and adaptation; their abundance, small size, and short lifespans; their importance as agents of biocontrol pollination, agricultural pests, and disease vectors. Expected: BIOL 0200 or equivalent. Enrollment limited to 12 sophomores only. Students MUST register for lecture AND lab.

BIOL 0940D. Rhode Island Flora: Understanding and Documenting Local Plant Diversity.
This Sophomore Seminar focuses on species level identification of plants in Rhode Island and will cover the dominant plant species in each of the state's main habitats including coastal wetlands and uplands, freshwater wetlands, peatlands, upland forests, and disturbed areas. Students will learn to identify plants using online interactive keys as well as more technical dichotomous keys and will also cover basic ecological processes in each habitat including the interaction of soils, geology, and hydrology. Materials related to plant morphology, plant taxonomy, plant evolution, understanding phylogenetic trees, and botanical illustration. Instructor permission required.

Fall	BIOL0940D	S01	10238	F	1:00-5:00	(R. Kartzinel)

BIOL 0940E. Precision Medicine or Privileged Medicine? Addressing Disparities in Biomedical Research.
This course examines the biomedical research behind precision medicine, disparities in the inclusiveness of this research, and implications of these disparities for the relevance of precision medicine innovations for people and places in Rhode Island. We will focus on these four questions: What new knowledge is making precision medicine possible? Who has been the focus of the biomedical research generating this knowledge, and why? How might inclusiveness of this research impact healthcare disparities in Rhode Island? What is needed to improve the design and outcomes of precision medicine research so that it provides benefits and mitigates harms for all?

BIOL 0940G. Antibiotic Drug Discovery: Identifying Novel Soil Microbes to Combat Antibiotic Resistance.
This is a Course-based Undergraduate Research Experience (CURE) class that will provide students with the chance to propose, design and conduct their own research projects. Antibiotic resistance is a major global health threat. Pharmaceutical companies are less likely to fund research and development of new antibiotics due to their relative low profitability. As bacteria become more resistant to antibiotics, it is critical that we have a robust pipeline ready to combat these pathogens. The main focus of the course will be for students to discover new antibiotics in soil bacteria that can be used to treat infectious disease. Please NOTE: This course carries Biology concentration credit for the laboratory component, and also can be used for 1 semester of research towards the Biology ScB.

BIOL 0945. Toolbox for Scientific Research.
Why is scientific research important? What is the scientific method? What are hypotheses and theories? How do scientists identify research questions, design experiments, fund research, and communicate results? This sophomore seminar is designed for students who want to understand and engage in scientific research in biology. Through active learning seminars, group discussions, and meetings with scientists, students will gain a deeper understanding and an appreciation for the principles, practice, and culture of scientific research. The course will also help develop practical and transferable skills to succeed in research and give students an opportunity to connect with research groups at Brown.

BIOL 0946. Research Design + Quantitative Methods for the Health Sciences.
This is a course offered for students in one of Brown University's Biology concentrations that provides the skills necessary to identify a clinical research question from a case scenario, design a research design to answer a research question, identify the appropriate quantitative methods for the design, and interpret the results. These skills translate to almost any research experience, including honors theses and future endeavors. Students will also learn how to publish in oral and written formats across the health sciences disciplines.

Fall	BIOL0946	S01	10208	W	3:00-5:30(10)	(K. Monteiro)

BIOL 0960. Independent Study in Science Writing.
BIOL 0960 (fall/spring) is a half credit Independent Study in Science Writing course incorporating a nontechnical science journalism component into the Biology curriculum. Assignments may include investigative or analytical reviews, or feature articles on ethical or social impacts of new discoveries in the biological sciences. BIOL 0960 requires the submission of a formal project proposal completed collaboratively by the student and faculty mentor (see the Biology Undergraduate Education research page for details). BIOL 0960 is not for concentration credit in the biological sciences programs.

BIOL 0985. Greenhouse Crops & Interiorscapes.
This is an applied-knowledge course designed to prepare students to be introduced to the management of greenhouse operations and basic interiorscaping design & practices. This course covers principles of greenhouse structures, plant health and growth, growing media, greenhouse crop selection and propagation, and management techniques. Upon completion of this course, proficient students will be equipped with the technical knowledge and skills needed to prepare in furthering their education. This course will focus on introducing students to the greenhouse space and teach them how the facility aids in producing plants for research and for enjoyment. The course will also explain general propagation techniques and the world of interiorscaping, and how to grow the plants used for this purpose, as well as exploring basic interiorscape design. The course does not carry Biology concentration credit.

BIOL 1000. Quality Improvement Science and Application: From personal improvement to strengthening healthcare.
Have you ever set a goal, tried to accomplish it, failed, adjusted your routine, and tried again? If so, you have already engaged in quality improvement (QI)! QI is focused on how change is implemented in healthcare and in other settings (such as aerospace) with the goal of standardizing processes and reducing variation. QI is achieved through setting specific, measurable goals and making small, iterative changes; all while implementing and evaluating change. If you want to learn how to implement a change, sustain that change over time, and measure success, this course is for you. The project provides an opportunity to engage in QI in your life to implement and evaluate progress on a goal that is important to you (e.g., drinking more water, practicing better time management skills).

BIOL 1040. Bioimaging.
This course examines microscopy and image analysis in the life sciences. Theoretical and practical aspects of microscopy will be discussed. Students will obtain hands-on experience with electron microscopy, light microscopy, fluorescence microscopy, and confocal microscopy. Students will learn to display images in 3D. Advanced undergraduates. Instructor permission required.

Spr	BIOL1040	S01	20185	M	2:00-5:00	(G. Williams)

BIOL 1050. Biology of the Eukaryotic Cell.
This course examines subcellular processes and structure/function roles of macromolecular complexes regulating major cellular activities in eukaryotic cells. Course content will cover cellular and molecular techniques in cell biology, functions of cellular compartments, and the organization and expression of genetic information in eukaryotes, comparing normal and pathological states. Lectures and readings will emphasize the experimental basis for knowledge in modern cell biology using original literature and current research in cell/molecular biology. You will learn to read and analyze published research as well as master current concepts and understanding of cellular structure and function. You will then apply this mastery to propose an original research project that would advance those understandings. For advanced undergraduates and beginning graduate students. Complementary to BIOL 1270 and 1540. Prerequisites: BIOL 0280 or 0470 or 0500, or instructor permission. Graduate students register for BIOL 2050.

