

# 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 MATH-UH 1003Q.

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 Sciences (*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 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 (*for Natural Science Majors*)

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.

## 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>		
Colloquia		8
First-Year Seminar		4
Arts, Design, and Technology		4
Cultural Exploration Analysis		4
Data and Discovery		4
Structures of Thought and Society		4
January Term Courses (3 courses)		12
<b>Foundations of Science Courses</b>		
Complete 6.5 courses from SCIEN-UH 1101EQ–1603 Foundations of Science 1–6		26
<b>Required Courses</b>		
BIOL-UH 2010	Human Physiology	4
CHEM-UH 2010	Organic Chemistry 1 (1.25 courses)	5
MATH-UH 1012Q	Calculus with Applications to Science and Engineering	4
MATH-UH 1020	Multivariable Calculus with Applications to Science and Engineering	4
BIOL-UH 3120	Biostatistics	4
<b>Electives</b>		
Select four Biology Electives		16
<b>Research Seminar</b>		
BIOL-UH 3090	Research Seminar in Biology (half course)	2
<b>Capstone</b>		
BIOL-UH 4001	Capstone Project in Biology 1	4
BIOL-UH 4002	Capstone Project in Biology 2	4
Other Elective Credits		27
<b>Total Credits</b>		<b>140</b>

## Brain and Cognitive Science Specialization

Course	Title	Credits
<b>General Education Requirements</b>		
Colloquia		8
First-Year Seminar		4
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>		

Complete 6.5 courses from SCIEN-UH 1101EQ - 1603 Foundations of Science 1-6

<b>Required Courses</b>		
BIOL-UH 2010	Human Physiology	4
BIOL-UH 3101	Behavioral and Integrative Neuroscience	4
BIOL-UH 3117	Molecular Neurobiology	4
BIOL-UH 3211	Experimental Neurobiology	4
CHEM-UH 2010	Organic Chemistry 1	5
CHEM-UH 2050		4
MATH-UH 1012		4
MATH-UH 1020	Multivariable Calculus with Applications to Science and Engineering	4
PSYCH-UH 1001	Introduction to Psychology	4
PSYCH-UH 2410	Cognition	4
or PSYCH-UH 2412	Cognitive Neuroscience	
<b>Elective</b>		
Select one Biology Laboratory elective		4
<b>Research Seminar</b>		
BIOL-UH 3090	Research Seminar in Biology (half course)	2
<b>Capstone</b>		
BIOL-UH 4001	Capstone Project in Biology 1	4
BIOL-UH 4002	Capstone Project in Biology 2	4
Other Elective Credits		19
<b>Total Credits</b>		<b>128</b>

## Biophysics Specialization

Course	Title	Credits
<b>General Education Requirements</b>		
Colloquia		8
First-Year Seminar		4
Arts, Design, and Technology		4
Cultural Exploration Analysis		4
Data and Discovery		4
Structures of Thought and Society		4
<b>Required Courses</b>		
BIOL-UH 3130	Biophysics (can be used towards major electives)	4
PHYS-UH 3219	Biological Physics: From single molecules to the cell	4
CHEM-UH 3130	Computational Biology & Biophysics	4
<b>Electives</b>		
Select one of the following:		4
PHYS-UH 3014	Statistical Mechanics and Thermodynamics	
CHEM-UH 3260	Special Topics in Chemistry (NMR only)	
CHEM-UH 3020	Biochemistry: Macromolecular Structure and Function	
CHEM-UH 3011	Physical Chemistry: Thermodynamics and Kinetics	
CHEM-UH 3016	Analytical Chemistry	
<b>Total Credits</b>		<b>44</b>

## Sample Plan of Study

Course	Title	Credits
<b>1st Semester</b>		
MATH-UH 1012Q	Calculus with Applications to Science and Engineering	4
General Elective		4
First-Year Writing Seminar		4
Core Competency		4
<b>Credits</b>		<b>16</b>
<b>1st Semester Winter</b>		
General Elective		4
<b>Credits</b>		<b>4</b>
<b>2nd Semester</b>		
MATH-UH 1020	Multivariable Calc w/Apps to Science & Engineering	4
Colloquium		4
SCIEN-UH 1203	FoS 2: Lab	4
CHEMISTRY		NA
PHYSICS		NA
SCIEN-UH 1103	FoS 1: Lab	4
CHEMISTRY		NA
PHYSICS		NA
<b>Credits</b>		<b>16</b>
<b>3rd Semester</b>		
PHYSICS		NA
General Elective		4
Core Competency		4
SCIEN-UH 1404	FoS 4: Lab	4
BIOLOGY		NA
CHEMISTRY		NA
PHYSICS		NA
SCIEN-UH 1304	FoS 3: Lab	4
BIOLOGY		NA
CHEMISTRY		NA
<b>Credits</b>		<b>16</b>
<b>3rd Semester Winter</b>		
General Elective		4
<b>Credits</b>		<b>4</b>
<b>4th Semester</b>		
CHEM-UH 2010	Organic Chemistry 1	4
Colloquium		4
SCIEN-UH 1603	FoS 6: Lab	4
PHYSICS		NA
BIOLOGY		NA
SCIEN-UH 1503	FoS 5: Lab	4
PHYSICS		NA
BIOLOGY		NA
<b>Credits</b>		<b>16</b>
<b>5th Semester</b>		
Biology Elective		4
General Elective		4
General Elective		4
General Elective		4
<b>Credits</b>		<b>16</b>
<b>5th Semester Winter</b>		
General Elective		4
<b>Credits</b>		<b>4</b>
<b>6th Semester</b>		
BIOL-UH 2010	Human Physiology	4
General Elective		4
General Elective		4
Core Competency		4

BIOL-UH 3090	Research Seminar in Biology	4
<b>Credits</b>		<b>20</b>
<b>7th Semester</b>		
BIOL-UH 4001	Capstone Project in Biology 1	4
General Elective		4
Core Competency		4
Biology Elective		4
<b>Credits</b>		<b>16</b>
<b>8th Semester</b>		
BIOL-UH 4002	Capstone Project in Biology 2	4
General Elective		4
Biology Elective		4
Biology Elective		4
<b>Credits</b>		<b>16</b>
<b>Total Credits</b>		<b>144</b>

## Learning Outcomes

Upon successful completion of the program, graduates will:

- 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.
- 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.
- Understand how organisms adapt to their surroundings in the short-term level via physiology and in the long-term via evolution.
- Analyze the primary scientific literature, evaluate the evidence presented and critically assess the conclusions.
- 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.
- Conduct experiments reliably, reproducibly and independently.
- Analyze and interpret qualitative and quantitative data.
- Communicate science effectively to other scientists in writing and orally.

## Policies

### NYU Policies

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

### 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/>).