

# BIOMEDICAL SCIENCE

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## INTRODUCTION

The biomedical science major offers broad training in the biological sciences and serves as a solid preparation for allied health related fields, including medical, dental, physician assistant, and veterinary school. Graduates may also pursue employment in biomedical and related fields, such as business, communications, law and social policy development.

The biomedical science program of study combines lectures and a hands-on learning experience in both its core and elective courses. The elective courses offered within the major cover the key subject areas needed for admission to post-graduate training in allied health. In addition, the opportunity to perform independent research with a faculty member in the biology department provides additional opportunities for a broad education in biology.

Additionally, Canisius has developed programs for students interested in Early Assurance Acceptance into the Lake Erie College of Osteopathic Medicine (College of Medicine, Schools of Dental Medicine, Podiatric Medicine, and Pharmacy) as well as Joint Degree Programs with the University at Buffalo (School of Pharmacy), Lake Erie College of Osteopathic Medicine (School of Pharmacy), D'Youville University (School of Pharmacy) and SUNY College of Optometry.

## QUALIFICATIONS

Students must maintain a 2.0 overall average to graduate with a degree in biomedical science. Students must attain a D or greater in each of the introductory courses (BIO 111, BIO 112, and BIO 211) in order to progress into the next course in the biology sequence. Students must have a D or better in BIO 212 and successfully complete BIO 211L and BIO 212L to take any 400-level Biology courses.

## Advisement

All students should have an advisor in the major and should contact the department directly to have an advisor assigned if they do not already have one. Meetings with academic advisors are required prior to students receiving their PIN for course registration each semester. All majors should work closely with their advisor in discussing career expectations, choosing their major electives, developing their entire academic program and planning their co-curricular or supplemental academic experiences.

## MAJOR EXPERIENCES

All faculty in the biology department are research-active and maintain their own research program at Canisius. Students interested in pursuing research opportunities with biology faculty are encouraged to speak with individual faculty members about their work and research opportunities in their respective laboratories.

## Double Majors

Students who wish to expand their educational opportunities may decide to declare a double major. This decision may be based on career goals, planned graduate studies, and/or other student interests. Before a student declares a double major, it is important to meet with the appropriate academic departments for advisement. In order to declare a double major, the

student must complete the Major/Minor Declaration form. This form will be submitted electronically and reviewed and approved by each department chairperson as well as the appropriate associate dean.

Per university policy, each additional major requires a minimum of 15 credits that do not apply to the student's first or subsequent major. Some double major combinations can be completed within the minimum 120 credit hour degree requirement, but in other cases, additional coursework may be required. Please note that students will only receive **one** degree unless completing the dual degree (<https://catalog.canisius.edu/undergraduate/academics/curricular-information/>) requirement, including at least 150 undergraduate credit hours, regardless of the number of majors they complete. Both (all) majors appear on a student's transcript.

## Minors in Other Disciplines

Minors provide students the opportunity to pursue additional interests but generally do not require as many courses as a major. Minors generally range from five to eight required courses. To receive a minor, the student must complete at least 9 credit hours of coursework distinct from their other credentials (i.e., majors, other minors). The complete list of minors is available on the Canisius website (<https://www.canisius.edu/academics/programs/undergraduate/?type%5B%5D=17>) and in the catalog (<https://catalog.canisius.edu/undergraduate/minors/>) and provides links to each minor. Some majors and minors can be completed within the minimum 120 credit hour degree requirement, but in some cases additional coursework may be required. Students must complete the appropriate minor request form.

## Curriculum

### An Ignatian Foundation

All undergraduate students must complete either the Canisius Core Curriculum (<http://catalog.canisius.edu/undergraduate/academics/curricular-information/core-curriculum/>) or the All-College Honors Curriculum (<http://catalog.canisius.edu/undergraduate/academics/curricular-information/all-college-honors-program/>). Many schools refer to their college-wide undergraduate requirements as "general education" requirements. We believe that the core curriculum and the honors curriculum are more than a series of required classes; they provide the basis for a Jesuit education both with content and with required knowledge and skills attributes that are central to our mission.

### Free Electives

Students may graduate with a bachelor's degree with more but not less than 120 credit hours. Free electives are courses in addition to the Canisius Core Curriculum or All-College Honors Curriculum and major requirements sufficient to reach the minimum number of credits required for graduation. The number of credits required to complete a bachelor's degree may vary depending on the student's major(s) and minor(s).