Fall	BIOL1050	S01	10336	TTh	1:00-2:20(06)	(C. Toth)
Fall	BIOL1050	C01	18838	Th	12:00-12:50	(C. Toth)

BIOL 1070. Biotechnology and Global Health.
This course examines contemporary biotechnologies used to combat the predominant, worldwide problems in human health. Global health will be addressed from the scientific and engineering perspectives while integrating public health policy, health systems and economics, medical and research ethics, and technology regulation and management. This course is intended for graduate and advanced undergraduate students in biology, engineering, or related fields who have an interest in global health initiatives. Expected background: BIOL 0200 and BIOL 0800, or equivalents. Preference will be granted to graduate students in the Biotechnology and Biomedical Engineering programs. Only for related course credit in Biology. Enrollment limited to 20. Instructor permission required.

Fall	BIOL1070	S01	10204	TTh	9:00-10:20(05)	(J. Schell)

BIOL 1090. Polymer Science for Biomaterials.
Basic principles of polymer science and its application in medicine. Topics include basic polymerization chemistry, kinetics of polymerization and depolymerization with emphasis on bioerodible polymers, characterization of polymers by physical methods, bulk and surface properties, behavior of polymers in solutions, crystallization, gelation, and liquid crystals. Hands-on experience with polymer characterization. Expected: CHEM 0350. Enrollment limited to 25.

Fall	BIOL1090	S01	10333	T	1:00-4:00	(E. Mathiowitz)

BIOL 1100. Cell Physiology and Biophysics.
Current topics in cell physiology, with an emphasis on membrane-mediated interactions between cells and their environment. Topics may include: ion channel structure, function and regulation; intracellular regulatory molecules; mechanisms of sensory transduction; membrane receptors and second messenger systems; vesicle secretion; and cytoskeletal regulation of cell function. Lectures, discussion, and student presentations of the current literature. Expected: BIOL 0800 or NEUR 0010. Instructor permission required. **Enrollment limited to 30, and admission is based on seniority -- graduate students, seniors, then juniors. (Not for first and second-year undergraduates.) Students must request an override code through C@B.**

Fall	BIOL1100	S01	10339	M	3:00-5:30(03)	(A. Zimmerman)

BIOL 1110. Topics in Signal Transduction.
Signal transduction is one of the most rapidly developing fields in biomedical sciences. Defects in signaling pathways can be responsible for diseases such as cancer, diabetes, cardiovascular disorders and psychoses. This course offers students an overview of the molecular pathways that allow cells to receive and process signals from their external environment, with an emphasis on the emerging state-of-the-art techniques used in their study. Expected background: BIOL 0200, 0280, 0470, or 0500.

Fall	BIOL1110	S01	10207	W	3:00-5:30(10)	(E. Oancea)

BIOL 1120. Biomaterials.
A biomaterial is defined as a material suitable for use in medical implants that come in direct contact with patients' tissues. These include polymers, metals, and ceramics, and materials obtained from biological sources or through recombinant biotechnology. Goal: to provide comprehensive coverage of biomaterial science and technology. Emphasizes the transition from replacement to repair strategies. For advanced undergraduates and graduate students. Prerequisite: BIOL 0800 or instructor permission.

BIOL 1140. Tissue Engineering.
Tissue engineering is an interdisciplinary field that incorporates progress in cellular and molecular biology, materials science, and engineering, to advance the goal of replacing or regenerating compromised tissue function. Using an integrative approach, we will examine tissue design and development, manipulation of the tissue microenvironment, and current strategies for functional reconstruction of injured tissues. Expected: CHEM 0330, plus BIOL 0500 or 0800. Enrollment limited to 20. Instructor permission required.

BIOL 1150. Stem Cell Engineering.
Stem cell engineering focuses on using adult, embryonic, and induced pluripotent stem cells to repair damaged or diseased tissues. This course will examine the role of stem cells in development, tissue homeostasis, and wound healing, as well as how they can be used for tissue engineering and cell-based regenerative therapies. We will also discuss the ethical, legal, and regulatory issues that accompany current and emerging stem cell engineering endeavors. The course will use an inverted lecture and classroom discussion format to effectively deliver relevant information. Emphasis is placed on oral and written communication skills applied to assignments, tests, and individual projects. As an additional part of this course, students will receive hands-on training in how to culture cells and assess samples for stemness characteristics in a group laboratory setting.

Spr	BIOL1150	S01	20202	Th	3:00-5:30	(E. Darling)
Spr	BIOL1150	L01	25421	F	9:00-12:00	(E. Darling)

BIOL 1155. Hormones and Behavior.
This class will explore the hormonal basis of animal behavior. We will assess this relationship at the molecular, cellular, physiological, and evolutionary levels, focusing on a wide range of species beyond humans. Our goal is to understand the diverse mechanisms by which hormones act throughout the animal body to mediate what individuals do in their natural environment. We will explore how selective forces shape these mechanisms to not only arrive at common behavior traits, but also unique and unusual traits that allow species to thrive in harsh or extreme environments.

Spr	BIOL1155	S01	20209	MW	8:30-9:50(02)	(M. Fuxjager)

BIOL 1160. Principles of Exercise Physiology.
Application of the basic principles of physiology to the study of the response mechanisms of the human body during exercise. Topics include muscle and neural control, energy metabolism, cardiovascular and respiratory effects, endocrinology, principles of training, and special topics (e.g., diving, high altitude, and microgravity). Student presentations based on scientific articles are included.

Fall	BIOL1160	S01	16805	MWF	11:00-11:50(16)	(A. Smith)

BIOL 1180. Comparative Animal Physiology.
Comparative approach to the function and regulation of animal systems with an emphasis on vertebrates. Topics include circulation, gas exchange, neuromuscular function, excretion, acid-base and ion regulation, and temperature regulation. Considers the unity and diversity of physiological processes in animals differing both in phylogeny and environmental adaptation. Original papers are discussed. Expected: BIOL 0800 or equivalent.

BIOL 1190. Synaptic Transmission and Plasticity.
Synapses are the means by which the nervous system communicates. In this seminar-style course, we will explore the molecular and physiological underpinnings of synaptic transmission. We will then examine ways in which synapses can modulate their strength during development, learning, after addictive drugs, and other adaptive processes. Readings are ONLY from primary literature. Course recommended for juniors and seniors. Required: NEUR 1020. Enrollment limited to 20. Instructor's permission required, attendance at class on the first day is mandatory.

BIOL 1200. Protein Biophysics and Structure.
Structural Biology is the science to determine 3-dimensional structures of biomacromolecules (i.e. proteins, RNA, and DNA). These structures enable biologists to understand and explore their function. Since proteins, RNA, and DNA are the primary molecules of life, structural biology enables us to understand and influence these molecular machineries which form the basis of all biological processes. Throughout the class, the students will see examples of biologically important proteins and protein complexes that will allow them to correlate structure and biological function. Prerequisite: BIOL 0280.

