

# CELL AND MOLECULAR BIOLOGY (BS)

## Exploration and Discovery

The BS in Cell and Molecular Biology prepares students for graduate studies or work in biomedical fields. Laboratory experiences include opportunities for students to conduct original research working closely with a faculty mentor. This degree is also appropriate for professional schools including medical, dental, and veterinary schools. Note that some professional/graduate schools require a full year of physics. Students should work closely with their academic advisor to plan their coursework.

## Biological Sciences Honors Program

The Department of Biological Sciences encourages eligible students to develop an Honors research project working with an individual faculty member. A Biology Faculty Advisor will serve as a research mentor throughout the process, but the student is responsible for the design, data collection, analysis, and writing required to complete and communicate the results of the project. Students must understand that faculty can more readily advise Honors projects that integrate with their existing research interests. The Honors project can assist students wishing to pursue admission to competitive graduate and professional programs in biological sciences. Along with letters of recommendation, solid grade point average and Graduate Record Exam scores, participating in research is an important criterion such programs use to select students.

## Requirements for Admission to the Honors Program

- 3.25 minimum grade point average
- completion of at least 45 credit hours
- completion of Biological Science I (BI 1110) and Biological Science II (BI 1120) or their equivalents and at least one 3000/4000 level Biology course that involves a research project, or approval of the faculty sponsor
- availability and support of a Faculty Advisor
- submission of an Honors Application to the Department of Biological Sciences. The Application consists of a research proposal that is developed with the guidance and approval of a Faculty Advisor and contains a literature review, hypotheses, methods (including a budget), and references (formatted according to discipline-specific standards)
- approval of the Honors Application by the Biological Sciences faculty.

## Completing the Program

- completion of four credits of Undergraduate Research (BI 4950)
- presentation of the research findings
- submission of a final paper (in discipline-specific format) to the Department of Biological Sciences by May 1 of the year Honors distinction is sought
- presentation of the results at an appropriate scientific conference or seminar series, either at PSU or in the New England region
- overall approval of both the final paper and the presentation from the Biological Science faculty
- maintenance of a 3.25 minimum grade point average.

## Degree Requirements

Course	Title	Credits
<b>Major Requirements</b>		
BI 1110	Biological Science I (TECO)	4
BI 1120	Biological Science II	4
BI 2270	Integrative Biology (WECO)	4
BI 2110	Human Anatomy and Physiology I	3
BI 2120	Human Anatomy and Physiology II	3
BI 2130	Human Anatomy and Physiology Laboratory I	1
BI 2140	Human Anatomy and Physiology Laboratory II	1
BI 3040	Microbiology	4
BI 3060	Genetics	4
BI 3130	Evolution	4
BI 3240	Conservation (DICO,GACO,INCO,INCP)	3
BI 4100	Cell Structure and Function	4
BI 4188	Molecular Biology	4
BI 4970	Biology Seminar	1
CH 1050	Laboratory Safety	1
CH 2335	General Chemistry I (QRCO)	4
CH 2340	General Chemistry II	4
CH 3370	Organic Chemistry I	4
CH 3380	Organic Chemistry II	4
<b>Upper Level Cell and Molecular Biology Electives</b>		
Complete three courses from the following: <sup>1</sup>		12
BI 3035	Biochemistry I (INCO,INCP)	
BI 4150	Developmental Biology (WRCO)	
BI 4770	Animal Physiology (WRCO)	
BI 4780	Neurobiology (WRCO)	
BI 4950	Undergraduate Research	
CH 4025	Biochemistry II	
<b>Physics</b>		
PH 2410	University Physics I	3
or PH 2210	Physics I	
PH 2430	Physics Laboratory I	1
<b>Mathematics Foundations</b>		
MA 2550	Calculus I (QRCO)	4
General Education ( <a href="https://coursecatalog.plymouth.edu/general-education/">https://coursecatalog.plymouth.edu/general-education/</a> )		
EN 1400	Composition	4
IS 1115	Tackling a Wicked Problem	4
CTDI ( <a href="https://coursecatalog.plymouth.edu/general-education/#CTDI">https://coursecatalog.plymouth.edu/general-education/#CTDI</a> )	Creative Thought Direction	3-4
PPDI ( <a href="https://coursecatalog.plymouth.edu/general-education/#PPDI">https://coursecatalog.plymouth.edu/general-education/#PPDI</a> )	Past and Present Direction	3-4

SSDI ( <a href="https://coursecatalog.plymouth.edu/general-education/#SSDI">https://coursecatalog.plymouth.edu/general-education/#SSDI</a> )	3-4
Directions (choose from CTDI, PPD, SSDI) ( <a href="https://coursecatalog.plymouth.edu/general-education/">https://coursecatalog.plymouth.edu/general-education/</a> ) <sup>2</sup>	4-8
Electives	15
<b>Total Credits</b>	<b>120</b>

<sup>1</sup> One course must be Research Intensive (Developmental Biology (BI 4150), Neurobiology (BI 4780), or Undergraduate Research (BI 4950)); one course must be a Writing in the Discipline Connection (WRCO) (Developmental Biology (BI 4150), Animal Physiology (BI 4770), Neurobiology (BI 4780))

<sup>2</sup> Directions should total 16-17 credits because SIDI is waived for BS Cell and Molecular Biology.

## Recommended Course Sequence

Check all course descriptions for prerequisites before planning course schedule. Course sequence is suggested but not required.

