

# BIOLOGY (BS)

CIP: 26.0101

## Program Description

Biology is concerned with the workings of life in all its varied forms. In recent years, the life sciences have been revolutionized by the development of molecular, cellular, genomic, and bioinformatic techniques that are being applied to study fundamental processes in organisms. As a result, there has been a transformation in the understanding of life, from the genetic networks that guide how embryos develop to uncovering natural genetic variation and how life adapts to diverse environments at unprecedented resolution. These and other discoveries in biology are shaping society by improving human health, enhancing rational management of our environment, developing forensic science, and augmenting the production of renewable energy with the concomitant sequestering of pollutants. In addition, the rapid growth of the life sciences has fueled new ethical and legal issues that impinge on biological discoveries and their applications.

Recent developments in the biological sciences have led to a focus on systems biology, which aims to integrate the vast amount of molecular data that can now be captured, providing new insights into how and why biological systems are adaptable and robust. These developments have brought to light the interdisciplinary nature of modern biology, requiring an integrated exposure to fundamental concepts in biology, chemistry, computer science, engineering, mathematics, and physics.

The major in Biology offers students the opportunity to learn introductory science in an integrated format in the Foundations of Science sequence and to use contemporary tools and approaches to solve problems in areas of the current life sciences. Intermediate and advanced courses provide a broad and intensive background in modern biology for those interested in careers in research, health-related fields, biotechnology, and education, among others. The advanced courses emphasize the fundamental concepts and principles mastered in the Foundations of Science sequence, continuing the emphasis on using interdisciplinary approaches to understand the natural world.

The major in Biology is taught by faculty who carry out research in state-of-the-art laboratories in various areas in the life sciences. The Program in Biology at NYU Abu Dhabi has strong interactive ties with the Department of Biology, the Center for Genomics and Systems Biology, and other laboratories located at NYU New York and within the NYU global network.

*Organic Chemistry 2* is not required for the major in Biology. However, it is highly recommended for students who intend to apply to medical or dental school and for students interested in graduate school in the life sciences. In addition, majors in Biology are encouraged to complete coursework in probability and statistics.

The study away pathway for the Biology major can be found on the NYUAD Student Portal at [students.nyuad.nyu.edu/pathways](http://students.nyuad.nyu.edu/pathways) (<http://students.nyuad.nyu.edu/pathways/>). Students with questions should contact the Office of Global Education.

The program strongly recommends that not more than one biology elective be taken while studying away.

## Specializations

The program offers the following specializations:

### Brain and Cognitive Science

*Available for Biology majors only.*

The Biology major offers a specialization in Brain and Cognitive Science (BCS), which emphasizes the function of the nervous system and places a special emphasis on the biological and psychological processes through which organisms gain and access knowledge.

BCS investigates some of the deepest mysteries facing science. These concern the higher functions of the central nervous system: perception, memory, attention, learning, language, emotion, personality, social interaction, decision-making, motor control, and consciousness. All psychiatric disorders, neurological diseases, and developmental disorders are characterized by dysfunction of the neural systems in the brain.

Experimental approaches in BCS vary from analyses of molecular and cellular mechanisms in nerve cells and groups of nerve cells to behavioral studies of whole organisms. Theoretical tools include mathematical and computational modeling approaches that have proved useful in other areas of science. Experimental questions include issues related to biophysical and neurochemical mechanisms within single nerve cells, functional neural circuits consisting of small numbers of neurons, the behavior of large systems of neurons, and the relationship between the activity of elements of the nervous system and the behavior of organisms, as well as the neural substrate of cognitive processes.

Students who elect to complete the major in Biology with the BCS specialization replace three of the four electives in biology with the following required courses: BIOL-UH 3211 Experimental Neurobiology, BIOL-UH 3117 Molecular Neurobiology, BIOL-UH 3101 Behavioral and Integrative Neuroscience, and one Laboratory Elective such as BIOL-UH 3220 Experimental Systems Biology & Complex Human Disorders offered by the Biology program or PSYCH-UH 3617EQ Lab in Visual Neuroscience offered by the NYUAD Program in Psychology. The BCS specialization also requires completion of PSYCH-UH 2410 Cognition or PSYCH-UH 2412 Cognitive Neuroscience offered by the NYUAD Program in Psychology.