BIOL 1210. Synthetic Biological Systems.
A multidisciplinary course that combines science and engineering providing a solid foundation in a cutting edge field of biological engineering. Synthetic biology is a mixture of biology, chemistry, engineering, genetic engineering and biophysics. It builds on recent work in systems biology which involves the modeling of biological systems, but goes further in that it involves the construction and standardization of biological parts, that fit together to form more complex systems. Expected: at least four courses beyond BIOL 0200, CHEM 0330, PHYS 0300, ENGN 0300, MATH 0900, or CSCI 0040.

BIOL 1220. Synthetic Biological Systems in Theory and Practice.
A multidisciplinary laboratory, lecture, and discussion based course that combines several areas of science and engineering providing a foundation in the cutting edge field of synthetic biological engineering. The field of synthetic biology is centered around trying to make biology easier to engineer. It builds on recent work in systems biology which involves the modeling of biological systems, but goes further in that it involves the construction and standardization of biological parts that fit together making complex systems. This course will combine classes, guest lectures and discussion lab visits to give students the best possible tools for understanding and applying research in synthetic biology. Expected: at least two courses in any of the key disciplines (biology, chemistry, physics, math, engineering, computer science) beyond the introductory level, and permission of the instructor.

BIOL 1222A. Current Topics in Functional Genomics.
A technological revolution in genomics has exponentially increased our ability to gather biological data. A host of new methods and types of analysis has arisen to accommodate this dramatic shift in data collection. The broad scope of inquiry has ushered in an era of “system-wide” approaches and brute-force strategies where rare signals can be detected and studied. In this seminar we will cover papers that embody this new approach. Students typically have taken an advanced undergraduate-level course in biology.

Fall	BIOL1222A	S01	18652	T	3:00-5:30	(E. Larschan)

BIOL 1250. Host-microbiome Interactions in Health and Disease.
Will focus on current understanding of how various microbiomes communicate and interact with the host and the factors that influence these interactions. We will discuss how the new technologies such as metagenomics and metabolomics have enhanced our understanding of host-microbiome interactions in health and disease. Students will have the opportunity to participate in discussions on how to apply recent discoveries to disease processes, health restoration and maintenance. The course will help students develop skills in critical thinking and in reading and evaluating original scientific literature. Expected: students with a background in basic microbiology (BIOL 0530 or its equivalent). 20 enrollment.

Spr	BIOL1250	S01	20172	Th	2:00-4:30	(P. Belenky)

BIOL 1255. Climate Change & Health: Infections and Inequalities.
This course examines the connections between people, animals, plants and their shared environment to highlight the influence of climate change on infectious disease and its disproportionate effect on impoverished communities. During the course, we will spotlight a several infectious diseases (HIV, Rabies, Ebola, Chagas), exploring their history, pathophysiology and geographic spread. We will discuss how climate change has influenced ecosystems, causing shifts in transmission and creating new challenges for treatment. We will use a biosocial approach to understanding how and why these changes disproportionately affect impoverished communities. You will learn using podcast episodes, news articles, research studies and documentaries. Several guest speakers will supplement course materials and guide activities. This course offers the opportunity to learn about climate change & health using a One Health and biosocial approach.

BIOL 1260. Physiological Pharmacology.
Covers the physiology of human disease (e.g., Heart failure and arrhythmia; cancer signaling pathways with a focus on breast cancer; neurological disorders such as schizophrenia and Parkinson's disease) and discusses the pharmacology of the drugs used to treat disease. A group of the most commonly prescribed drugs is discussed in terms of their fundamental modes of action and clinical importance. Expected: BIOL 0800.

Fall	BIOL1260	S01	10215	TTh	10:30-11:50(13)	(J. Marshall)
Fall	BIOL1260	S02	10216	Arranged		(J. Marshall)

BIOL 1270. Advanced Biochemistry.
An advanced course in biochemistry, biochemical methods, and reading of the primary literature, featuring systematic coverage of the biochemistry of the central dogma, including DNA (replication, repair, recombination), RNA (regulation and mechanism of transcription, processing, turnover), and proteins structure, synthesis, modification, degradation, mechanisms of action, function). Expected: BIOL 0280, CHEM 0350, 0360. Graduate students register for BIOL 2270.

Fall	BIOL1270	S01	10218	TTh	2:30-3:50(12)	(A. Salomon)

BIOL 1290. Cancer Biology.
Provides a conceptual understanding of molecular events underlying development of human cancer. Focused on genetic changes leading to malignant transformation of cells. Covers cell cycle control, DNA damage, mutagenesis, cancer predisposition syndromes, oncogenic viruses, tumor immunology, metastasis, cancer chemotherapy and drug resistance. Lecture plus discussion of primary literature. Prerequisites: BIOL 0280 OR BIOL 0470 OR BIOL 0500.

BIOL 1295. Fundamentals of Cancer Immunotherapy.
Fundamentals of Cancer Immunotherapy focus on how are understanding of the relationship of cancer with the host immune system has allowed the development of a new generation of therapies. The course will be delivered by lecture/seminar and group discussions. The course covers contemporary knowledge of tumor-immune cell interactions, and the principles of immunotherapeutic approaches currently being applied in the clinic and in development. The course is designed so that students will view cancer immunotherapy through a range of different lenses; from intricate molecular details to cellular ecosystems and organismal effects. Lecture materials will provide detailed descriptions of the basic concepts involved and original research articles will be used to help develop critical thinking in the cancer immunotherapy field.

Recommended Prerequisites: At least two of the following or their equivalents: BIOL 0280, BIOL 0500, BIOL 0470, BIOL 0530, BIOL 1290

BIOL 1300. Biomolecular Interactions: Health, Disease and Drug Design.
Interactions between the molecules of life-proteins, RNA, DNA, membrane components-underlie all functions necessary for life. This course focuses on how nature controls these interactions, how these interactions can go awry in disease, and how we can learn the rules of these interactions to design drugs to treat disease. Students will review the physical basis of molecular interactions, learn classic and state-of-the-art high-resolution and high-throughput tools used to measure interaction, and survey the experimental and computational strategies to harness these interactions using a case study in rational drug design. Prerequisite: Introductory Biochemistry (BIOL 0280). Enrollment limited to 20; instructor permission.

Fall	BIOL1300	S01	10220	M	3:00-5:30(03)	(N. Fawzi)

BIOL 1310. Developmental Biology.
Covers the molecular and cellular events of development from fertilized egg to adult. Genetic basis of body form, cell fate specification and differentiation, processes controlling morphogenesis, growth, stem cells and regeneration will be examined. Differential gene regulation, intercellular signaling and their evolutionary conservation will be central to discussion of mechanisms governing developmental processes. Additional topics: developmental plasticity, impact of epigenetic and environmental factors, and basis of disease gleaned from developmental biology research. Live embryos will complement and reinforce concepts covered in class. Enrollment limited to 36. Expected: BIOL 0200 (or equivalent), and one course in genetics, cell biology or embryology.