## Major Requirements

Biomedical Science Major Course Requirements

Code	Title	Credits
<b>Science Foundations</b>		
BIO 111 & 111L	Introductory Biology I and Introductory Biology Laboratory I	4
BIO 112 & 112L	Introductory Biology II and Introductory Biology Laboratory II	4
BIO 211 & 211L	Biochemistry and Cell Biology I and Biochemistry and Cell Biology Lab I	4

BIO 212 & 212L	Biochemistry and Cell Biology II and Biochemistry and Cell Biology Lab II	4
BIO 351	Biology Seminar I	1
CHM 111 & 111L	General Chemistry I and General Chemistry I Laboratory	4
CHM 112 & 112L	General Chemistry II and General Chemistry II Laboratory	4
CHM 227 & 227L	Organic Chemistry I and Organic Chemistry I Laboratory	4
CHM 228 & 228L	Organic Chemistry II and Organic Chemistry II Laboratory	4
PHY 201 & 201L	College Physics I and College Physics I Laboratory	4
PHY 202 & 202L	College Physics II and College Physics II Laboratory	4
MAT 111	Calculus I	4
MAT 141 or PSY 201	Inferential Statistics and Computers for Science Basic Statistics for Behavioral Sciences	3-4
At least one of the following (second or third course shall fulfill Biology Elective requirement)		4
BIO 307 & 307L	Microbiology and Microbiology Laboratory	4
BIO 324 & 324L	Human Anatomy and Human Anatomy Lab	
BIO 340 & 340L	Physiology and Physiology Laboratory	
Biology Elective from List A, with Lab:		4
Biology Elective from List A or B, with Lab:		4
Biology Elective from List A or B:		3
<b>Psychological/Social/Ethical Foundations</b>		
One of the following:		3
PSY 101 or PSY 102	Introduction to Psychology I Introduction to Psychology II	3
SOC 110 or SOC 111	Introduction to Sociology Contemporary Social Problems	
One of the following:		
PHI 243	Bio-Medical Ethics	3
RST 345	Bio-Moral Problems	
ENG 218	Literature and Medicine	
Experiential Learning (up to 3 credits)		1-3
BIO 298	Pre-clinical Experience for Undergraduates	4
HRP 498	PEPID Medical Informatics Internship	
HRP 499	Health Professions Internship	
<b>Total Credits</b>		<b>70-73</b>

## List A: Advanced Biology for Biomedical Science

Code	Title	Credits
BIO 307 & 307L	Microbiology and Microbiology Laboratory	4
BIO 324 & 324L	Human Anatomy and Human Anatomy Lab	4
BIO 340 & 340L	Physiology and Physiology Laboratory	4
BIO 404 & 404L	Genetics and Genetics Laboratory	4

BIO 419 & 419L	Cell Biology and Cell Biology Laboratory	4
BIO 425 & 425L	Cellular Neurobiology and Cellular Neurobiology Laboratory	4
BIO 426 & 426L	Immunochemistry and Immunochemistry Laboratory	4
BIO 432 & 432L	Developmental Biology and Developmental Biology Laboratory	4
BIO 450 & 450L	Molecular Biology and Molecular Biology Laboratory	4

## List B: Application of Biomedical Science (ABMS)

Code	Title	Credits
BIO 305 & 305L	Medical Microbiology and its Ecological Basis and Medical Microbiology and its Ecological Basis Lab	4
BIO 308	Parasitology	3
BIO 345	Functional Neuroanatomy	3
BIO 360	Environmental Health	3
BIO 412 & 412L	Evolution & Development and Evolution & Development Lab	4
BIO 430 & 430L	Advanced Cellular Biochemistry and Metabolism and Advanced Cellular Biochemistry and Metabolism Laboratory	4
BIO 435 & 435L	Developmental Neurobiology and Develop Neurobiology Laboratory	4
BIO 441	Neurobiology of Nervous System Disorders	3
BIO 444	Cancer Biology	3

## Roadmap

### Freshman

Fall	Spring
BIO 111 & 111L	BIO 112 & CHM 112L
CHM 111 & 111L	CHM 112
MAT 141 or PSY 201	MAT 111

### Sophomore

Fall	Spring
BIO 211 & 211L	BIO 212 & 212L
CHM 227 & 227L	CHM 228 & 228L
select one of the following: <sup>1</sup>	BIO 351

SOC 110 or 111 PSY 101 or 102
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### Junior

Fall	Spring
PHY 201 & 201L	PHY 202 & 202L
Biology Elective w/ Lab (List A)	Biology Elective w/ Lab (List A or List B)
PHI 243 or RST 345	

**Senior****Fall**

Biology Elective (List A or B)

**Spring**

select one of the following:

BIO 307  
& 307LBIO 324  
& 324LBIO 340  
& 340L

BIO 298 or HRP 498

<sup>1</sup> PSY 102 and SOC 111 may be taken in Spring

## Learning Goals and Objectives

### Student Learning Goal 1

**Students will develop competency with respect to knowledge, having a working understanding of basic concepts in biomedical science.**

Students will:

- Objective a: demonstrate detailed knowledge of two areas of biomedical science—advanced biology and applied biomedical science;
- Objective b: connect previously learned material with current research in biology;
- Objective c: demonstrate knowledge of key ethical issues in biomedical science.

### Student Learning Goal 2

**Students will develop problem solving skills applicable to biomedical science.**

Students will:

- Objective a: accurately interpret data;
- Objective b: design an experiment to address a specific hypothesis;
- Objective c: critically analyze an article from the original scientific literature or a professional report.

### Student Learning Goal 3

**Students will demonstrate mastery with respect to technical skills in biomedical science.**

Students will:

- Objective a: effectively communicate scientific material in a written format;
- Objective b: effectively communicate scientific material orally;
- Objective c: draw graphs or design tables to accurately represent scientific information;
- Objective d: describe or explain instrumentation and technology appropriate to their course of study