To complete the bachelor's degree in 4 years, you must successfully complete a minimum of 15 credits each semester or have a plan to make up credits over the course of the 4 years. For example, if you take 14 credits one semester, you need to take 16 credits in another semester. Credits completed must count toward your program requirements (major, option, minor, certificate, general education or free electives).

Course	Title	Credits
<b>Year One</b>		
EN 1400	Composition	4
IS 1115	Tackling a Wicked Problem	4
MA 2550	Calculus I (QRCO)	4
BI 1110	Biological Science I (TECO)	4
BI 1120	Biological Science II	4
CH 1050	Laboratory Safety	1
CH 2335	General Chemistry I (QRCO) <sup>1</sup>	4
CH 2340	General Chemistry II <sup>1</sup>	4
Elective		2
<b>Credits</b>		<b>31</b>
<b>Year Two</b>		
BI 2270	Integrative Biology (WECO)	4
BI 2110 & BI 2130	Human Anatomy and Physiology I and Human Anatomy and Physiology Laboratory I	4
BI 2120 & BI 2140	Human Anatomy and Physiology II and Human Anatomy and Physiology Laboratory II	4
CH 3370	Organic Chemistry I	4
CH 3380	Organic Chemistry II	4
SSDI ( <a href="https://coursecatalog.plymouth.edu/general-education/#SSDI">https://coursecatalog.plymouth.edu/general-education/#SSDI</a> )	Self and Society Direction	3-4

Directions (choose from CTDI, PPD, SSDI) ( <a href="https://coursecatalog.plymouth.edu/general-education/">https://coursecatalog.plymouth.edu/general-education/</a> ) <sup>2</sup>	4-8
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<b>Credits</b>		<b>27-32</b>
<b>Year Three</b>		
BI 3040	Microbiology	4
BI 3060	Genetics	4
BI 3240	Conservation (DICO,GACO,INCO,INCP)	3
BI 4100	Cell Structure and Function	4
Complete one Upper Level Cell and Molecular Biology Elective from the following:		4
BI 3035	Biochemistry I (INCO,INCP)	
BI 4150	Developmental Biology (WRCO)	
BI 4770	Animal Physiology (WRCO)	
BI 4780	Neurobiology (WRCO)	
BI 4950	Undergraduate Research	
CH 4025	Biochemistry II	
Complete one Physics Course from the following:		
PH 2410 or PH 2210	University Physics I or Physics I	3
PH 2430	Physics Laboratory I	1
CTDI ( <a href="https://coursecatalog.plymouth.edu/general-education/#CTDI">https://coursecatalog.plymouth.edu/general-education/#CTDI</a> )	Creative Thought Direction	3-4
Electives		3-4
<b>Credits</b>		<b>29-31</b>
<b>Year Four</b>		
BI 3130	Evolution	4
BI 4188	Molecular Biology	4
BI 4970	Biology Seminar	1
Complete two Upper Level Cell and Molecular Biology Electives from the following:		8
BI 3035	Biochemistry I (INCO,INCP)	
BI 4150	Developmental Biology (WRCO)	
BI 4770	Animal Physiology (WRCO)	
BI 4780	Neurobiology (WRCO)	
BI 4950	Undergraduate Research	
CH 4025	Biochemistry II	
PPDI ( <a href="https://coursecatalog.plymouth.edu/general-education/#PPDI">https://coursecatalog.plymouth.edu/general-education/#PPDI</a> )	Past and Present Direction	3-4
Electives		9-10
<b>Credits</b>		<b>29-31</b>
<b>Total Credits</b>		<b>120</b>

<sup>1</sup> General Chemistry should only be taken in the first year if the student has suitable math skills. Many graduate and professional schools require a second semester of physics.

<sup>2</sup> Directions should total 16-17 credits because SIDI is waived for BS Cell and Molecular Biology.

## Learning Outcomes

- An understanding of the scientific method as the means to increase understanding of the natural world through hypothesis-testing.
- An aptitude for critically reading scientific literature, including primary research journals.
- Proficiency in writing, especially in scientific format.
- An ability to present scientific information orally with emphasis on clear interpretation of scientific data.
- Proficiency in techniques specific to a subdiscipline of biology, including but not limited to laboratory, field, and statistical techniques.
- An understanding of the critical issues facing the environment at local, regional, national, and global scales.
- Biological literacy allowing for the evaluation of new information and emerging issues.
- Readiness for post-graduate experiences in graduate school, professional school, or biology employment.

## Career Pathways

Biologists study living organisms and their relationships to the environment from molecules, to cells, to ecosystems. Most specialize in a particular discipline within biology, sometimes by pursuing a specialized degree like Environmental Biology or Cell and Molecular Biology. Some go on to attain further education in graduate school or a health professional school for medicine, public health, or pharmacy. There are as many job opportunities as areas of study.

For more information, visit Career Services in the Global Education Office.

Sample Job Titles include: Biochemist, Botanist, Ecologist, Fishery Biologist, High School Science Teacher, Marine Biologist, Microbiologist, Zoologist, Veterinarian, Medical doctor, Physician Assistant, Nurse Practitioner, Doctor of Osteopathic Medicine, Research Scientist, Wildlife Biologist, Pharmacist, Dentist, Medical scientist, Virologist

See the U.S. Department of Labor Outlook for a complete list.

Useful Skills for Jobs in the Biology Fields:

- Research skills such as data collection, laboratory techniques, and working in teams
- Ability to problem-solve and think critically
- Written and verbal communication skills to convey technical and scientific data to both scientific and non-scientific communities