BIOL 1330. Biology of Reproduction.
This course is an advanced, seminar-based course. Primary literature is emphasized to complement the format of extensive student seminar presentations. It is essential that students have a strong background in biology in order to gain the most from this course. The emphasis of the course is student seminar presentation and extensive discussion on the material. This is often the first opportunity for students to present/discuss science in a seminar format. Expected background: a course in Cell Biology (e.g. BIOL 0500 or 1050), and two additional Biology courses above the introductory (BIOL 0200) level. Enrollment limited to 20.

Spr	BIOL1330	S01	20189	M	3:00-5:30(13)	(G. Wessel)

BIOL 1410. Evolutionary Genetics.
This course will focus on selected topics in molecular population genetics, molecular evolution, and comparative genomics. Classic and current primary literature at the interface of evolution and genetics will be discussed in a seminar format. The laboratory involves wet-lab exercises (allozymes, PCR- RFLP, sequencing), plus computer labs using DNA analysis packages. Students will prepare a final grant proposal on specific research interests. Expected: BIOL 0470 or 0480. Students MUST register for the lecture section and the lab. Enrollment limited to 20.

BIOL 1420. Experimental Design in Ecology.
An overview and discussion of the basic principles used to design lab and field experiments in ecology and environmental science. Topics include: replication and statistical power, appropriate use of factorial designs, nonparametric methods, post hoc texts, natural versus manipulative experiments, experimental artifacts and impact study design. Discussions based on primary literature and a new text. Expected: BIOL 0420.

BIOL 1425. Phylogenetic Biology.
This course is the study of the evolutionary relationships between organisms, and the use of evolutionary relationships to understand other aspects of organism biology. This course will provide a detailed picture of the statistical, mathematical, and computational tools for building phylogenies and using them to study evolution. Enrollment is by instructor permission. Students will present scientific papers in class and complete a final project consisting of their own phylogenetic analysis. Expected Background: Evolutionary Biology and quantitative methods (such as statistics, computation, or math). Open to juniors, seniors, and graduate students. Enrollment limited to 16.

BIOL 1430. Foundations of Population Genetics.
Population genetics considers the genetic basis of evolution: temporal changes in the genetic composition of populations in response to processes such as mutation, natural selection and random sampling effects. Starting from first principles, this course will develop a theoretical understanding of these dynamics. We will also explore the application of these tools to genomic-scale data in order to quantify the influence of various evolutionary processes at work in natural populations. Assessments will be based on problem sets, two midterm exams and one final exam. Prerequisites: MATH 0100 and one of BIOL 0470 or 0480, or permission.

Fall	BIOL1430	S01	10239	MWF	11:00-11:50(16)	(D. Weinreich)

BIOL 1435. Computational Methods for Studying Demographic History with Molecular Data.
This course broadly covers the field of population genetics and genomics, and focuses on how inferences about demographic history can be made from genetic variation observed across populations today. The main question we will endeavor to answer in class is “How can we infer demographic history in a population using next-generation sequencing data?” Students will also learn how to apply computational tools/ methods to infer demographic history using both simulated and real DNA sequencing data.

Spr	BIOL1435	S01	20210	Arranged		(E. Huerta-Sanchez)

BIOL 1440. Coral Reef Ecology.
An examination of current topics in the biology of corals and the ecology and conservation of coral reefs in the Anthropocene. The seminar course sessions include an introductory lecture on the topic at hand coupled with discussion of assigned papers in the recent scientific literature. The course follows ecological principles to examine key species interactions, biodiversity patterns and consequences, trophic dynamics, pathways of resilience and regime shifts on coral reefs. This foundation builds the knowledge needed for advanced discussions of the effect of global climate change on coral reefs during the latter part of the course. Students select a contemporary topic to investigate and prepare a critical evaluation of research on that topic as a final term paper.

BIOL 1445. Medicine in Austere Settings.
This course examines the practice of medicine in austere settings and will include content related to tropical medicine/neglected tropical diseases, humanitarian relief, disaster management and wilderness medicine. Students will explore the history of these fields and the challenges that medical professionals face in these environments. It will focus on the multitude of ethical dilemmas when providing care in austere settings. Students should expect to think critically about challenging questions and learn various skills useful to the practice of medicine in austere settings, including basic epidemiology, public health coordination, disaster management and wilderness medicine techniques. Each week will feature a different scenario to tackle. Students will learn using podcast episodes, news articles, research studies, and documentaries. This course is well-suited for students who are interested in public health, international health policy or aim to pursue a career as a medical professional.

BIOL 1450. Community Ecology.
This course will explore foundational concepts in community ecology, and will draw on examples and case studies from marine and terrestrial ecosystems, including species-rich tropical rain forests and coral reefs, the marine intertidal and benthic environments, and species-poor forests and grasslands of the temperate zone. Overarching themes will emphasize theoretical frameworks to understand the evolutionary origins and maintenance of this biological diversity. This will be accomplished using traditional lectures, weekly student-led discussions, readings of the primary literature, and class activities. Expected background: BIOL 200 or equivalent placement; and BIOL 0420; OR instructor permission.

BIOL 1455. Planetary Health: Global Environmental Change and Emerging Infectious Disease.
Will a warmer world be a sicker world? What is it about the New England landscape that supports the proliferation of Lyme Disease? How are local wildlife trade and global species invasions contributors to emerging diseases like the 2003 outbreak of monkeypox virus in the USA? We will explore these and related questions in Planetary Health. Planetary health is a timely new field focused on understanding the human health implications of human-caused disruptions to Earth's natural systems. The facet of ‘health’ that we focus on in this course is infectious disease. Students will learn how, when, where and why infectious diseases emerge in association with anthropogenic environmental impacts, specifically climate change, land-use change, and increased human interaction with animals. This course satisfies the Health and Human Biology senior capstone requirement for students studying in the planetary health theme.

BIOL 1465. Human Population Genomics.
An introduction to human genomics and the evolutionary forces that shape observed genetic variation across humans today. Topics will include the relationship among humans and other primates, human population genetics and genomics, and examples of the concomitant evolution of both cultural traits and domesticated organisms. Assignments include a class presentation and reviewing papers on a selected topic. Expected background: BIOL 0470 or 0480, and BIOL 0495, PHP 2500, or equivalent. Enrollment limited to 25. Instructor permission required.

Fall	BIOL1465	S01	10241	TTh	2:30-3:50(12)	(E. Huerta-Sanchez)

BIOL 1470. Conservation Biology.
Conservation Biology is the scientific study of the phenomena that affect the maintenance, loss, and restoration of biological diversity. Topics covered include: 1) the impacts of global warming, species invasions, and habitat destruction on biodiversity, 2) strategies developed to combat these threats, and 3) a consideration of key economic and ethical tradeoffs. Special attention will be paid to current debate and controversy within this rapidly emerging field of study.