Biology majors who seek to complete the BCS specialization are strongly encouraged to complete *Organic Chemistry 2* and *Introduction to Probability and Statistics*, depending on their career goals or plans for graduate and professional school.

### Biophysics

*Available for Natural Science majors only.*

The Biology, Chemistry, and Physics majors offer a specialization in Biophysics which emphasizes the crosstalk between these three disciplines in understanding biological function.

Everything obeys the laws of physics, and biological systems are no exception. The complexity of biological systems, however, is compounded by the fact that they span a broad range of interacting spatial scales from a few atoms to global ecosystems, and that life inherently functions far from the equilibrium. This complexity poses problems for physicists, chemists, and biologists that are at once interesting and challenging. Biophysics addresses these problems through an interdisciplinary approach that builds on strengths in physics, chemistry, and biology.

Biology majors who elect to complete the Biophysics specialization must complete all courses required for the Biology majors, three required Biophysics courses, and one elective selected from the list below. No more than two of these courses can be used to satisfy the elective requirement for the Chemistry major. The other three would be in addition to the minimum elective requirements for the major.

## Study Away

The study away pathway can be found on the NYUAD Student Portal at [students.nyuad.nyu.edu/pathways](https://students.nyuad.nyu.edu/pathways) (<https://bulletins.nyu.edu/undergraduate/abu-dhabi/programs/biology-bs/students.nyuad.nyu.edu/pathways/>). Students with questions should contact the Office of Global Education.

## Admissions

New York University's Office of Undergraduate Admissions supports the application process for all undergraduate programs at NYU. For additional information about undergraduate admissions, including application requirements, see How to Apply (<https://www.nyu.edu/admissions/undergraduate-admissions/how-to-apply.html>).

## Program Requirements

Course	Title	Credits
<b>General Education Requirements</b>		
Physical Education (2 courses)		
Quantitative Reasoning (1 course)		
Experimental Inquiry (1 course)		
Islamic Studies (1 course)		
First-Year Writing Seminar		4
Colloquia		4
Field Colloquia (2 J-Term courses)		6
<b>Core Competencies</b>		
Arts, Design, and Technology		4
Cultural Exploration Analysis		4
Data and Discovery		4
Structures of Thought and Society		4
<b>Foundations of Science Courses</b>		
Foundations of Science 1–6 (see list below)		26
<b>Major Required Courses</b>		
BIOL-UH 2010 Human Physiology		4
BIOL-UH 3120 Biostatistics		4
CHEM-UH 2010 Organic Chemistry 1 (1.25 courses)		5
MATH-UH 1012Q Calculus with Applications to Science and Engineering		4
MATH-UH 1020Q Multivariable Calculus with Applications to Science and Engineering		4
BIOL-UH 3090 Research Seminar in Biology (half course)		2
<b>Major Electives</b>		
Complete 4 Biology electives (see list below - can include Lab electives)		16
<b>Capstone</b>		
BIOL-UH 4001 Capstone Project in Biology 1		4
BIOL-UH 4002 Capstone Project in Biology 2		4
<b>Other Electives</b>		

Other Elective Credits	25
------------------------	----

Total Credits	128
---------------	-----

## Foundations of Science

### Foundations of Science 1-6 courses

Code	Title	Credits
SCIEN-UH 1121EQ	Foundations of Science 1-2: Physics	1.5
SCIEN-UH 1122EQ	Foundations of Science 1-2: Chemistry	3
SCIEN-UH 1123EQ	Foundations of Science 1-2: Biology	1.5
SCIEN-UH 1124C	Foundations of Science 2 Lab: Chemistry	1
SCIEN-UH 1124P	Foundations of Science 1 Lab: Physics	1
SCIEN-UH 1341Q	Foundations of Science 3-4: Physics	3
SCIEN-UH 1342Q	Foundations of Science 3-4: Chemistry	3
SCIEN-UH 1343	Foundations of Science 3-4: Biology	2
SCIEN-UH 1344BE	Foundations of Science 4 Lab: Biology	1
SCIEN-UH 1344CE	Foundations of Science 3 Lab: Chemistry	1
SCIEN-UH 1561Q	Foundations of Science 5-6: Physics	3
SCIEN-UH 1563	Foundations of Science 5-6: Biology	3
SCIEN-UH 1564BE	Foundations of Science 5 Lab: Biology	1
SCIEN-UH 1564EP	Foundations of Science 6 Lab: Physics	1

