

# CHEMICAL BIOLOGY MAJOR

The major in Chemical Biology addresses the growing interest that many biologists have in the molecular aspects of biology and the increasing emphasis that many chemists place on the significance of chemical interactions and reactions in biological systems. The mission of the major in Chemical Biology is to provide students with an inter-disciplinary and thorough training in both biology and chemistry so that they can understand and investigate the chemical processes that take place at the molecular level in living systems. Chemical Biology majors take a wide variety of chemistry and biology courses with the flexibility to focus on particular areas of their own interest. All students majoring in Chemical Biology engage in faculty-directed independent research projects as part of the major requirement. This gives students the opportunity to apply the principles that they have learned in the classroom and laboratory to the solution of real world scientific problems. In doing research, students gain hands-on experience in the use of state-of-the-art instrumentation, data analysis and interpretation. Students have presented their research at local and national conferences and in journal publications.

A major in Chemical Biology provides a strong academic background for students interested in pursuing graduate, professional and industrial careers at the interface between chemistry and biology. Students in the major benefit from the presence of pharmaceutical, chemical and biochemical industries, and many strong graduate and professional programs in the Philadelphia region. Chemical Biology majors have gone on to careers in cellular and molecular biology, biochemistry, genetics, pharmacy and pharmacology, medicine, biotechnology, forensic science and neuroscience.

## Learning Goals and Outcomes

**Goal 1:** Students will understand the role of chemical properties in biological systems and processes.

**Outcome 1.1:** Students will understand and be able to describe biochemical processes of living organisms and the role of macromolecules in these processes.

**Goal 2:** Students will gain knowledge of problems at the chemistry-biology interface and learn the molecular approaches utilized to solve these.

**Outcome 2.1:** Students will acquire an in-depth understanding of fundamental chemical and biological principles to apply quantitative reasoning to biological problems and their solutions.

**Goal 3:** Students will acquire research experience through faculty-supervised independent projects in chemistry or biology.

**Outcome 3.1:** Students will be able to design an experiment, use modern instrumentation for data acquisition and processing in laboratory courses and in independent research.

**Goal 4:** Students will effectively communicate scientific information.

**Outcome 4.1:** Students will search the literature for published work relevant to a problem of interest and be able to develop cogent written and oral presentations of scientific content.

## Requirements

The traditional undergraduate programs includes a minimum of 120 credits distributed across three components: A General Education component

divided into Signature Courses, Variable Courses, and an Integrative Learning requirement; a Major and Divisional component; and Free Electives. In addition to course requirements as specified in each area, students must complete one certified course in each of the following overlay areas<sup>1</sup>:

1. Diversity, Globalization or Non-western Area Studies,
2. Ethics Intensive
3. Writing Intensive, and
4. Diversity

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Overlay requirements are part of the 120 credit requirements

## General Education Signature Courses

See this page about Signature courses (<https://academiccatalog.sju.edu/curricula/#signature>).

## General Education Variable Courses

See this page about Variable courses (<https://academiccatalog.sju.edu/curricula/#variable>). Six to Nine courses

Code	Title	Hours
<b>Mathematics</b>		
MAT 155 or MAT 161	Fundamentals of Calculus Calculus I	3
<b>Natural Science</b>		
Select one of the following:		
PHY 102 & 102L	General Physics II and General Physics Laboratory II	4
PHY 106 & 106L	University Physics II and University Physics Lab II	4

## General Education Overlays

See this page about Overlays (<https://academiccatalog.sju.edu/curricula/#overlay>).

## General Education Integrative Learning Component

See this page about Integrative Learning Component (<https://academiccatalog.sju.edu/curricula/#integrative-learning>). Three courses:

Code	Title	Hours
BIO 101 & 101L or BIO 150L	Bio I: Cells and Bio I: Cells Lab Bio I: Cells Lab Phage	4
Select one of the following:		
CHM 120 & 120L	General Chemistry I and General Chemistry Lab I	4
CHM 121 & CHM 120L	General Chemistry Honors I and General Chemistry Lab I	4
Select one of the following:		
PHY 101 & 101L	General Physics I and General Physics Laboratory I	4
PHY 105 & 105L	University Physics I and University Physics Lab I	4

## Major Requirements

Code	Title	Hours
<b>Required Courses:</b>		
MAT 128 or MAT 162	Applied Statistics Calculus II	3-4
BIO 102 & 102L or BIO 151L	Bio II: Genetics and Bio II: Genetics Lab Phage Lab	4
BIO 201 & 201L	Bio III: Organismic Biology and Bio III: Organismic Biol Lab	4
CHM 125 & 125L or CHM 126	General Chemistry II and General Chemistry Lab II General Chemistry Honors II	3-4
CHM 330 & 330L	Instrumental Analysis and Instrumental Analysis Lab	5
CHM 210 & 210L	Organic Chemistry I and Organic Chemistry Lab I	4
CHM 215 & 215L	Organic Chemistry II and Organic Chemistry Lab II	4
CHM 320 or CHM 310	Physical Chem for Chem Bio Physical Chemistry I	3
CMB 390	Chemical Biology Seminar <sup>1</sup>	0
<b>Select three of the following:</b>		<b>12</b>
BIO 402 & 402L	Advanced Cell Biology and Advanced Cell Biology Lab	
BIO 411 & 411L	Molecular Genetics and Molecular Genetics Lab	
BIO 412 & 412L	Neurobiology and Neurobiology Lab	
BIO 415 & 415L	Immunology and Immunology Lab	
BIO 416 & 416L	Microbiology and Microbiology Lab	
BIO 422 & 422L	Applied&Environ Microbio and Applied & Environ Micro Lab	
BIO 421 & 421L	Molecular&Cellular Biophysics and Mol & Cell Biophysics Lab	
BIO 424 & 424L	Biotechnology and Biotechnology Lab	
BIO 425 & 425L	Bacterial Pathogenesis and Bacterial Pathogenesis Lab	
<b>Select one of the following in-depth Chemistry courses:</b>		<b>3</b>
CHM 360	Nanochemistry	
CHM 400	Chemistry of the Earth	
CHM 410	Biophysical Chemistry	
CHM 411	Medicinal Chemistry	
CHM 420	Atmospheric Environmental Chem	
CHM 430	Mechanisms in Organic Chem	
CHM 435	Tech Applications of Chemistry	
CHM 440	Organometallic Chemistry	
CHM 460	Aqueous Environmental Chem	
CHM 480	Inorganic Biochemistry	
CHM 490	Spectroscopy	
<b>Select one of the following:</b>		<b>3-4</b>

BIO 404	Biochemistry	
CHM 340	Biochemistry	
<b>Select one of the following: <sup>2</sup></b>		<b>3</b>
BIO 493 or BIO 494	Undergraduate Research in Bio Undergraduate Research in Bio	
CHM 393 or CHM 394	Junior Research I Junior Research II	
CHM 493 or CHM 494	Senior Research I Senior Research II	
<b>Total Hours</b>		<b>51-54</b>

1

Students must register for CMB 390 each semester as a junior or senior (4 total).

2

The research requirement can also be satisfied with CMB 490 Introduction to Research and an in-depth Chemistry course or a Biology elective course listed above.

## Free Electives

At least six courses.