Fall	BIOL1470	S01	10242	TTh	9:00-10:20(05)	(D. Sax)

BIOL 1480. Terrestrial Biogeochemistry and the Functioning of Ecosystems.
Three fundamental multidisciplinary questions will be addressed: How do ecosystems work? What limits the growth of life on Earth? How are humans altering the framework in which all life exists? Earth is basically a closed chemical system, and the reactions that support life are fueled by sunlight. But added to this chemistry and physics is the tremendous influence of life. Life created an oxygen atmosphere; the evolution of biological nitrogen fixation exponentially increased how many organisms could exist, and the soils that support human food production developed only by biologically-mediated processes. Throughout Earth's 4.5 billion-year history changes in Earth's basic biogeochemical processes have been fairly slow. Under our inattentive stewardship, we have almost instantaneously altered all of the major element cycles. We will focus heavily on what these changes mean for life on Earth. Instructor permission required.

BIOL 1485. Climate Change Health and Ecology.
Explore the linkages between climate change and health. Students will come to appreciate the topic through the foundations of the primary disciplines relevant to the field including global health, environmental change, disease ecology, and others. Climate-health linkages will be learned through weekly case studies addressed collectively through student-centered lectures, discussion of the primary literature, groups activities and guest lectures from campus faculty on topics ranging from climate migration to infectious disease range shifts. Expected background: BIOL 0475, or BIOL 1470, or PHP 1070, or PHP 1920, or equivalent experience with instructor's permission. Enrollment limited to 12 juniors and seniors.

BIOL 1495. 500 Million Years of Land Plants.
Explores the evolution of terrestrial plants and the ecosystems they structure. Introduces the fossil record of plants and basic patterns of plant diversification on land. Highlights major trends in the evolution of plant morphology, anatomy, and ecology. Lectures survey the diversity and community structure of different geological time periods. Weekly discussion sections, field trips, and assignments examine major evolutionary trends, particularly with regard to climatic changes over time. Expected: BIOL 0400, BIOL 0430, (or equivalent placement). Enrollment limited to 15 students; instructor permission; register for section and conference.

BIOL 1500. Plant Physiological Ecology.
An in-depth look at plant ecological strategy, focusing on the anatomical and physiological adaptations of plants to particular environments. Additional topics include plant-animal interactions, historical biogeography, and community assembly processes. A comparative, phylogenetic approach is emphasized. Lectures present a broad overview of topics, and discussions focus on current outstanding problems. Lab exercises provide hands-on experience in designing experiments, measuring plant performance, and scientific writing. Required laboratory hours to be arranged by the instructor. Expected: BIOL 0430 or BIOL 0440. Enrollment limited to 15.

BIOL 1505. Environmental Physiology.
This course seeks to explore the physiological mechanism by which animals are adapted to live in our planet’s diverse habitats. We study this topic by considering the physical and chemical properties of the environment, and how these properties shape the organismal functioning and performance. No animal is off limits to our exploration, as we will look at both vertebrates and invertebrates alike. Overarching themes will emphasize the power of natural selection as an evolutionary force that writes the “rules” of life, particularly in terms of survival.

BIOL 1515. Conservation in the Genomics Age.
The course will introduce students to the rapidly developing field of molecular ecology, emphasizing its importance for conservation biology. Students will explore key principles in evolutionary ecology based on readings, lectures, and discussions. Participants will also gain practical experience with ecological, genomic, and computational methods in the lab. This course is intended for advanced undergraduate and graduate students. Suggested prerequisites include Principles of Ecology (0420); Evolutionary Biology (0480) or Genetics (0470); the Lab Techniques Workshop for Biology Students provided by MDL; or similar with permission. Students will obtain permission from the professor to enroll.

BIOL 1520. Innate Immunity.
Innate immunity is the initial response to microbes that prevents infection of the host. It acts within minutes to hours, allowing the development of the adaptive response in vertebrates. It is the sole mechanism of defense in invertebrates such as insects. The components and mechanisms dictating this response are explored. Prerequisite: BIOL 0530. Enrollment limited to 30. Graduate students must obtain instructor permission.

Fall	BIOL1520	S01	10198	MW	8:30-9:50(09)	(L. Brossay)

BIOL 1525. Pathogenomics: Analysis, interpretation and applications of microbial genomes.
Pathogen genomes offer a wealth of information—from the discovery of new gene functions to helping to pinpoint the source of a food borne disease outbreak—and have become an increasingly widespread tool in microbiology in recent years. This course will introduce the fundamentals of genome sequencing and analysis for the study of microbial pathogens, and discuss current applications of these techniques in diverse microbial taxa (viruses, bacteria, fungi and parasites). In addition to lectures, the course will include hands-on computational analysis of pathogen genomic data in which students will learn how to analyze genomic data and apply these skills to an independent project investigating a novel question using a publicly available genomic dataset. Students should have taken introductory courses in genetics or microbiology (either BIOL0470 or BIOL0510) and programming (CSCI0111 or higher) prior to enrolling in this class.

Spr	BIOL1525	S01	20305	TTh	9:00-10:20(05)	(K. Siddle)
Spr	BIOL1525	C01	25458	T	1:00-2:20	(K. Siddle)
Spr	BIOL1525	C02	25459	Th	1:00-2:20	(K. Siddle)

BIOL 1530. Emergency Medical Systems: An Anatomy of Critical Performance.
Students taking BIOL 1530 will explore Emergency Medicine and the many subjects that make up the practice of providing care to patients at the most critical and dire moments of their lives. We will read, discuss, and write about Trauma, Medical Malpractice, Death and Dying, Refugee and Disaster Medicine, Interpersonal Violence, and Crisis focused Medical Ethics, among others, all viewed through the lens of Emergency Medicine. You will shadow in the Emergency Department of a Trauma Center and debrief with your TA’s in weekly meetings, where the class topics will be discussed in open forums. This class, formerly PHP1520, has created a transformative experience for more than 30 years and will continue to foster new perspectives and ideas for every student who participates.

Spr	BIOL1530	S01	20206	W	3:00-5:30(10)	(B. Becker)

BIOL 1535. Survey of Health Informatics.
This survey course provides an overview of the field of biomedical informatics covering relevant topics in computer science, healthcare, biology, and social science. This is not a programming course and there are no computer coding components in this course. Emphasis is given to understanding the organization of biomedical information, the effective management of information using computer technology, and the impact of such technology on biomedical research, education, and patient care. The final capstone project of this course requires the in-depth examination, critique, and presentation of a specific topic in biomedical informatics, within the context of student (clinical or computational) interests. Students taking the course for graduate credit must produce a manuscript suitable for peer-review that synthesizes existing research and presents insights or applications in biomedical informatics.