## Electives

### Biology Electives

Lab electives can also be used toward major electives

Code	Title	Credits
BIOL-UH 2113	Evolution	4
BIOL-UH 2114	Genetics	4
BIOL-UH 3114	Molecular Biology	4
BIOL-UH 3116	Immunology	4
BIOL-UH 3117	Molecular Neurobiology	4
BIOL-UH 3118	Conservation Biology	4
BIOL-UH 3121	RNA Biology	4
BIOL-UH 3122	Stem Cell Biology	4
BIOL-UH 3123	Introduction to Bioinformatics	4
BIOL-UH 3124	Developmental Biology	4
BIOL-UH 3125	Population Genomics	4
BIOL-UH 3130	Biophysics	4
BIOL-UH 3160	Special Topics in Biology	4
BIOL-UH 3211	Experimental Neurobiology	4
BIOL-UH 3213	Applied Molecular Biology Techniques	4
BIOL-UH 3215	Microbiology	4
BIOL-UH 3218	Synthetic Biology	4
BIOL-UH 3220	Experimental Systems Biology & Complex Human Disorders	4

CHEM-UH 3020	Biochemistry: Macromolecular Structure and Function	4	<b>Course</b>	<b>Title</b>		<b>Credits</b>
CHEM-UH 3021	Biochemistry: Metabolism	4	<b>Biophysics Required Courses</b>			4
CHEM-UH 3022	Biochemistry: Experimental Biochemistry	4	BIOL-UH 3130	Biophysics		
ENGR-UH 3130	Quantitative Synthetic Biology	2	CHEM-UH 3130			
ENGR-UH 3810	Quantitative Physiology	2	PHYS-UH 3219	Biological Physics: From single molecules to the cell		4
PSYCH-UH 3617EQ	Lab in Visual Neuroscience	4	<b>Biophysics Electives</b>			
			Complete 1 from the following:			4

## Biology Lab Electives

Lab electives can also be used toward major electives

Code	Title	Credits
BIOL-UH 3123	Introduction to Bioinformatics	4
BIOL-UH 3211	Experimental Neurobiology	4
BIOL-UH 3213	Applied Molecular Biology Techniques	4
BIOL-UH 3218	Synthetic Biology	4
BIOL-UH 3220	Experimental Systems Biology & Complex Human Disorders	4
PSYCH-UH 3617EQ	Lab in Visual Neuroscience	4

## Specialization Requirements

### Brain and Cognitive Science (for Biology majors)

Students pursuing the Brain and Cognitive Science (BCS) Specialization for Biology will complete 4 BCS courses and 1 Lab elective, instead of the 4 Biology major electives.

Course	Title	Credits
<b>BCS Required Courses</b>		
<b>BCS Lab Elective</b>		
BIOL-UH 3101	Behavioral and Integrative Neuroscience	4
BIOL-UH 3117	Molecular Neurobiology	4
PSYCH-UH 1001	Introduction to Psychology	4
PSYCH-UH 2410	Cognition	4
or PSYCH-UH 2412	Cognitive Neuroscience	
Complete 1 from the following:		4
BIOL-UH 3211	Experimental Neurobiology	
PSYCH-UH 3617EQ	Lab in Visual Neuroscience	
PSYCH-UH 3620EQ	Lab in Clinical Neuropsychology	
PSYCH-UH 3621EQ	Lab in Language Science	
PSYCH-UH 3720	Special Topics in Psychology	

### Biophysics (for Biology majors)

Students pursuing the Biophysics Specialization complete 3 Biophysics courses and 1 elective. A maximum of two courses from the specialization to count towards the major elective requirement (BIOL-UH 3130 is one of them and because it is required for this specialization, reduces major electives by 1).