Fall	BIOL1535	S01	18459	M	3:00-5:30(03)	(N. Sarkar)

BIOL 1540. Molecular Genetics.
Even in this era when whole genome DNA sequencing has become routine, there are still thousands of eukaryotic genes with unknown functions. Genetic screens for mutations that alter pathways of interest remain the premier approach to understanding gene function in the context of the organism. In Molecular Genetics students will learn the key concepts involved in designing and interpreting genetic screens using the powerful tools available in model animal, plant, and fungal organisms. Students will also learn how to understand and analyze results presented in the primary scientific literature. Furthermore, students will gain an appreciation of how the field of genetics has changed through discoveries and technological advances made over the past 50 years. Graduate students should register for BIOL 2540.

Spr	BIOL1540	S01	20190	TTh	2:30-3:50(11)	(Y. Huang)

BIOL 1545. Human Genetics and Genomics.
This course will exemplify the power of genetically informed approaches to understanding human biology. It is intended for advanced undergraduate students and graduate students; prerequisites include BIOL0470 or equivalent. The course is based in lectures, reading material (textbook and primary literature), and in-class discussions. Course topics include: medical genetics and genomics; methods to study human genotypes and related phenotypes; industry-related topics; and ethical and societal implications of genome science. It will benefit students with career interests in basic science, medicine, biotechnology, or science policy. Enrollment is limited to 20 students; selection will be based on seniority, prerequisites, and registration order.

BIOL 1550. Parasitism: Biology and Disease.
Protozoan parasites influence the health of human populations in less developed countries, leading to severe human suffering and loss of economic development. Understanding the fundamental biology of these pathogens and how they are transmitted is essential for developing treatments and mitigation strategies to improve human health. Focuses on biochemical, genetic, cellular, and immunological aspects of parasite and host responses. Expected: BIOL 0470 or BIOL 0530.

This course was formerly "Biology of Emerging Microbial Diseases"

Spr	BIOL1550	S01	20173	MWF	11:00-11:50(04)	(C. de Graffenried)

BIOL 1555. Methods in Informatics and Data Science for Health.
The goal of this course is for students to develop a solution that uses data science and informatics approaches to address a biomedical or health challenge. This course will teach informatics and data science skills needed for public health and biomedicine research. Emphasis will be given to algorithms used within the context of biomedical research and health care, including those used in biomolecular sequence analysis, electronic health records, clinical decision support, and public health surveillance. This course has been developed as a Course-based Undergraduate Research Experience (CURE), where students will gain experience with the scientific method, its application, and presentation.

Spr	BIOL1555	S01	20175	M	3:00-5:30(13)	(E. Chen)

BIOL 1560. Virology.
Emphasizes the understanding of molecular mechanisms of viral pathogenesis. Begins with a general introduction to the field of virology and then focuses on the molecular biology of specific viruses that are associated with human disease. Lectures based on current literature. Prerequisite: BIOL 0280, 0470, or 0530, or instructor permission.

Fall	BIOL1560	S01	10199	MWF	9:00-9:50(09)	(A. Jamieson)

BIOL 1565. Survey of Biomedical Informatics.
Survey course provides overview of field of biomedical informatics. Topics include computer science, healthcare, biology, social science. This course is designed to be complementary to BIOL 1555. Emphasis given to understanding the organization of biomedical information, effective management of information using computer technology, impact of such technology on biomedical research, education, patient care. Major aim explores the process of developing and applying computational and information science techniques for assessing current information practices, determining information needs of health care providers and patients, developing interventions or supporting clinical practice using informatics, and evaluating the impact of informatics solutions from a biomedical perspective.

BIOL 1575. Evaluation of Health Information Systems.
This course covers the field of evaluation of health information systems (HIS) in a range of roles and environments, in the US and worldwide. It includes topics in health information system (HIS) design and deployment, healthcare workflow, quantitative and qualitative evaluation methods and socio-technical environment for HIS. Emphasis is given to understanding the range of evaluation questions that can be asked, identifying the key stakeholders, understanding available evaluation techniques, and designing rigorous but achievable studies. Examples will include Open Source systems, medical Apps, and economic evaluation, the role of evaluation frameworks and theories, and notable HIS successes and failures. Recommended: past or concurrent enrollment BIOL 1565 or a public health course covering clinical research.

Fall	BIOL1575	S01	10202	TTh	1:00-2:20(06)	(H. Fraser)

BIOL 1580. Metabolism Across Biological Scales: Integrative Physiology and Pathobiology.
Metabolism is a fundamental biological process encompassing all chemical reactions in the human body. The genetic diversity of trillions of microorganisms that live in and on the host further enhances the chemical diversity in mammals. Metabolic perturbation underlies almost all human diseases. Recent advances in analytical tools such as high-resolution mass spectrometry and imaging mass spectrometry, the use of stable isotope tracing and metabolic flux analysis, as well as the development of genetically encoded sensors and mathematical modeling have provided critical insights into mammalian biology in health and diseases. This course provides historical perspectives and explores recent advances in various metabolism-related topics. It is designed to be interactive and includes guest lectures from renowned scientists and learning modules to develop skills in creative writing, critical thinking, science communication, and artistic expression.

Spr	BIOL1580	S01	26576	TTh	2:30-3:50(11)	(K. Chellappa)

BIOL 1595. Artificial Intelligence in Health Care.
This course will teach the fundamental theory and methods of artificial intelligence (AI) alongside their application to the biomedical domain. It will give a representative overview of traditional methods as well as modern developments in the areas of (deep) machine learning, natural language processing and information retrieval. The course is designed to be accessible to non-computer science audiences and will not require extensive prior programming experience. The course will be accompanied by practical assignments applying the discussed techniques in a biomedical context. Understanding of formal theoretical knowledge will be assessed in a final exam. The course is designed for students concentrating in domains such as Computational Biology and Applied Mathematics-Biology; or Neuroscience concentrators who have completed a course in introductory statistics (e.g., BIOL 0495).

Spr	BIOL1595	S01	26300	MW	8:30-9:50(02)	'To Be Arranged'

BIOL 1600. Development of Vaccines to Infectious Diseases.
Provides background steps involved in vaccine development, from conceptualization to production to deployment. Considers infectious diseases and associated vaccines in context of community health. Appropriate for students wanting to gain an understanding of vaccine science. Provides a foundation for advanced courses in immunology and infectious disease, biomedical research, or medical/graduate studies. Activities include a weekly section meeting for discussion of relevant primary literature, and a final project of the student's choice in the form of an in–class presentation, a research paper or an approved alternative format. Expected: BIOL 0200 or equivalent placement; BIOL 0530, and at least one additional biology course.

Spr	BIOL1600	S01	20174	Arranged		(S. Vaishnava)

BIOL 1610. Experimental Neurobiology.
Please see NEUR1600 for registration instructions. Intensive laboratory experience in neuroscience appropriate for students with basic background in Neurobiology. Learn and employ the classical neurophysiological techniques of extracellular recording, intracellular recording and receptive field mapping using a variety of animal species. Experiments will include recording of sensory signals in the cockroach leg; frog sciatic nerve and sciatic nerve/muscle preparation; intracellular recording of neurons in Aplysia; receptive field mapping in frog skin; and visual field mapping in the frog tectum. Instruction on and practice of effective science writing is another component to this course. Labs are supplemented by informal lectures. Enrollment limited to 18.

Spr	BIOL1610	S01	20310	W	1:00-6:00	(J. Stein)

BIOL 1630. Big Data Neuroscience Lab.
Recent technological developments have transformed neuroscience research, enabling us to generate comprehensive 'big data' sets that are often shared freely amongst the neuroscience community. This lab course will explore strategies to effectively use such open-sourced neuroscience data sets. Students will identify fundamental open questions in brain science and develop strategies to mine open-source sequencing, imaging and connectivity data to address their research questions. Please see NEUR1630 for registration instructions.

BIOL 1650. Structure of the Nervous System.
Combined lecture and laboratory course on the anatomy of the central nervous system. Lectures survey the circuitry of the major neural systems for sensation, movement, cognition, and emotion. Laboratory exercises (Mon. 10:30-12:30) include brain dissections, microscopy of neural tissue, and discussion of clinical cases. Prerequisites: NEUR 0010, NEUR 1020, and NEUR 1030. Please see NEUR1650 for registration instructions.

Fall	BIOL1650	S01	10230	TTh	2:30-3:50(12)	(D. Berson)

BIOL 1800. Animal Locomotion.
How and why do animals run, jump, swim and fly? Physiology, anatomy, ecology, and evolutionary history all influence, and are influenced by, the way animals move around. We will integrate analyses from many levels of biological organization - from molecular motors, through bone-muscle systems, to biogeography - with methods and approaches from mechanics, fluid dynamics, and robotics. Expected: BIOL 0800 and PHYS 0030. Instructor permission required.

BIOL 1810. 21st Century Applications in Cell and Molecular Biology.
Twenty-first century applications in cell and molecular biology focuses on the structure and function of macromolecules and cells and how they are altered in disease and therapy. This course will explore physical principles underlying cell function, along with biophysical approaches for solving problems of cell and molecular biology. Cutting-edge molecular and cellular-based therapeutics will be discussed throughout this course; this includes viral gene delivery constructs, novel platforms for tissue engineering, CRISPR genome editing, and immune checkpoint therapy. This course is particularly suitable for undergraduate students interested in basic medical research, graduate school, or research-based careers in biotechnology or pharmaceutical industry.

Spr	BIOL1810	S01	20194	MWF	10:00-10:50(03)	(M. Dawson)

BIOL 1820. Environmental Health and Disease.
Humans live, work, and play in complex chemical environments. BIOL1820 examines how environmental exposures impact health and contribute to disease. We will discuss contamination in the context of colonialism and capitalism as well as critically assess the ways society shapes science as a discipline. The course covers basic concepts in toxicology, physiology, and molecular biology and is divided into 6 units. The first unit, Science, Society, and Scientific Funding, will introduce you to the main themes of the course. The remainder of the course will be divided into the following units: radiation, lead, per- and polyfluoroalkyl substances (PFAS), endocrine disruptors, and emerging environmental concerns. For each unit, students will learn how contamination affects different communities and examine the biological systems impacted by contaminant exposure. BIOL1820 is designed for third and forth year undergraduates, and is open to others with permission.

Spr	BIOL1820	S01	20212	Arranged		(J. Plavicki)

BIOL 1840. Epigenetics in Health and Disease.
In this course, students will explore an alternative perspective on genetic regulation beyond basic Mendelian genetics. If we share the same genetic content, why are our cells different, and why do they perform distinct functions? Why do some diseases profoundly affect gene regulation without a genetic mutation to explain them? The epigenome, a dynamic layer of information associated with genetic material (beyond DNA), plays a crucial role in creating genetic diversity. This course will examine epigenetic mechanisms, their regulation, and their impact on various biological layers, from cellular processes to diseases, brain circuits, psychological disorders, and social behavior. While the primary focus will be on human health and disease, students will also explore non-human case studies, investigating a range of organisms, including plants and animals, to demonstrate the diversity and complexity of epigenetic mechanisms.

Spr	BIOL1840	S01	25537	Th	4:00-6:30(17)	(M. Martinez Moreno)

BIOL 1850. Environmental and Genetic Toxicology.
Human disease is produced by complex interactions between inherited genetic predisposition and environmental exposures. These interactions will be explored at the molecular, cellular, and systemic levels. Prototype diseases will include hereditary disorders of hemoglobin, hypercholesterolemia, birth defects, and cancer. Expected: Cell Biology.

BIOL 1855. Tropical Medicine & Neglected Tropical Diseases.
This asynchronous/online course uses a biosocial approach to examine tropical medicine and neglected tropical diseases (NTDs). Students will learn about the troubled origins of tropical medicine and current efforts to decolonize global health. In addition, students will explore the effects of climate change on tropical medicine and neglected tropical diseases. The course will include a focus on global public health and the various interventions used to reduce the impact of neglected tropical diseases. Students will be challenged with a multitude of ethical dilemmas faced by global health practitioners and should expect to think critically about challenging questions. As part of the course, students will also learn about the epidemiology and pathophysiology of several tropical diseases, including malaria, dengue fever, Chagas disease, and more. Students will learn using assigned readings, podcast episodes, news articles, research studies, and documentaries.

BIOL 1865. Toxicology.
Toxicology is the science that describes the adverse biological effects of exogenous chemical and physical stressors, including environmental, industrial, and agricultural chemicals and pharmaceuticals. This course will introduce the principal biological processes that determine an organism's response to a toxicant, including absorption, distribution through a biological system, metabolism, elimination, and effects at the site(s) of action. We will discuss modern challenges in toxicology, such as assessing toxicity of mixtures and testing some of the thousands of untested chemicals in commerce. The material will be presented in lecture and student-led discussions, with readings from the toxicology literature.

Spr	BIOL1865	S01	20213	TTh	1:00-2:20(08)	(D. Spade)

BIOL 1870. Techniques and Clinical Applications in Pathobiology.
A methodology course featuring laboratory and lecture instruction in established and leading-edge technologies. Examples: flow cytometry (multi-parameter analysis, cell sorting); molecular biology (PCR, real time PCR, in situ hybridization, microarrays, DNA sequencing, bioinformatics); digital imaging (image acquisition, processing and analysis); confocal microscopy ; histology and immunohistochemistry(confocal, immuno-histochemistry).