## Sample Plan of Study

Course	Title	Credits
<b>1st Semester/Term</b>		
<b>2nd Semester/Term</b>		
First-Year Writing Seminar		4
Core Competency		4
Core Competency		4
General Elective		4
Physical Education		
<b>Credits</b>		16
<b>3rd Semester/Term</b>		
Field Colloquia (J-Term)		3
<b>Credits</b>		3
<b>4th Semester/Term</b>		
SCIEN-UH 1121EQ	Foundations of Science 1-2: Physics	1.5
SCIEN-UH 1122EQ	Foundations of Science 1-2: Chemistry	3
SCIEN-UH 1123EQ	Foundations of Science 1-2: Biology	1.5
SCIEN-UH 1124C	Foundations of Science 2 Lab: Chemistry	1
SCIEN-UH 1124P	Foundations of Science 1 Lab: Physics	1
MATH-UH 1012Q	Calculus with Applications to Science and Engineering	4
Colloquia		4
Physical Education		
<b>Credits</b>		16
<b>5th Semester/Term</b>		
Field Colloquia (J-Term)		3
<b>Credits</b>		3
<b>6th Semester/Term</b>		
SCIEN-UH 1341Q	Foundations of Science 3-4: Physics	3
SCIEN-UH 1342Q	Foundations of Science 3-4: Chemistry	3
SCIEN-UH 1343	Foundations of Science 3-4: Biology	2
SCIEN-UH 1344BE	Foundations of Science 4 Lab: Biology	1
SCIEN-UH 1344CE	Foundations of Science 3 Lab: Chemistry	1
MATH-UH 1020Q	Multivariable Calculus with Applications to Science and Engineering	4
Major Elective		3
<b>Credits</b>		17

CHEM-UH 2010	Organic Chemistry 1	5
	Credits	17
<b>7th Semester/Term</b>		
BIOU-UH 2010	Human Physiology	4
Major Elective		4
Major Elective		4
Core Competency		4
	Credits	16
<b>8th Semester/Term</b>		
BIOU-UH 3090	Research Seminar in Biology	2
Major Elective		4
General Elective		4
Core Competency		4
	Credits	14
<b>9th Semester/Term</b>		
BIOU-UH 4001	Capstone Project in Biology 1	4
General Elective		4
General Elective		4
General Elective		2
	Credits	14
<b>10th Semester/Term</b>		
BIOU-UH 4002	Capstone Project in Biology 2	4
General Elective		4
General Elective		4
	Credits	12
	<b>Total Credits</b>	<b>128</b>

## Learning Outcomes

Upon successful completion of the program, graduates will:

1. Describe and explain the specialized factual and theoretical concepts involved in modern biology including the flow and regulation of genetic information and signaling in biological systems.
2. Recognize that living systems are subject to the same laws and rules of chemistry and physics as the inanimate world and understand the fundamental relationships between structure and function in biological systems.
3. Understand how organisms adapt to their surroundings in the short-term level via physiology and in the long-term via evolution.
4. Analyze the primary scientific literature, evaluate the evidence presented and critically assess the conclusions.
5. Identify problems and questions in the life science, evaluate their importance, craft hypotheses and select and design the appropriate rigorous experiments to test these ideas, as well as providing constructive feedback to peers on their experimental designs.
6. Conduct experiments reliably, reproducibly and independently.
7. Analyze and interpret qualitative and quantitative data.
8. Communicate science effectively to other scientists in writing and orally.

## Policies

### Program Policies

#### Foundations of Science Grading Policy

While each level of Foundations of Science is an integrated course, separate grades are provided for various components as a means to allow students to document their completion of the specific disciplinary and laboratory content that makes up these courses. Consistent with this integrated approach, students must earn an average grade of C for the components of each level of Foundations of Science to continue

into the next level or to use the course to satisfy the prerequisites for other courses outside of Foundations of Science. Additionally, students majoring in biology, chemistry, or physics, must have grades of at least C in all Foundations of Science components in their specific, respective major fields. Finally, although continuation into other courses is based on the average performance in each level of Foundations of Science, students earn academic credits only for those graded components they pass or, for students subject to the transcript policy (see Academic Policies), only for those components with grades of at least C-. The number of earned credits for Foundations of Science components is particularly important for all engineering majors who must earn at least 16 credits in science.

#### NYU Abu Dhabi Policies

A full list of relevant policies can be found on NYU Abu Dhabi's undergraduate academic policies page (<https://bulletins.nyu.edu/undergraduate/abu-dhabi/academic-policies/>).

#### NYU Policies

University-wide policies can be found on the New York University Policy pages (<https://bulletins.nyu.edu/nyu/policies/>).