BIOL 1880. Comparative Biology of the Vertebrates.
The biology, structure, and evolutionary history of the vertebrates considered phylogenetically, emphasizing evolution of the major body systems. Stresses an evolutionary approach to the correlation of structure and function with environment and mode of life. Labs include dissection of several different vertebrates and comparative osteological material. Emphasis of course is on critical thinking rather than memorization of material. Recommended: BIOL 0320 or 0800. First year students must obtain instructor permission to register. Enrollment limited to 32. Students MUST register for the lecture section and the lab.

BIOL 1885. Human Anatomy and Biomechanics.
Human Anatomy and Biomechanics examines the structure of the human body from the perspectives of biomechanics, evolution, and development, focusing on the musculoskeletal system, sensory systems, and the complex, multifunctional organ of the human skin. The course considers biological form and function at multiple levels of organization and in diverse contexts, and offers students opportunities to synthesize, question, and write about ideas presented in class. The course includes a weekly, 2-hr laboratory section in which students will use kinesthetic learning to develop deep knowledge of anatomico-medical terminology, study osteology and develop powers of observation working with human and non-human animal bones, dissect a preserved rabbit specimen to learn the soft-tissue anatomy of a mammal and visit the human anatomy dissection lab at the Alpert Medical School.

Spr	BIOL1885	S01	20211	TTh	1:00-2:20(08)	(S. Swartz)
Spr	BIOL1885	L01	25485	W	3:00-5:00	(S. Swartz)
Spr	BIOL1885	L02	25486	Th	3:00-5:00	(S. Swartz)

BIOL 1890. Human Histology.
This course will provide an in-depth treatment of the “stuff we are made of” and the wonderful logic of its organization. This course focuses fi rst on the biology of the four basic tissues (epithelium, connective tissue, muscle and nerve) and second, how they contribute to the functional anatomy of all organs and systems. For Pfizer students only.

BIOL 1920C. Social Contexts of Disease.
What shapes our understandings of disease, and what makes a disease real? How might we explain the demise of formerly prevalent diseases and the arrival of others? How do politics, technologies, and institutions affect conceptions of disease and structure their treatment? Will examine the impact of social context on patients' experiences of disease, including clinical, scientific, and public health approaches. Will consider disease in relation to social relationships, power of the state to regulate disease, and cultural care of the body. Enrollment limited to 20 students; instructor permission required; serves as Capstone in Health and Human Biology. Not for concentration credit.

BIOL 1941A. Plants in a Changing Planet.
Plants are the foundation of Earth's ecosystems and essential to human survival and civilization. This seminar will examine the physiological, ecological, and evolutionary responses of plants to rapid environmental change, and the consequences for agriculture and the structure and function of natural systems. Expected background: at least one of the following courses - BIOL 0420, 0430, 0440, 0480, or ENVS 0490.

BIOL 1945. Outbreaks and Infections: Harnessing History and Preventing Future Epidemics.
This senior capstone course will investigate epidemic diseases that have plagued mankind in the past and explore the factors that contribute to the continued spread of diseases today. This course will emphasize the biology of both infectious and noninfectious diseases by exploring mechanisms of spread, pathogenesis, and prevention. Attention will also be given to environmental, economic, geographical, and social contributors to disease. Interactive class discussions, student presentations, analysis of primary literature, and multimedia homework will develop student skills culminating in an independent research project that dissects the life history of a disease and provides a forward-thinking strategy to combat it. The enrollment for this course is 15 students and limited to seniors who are HHB concentrators. Other students should request an override and priority will be given to senior Biology AB students.

Fall	BIOL1945	S01	10334	TTh	1:00-2:20(06)	(A. Dugan)

BIOL 1950. Directed Research/Independent Study.
Directed research/independent study in biological sciences: basic science, social studies of biomedical science, and clinically-oriented projects, mentored by individual faculty members in the Division of Biology and Medicine. Sites include campus and hospital based facilities. Projects can serve as the basis for Honors theses, or to fulfill research requirements in a Bio-Med concentration program. Students planning to use 1950/1960 to fulfill a concentration requirement must receive approval from the concentration advisor. No more than two (2) semesters of BIOL 1950/1960 may be used toward a concentration program in the biological sciences. Faculty from outside the Division may supervise projects for bio-med program concentrators, but should do so using their Department's own Independent Study course number. Registration for BIOL 1950 requires the submission of a formal Project Proposal Form: https://brown.co1.qualtrics.com/jfe/form/SV_6KYM101CeOasFXE. For detailed information, please visit: https://bue.brown.edu/research/independent-study.

BIOL 1960. Directed Research/Independent Study.
Directed research/independent study in biological sciences: basic science, social studies of biomedical science, and clinically-oriented projects, mentored by individual faculty members in the Division of Biology and Medicine. Sites include campus and hospital based facilities. Projects can serve as the basis for Honors theses, or to fulfill research requirements in a Bio-Med concentration program. Students planning to use 1950/1960 to fulfill a concentration requirement must receive approval from the concentration advisor. No more than two (2) semesters of BIOL 1950/1960 may be used toward a concentration program in the biological sciences. Faculty from outside the Division may supervise projects for bio-med program concentrators, but should do so using their Department's own Independent Study course number. Registration for BIOL 1960 requires the submission of a formal Project Proposal Form: https://brown.co1.qualtrics.com/jfe/form/SV_6KYM101CeOasFXE. For detailed information, please visit: https://bue.brown.edu/research/independent-study.

BIOL 1970A. Stem Cell Biology.
Senior seminar course will provide an interactive forum by which up to twenty seniors (and qualified juniors with permission) will explore the biology of stem cells from their humble beginnings in the embryo to their potential use in regenerative medicine. The potency and regulation of embryonic and adult stem cell populations derived from diverse organisms will be contrasted with laboratory-derived human stem-like cells for biomedical applications. Critical reading of classical and modern literature in the field of stem cell biology will form the basis of student-led presentations, papers and ethical forums. Expected: biochemistry, genetics and/or cell biology. Instructor permission.

Fall	BIOL1970A	S01	10224	M	2:00-4:30	(R. Freiman)

BIOL 1980. HIV/AIDS in Diverse Settings: Focus on Israel.
Participants in this winter session course will explore HIV/AIDS within the context of Israel’s diverse society, unique demographics and universal healthcare. While in Israel, students will visit clinics, hospitals, and universities, engage with health care providers, experts in the field and populations with HIV. By the end of the course students will gain research skills and an understanding of this pandemic, its management and challenges in Israel, and how this important disease is modulated through risk factors, healthcare systems, medical innovations, and socio-economic factors. There is no need for prior experience in any associated discipline or any knowledge of Hebrew.
Course schedule: January 2-6, 2023 - daily seminars at Brown (including student and guest lectures); January 7-16 - tour in Israel; January 17 - rest day; January 18-24 - daily seminars at Brown.

BIOL XLIST. Courses of Interest to Biology Concentrators.