CHEMISTRY MAJOR: CHEMICAL BIOLOGY OPTION (B.S.)

https://ceps.unh.edu/chemistry/program/bs/chemistry-chemical-biology-option

Description

Chemical Biology is the interdisciplinary study of the chemicals and chemical reactions involved in biological processes, incorporating the disciplines of chemistry, biochemistry, cell biology, and pharmacology. In contrast to biochemistry which is the study of biomolecules within and between cells, chemical biology is concerned with using chemical principles to probe, manipulate, and control biological systems in vitro and in vivo.

The Chemical Biology major option will prepare students for a world where molecular behavior and design are increasingly important for drug design, tissue engineering, biologically based materials, and agriculture. The program also is excellent foundation for pre-professional (e.g. pre-med, pre-dentistry, pre-pharmacy) students.

The option is available as a set of electives drawn from current course offerings in Chemistry, Chemical Engineering, Bioengineering, Biomedical Science, and Biochemistry, Molecular, and Cellular Biology. This BS degree option fulfils the requirements for certification by the American Chemical Society.

Requirements

Degree Requirements

Minimum Credit Requirement: 128 credits

Minimum Residency Requirement: 32 credits must be taken at UNH

Minimum GPA: 2.0 required for conferral*

Core Curriculum Required: Discovery & Writing Program Requirements

Foreign Language Requirement: No

All Major, Option and Elective Requirements as indicated.
**Major GPA requirements as indicated.*

Major Requirements

Code	Title	Credits
Chemistry Core Courses		
CHEM 400	Freshman Seminar	1
CHEM 403	General Chemistry I	4
CHEM 404	General Chemistry II	4
CHEM 547 & CHEM 549	Organic Chemistry I and Organic Chemistry Laboratory	5
CHEM 548 & CHEM 550	Organic Chemistry II and Organic Chemistry Laboratory	5
CHEM 517	Introduction to Chemical Measurement Science	3
CHEM 574	Chemistry Across the Periodic Table	4
CHEM 683	Physical Chemistry I	3
or CHEM 684	Physical Chemistry II	
Advanced Chemistry Labs		
Select two courses from the following:		4
CHEM 576	Experimental Inorganic Chemistry	
CHEM 518	Practical Chemical Measurement Techniques and Instrumentation	
CHEM 685	Physical Chemistry Laboratory	
or CHEM 686	Physical Chemistry Laboratory	
Math and Physics Core Courses		
MATH 425	Calculus I	4
MATH 426	Calculus II	4
PHYS 407	General Physics I	4
PHYS 408	General Physics II	4
Chemical Biology Option Requirements		
BIOL 411	Introductory Biology: Molecular and Cellular	4
BMCB 751	Principles of Biochemistry I	4
BMCB 752	Principles of Biochemistry II	4
CHEM 740	Chemical Biology	3
CHEM 741	Chemical Biology Laboratory	4
Chemical Biology Electives		
Select three courses from the following for a minimum of 10 credits:		
BIOL 528	Applied Biostatistics I	4
or MATH 644	Statistics for Engineers and Scientists	
BMS 503 & BMS 504	General Microbiology and General Microbiology Laboratory	5
BMCB 605	Principles of Cell Biology	4
BMCB 750	Physical Biochemistry	3
BMCB 760	Pharmacology	4
BMCB 763	Biochemistry of Cancer	4
BMCB 794	Protein Structure and Function	4
BMCB 755	Protein Biochemistry Laboratory	5
BMCB 754	Molecular Biology Research Methods	5
GEN 604	Principles of Genetics	4
CHEM 708	Spectroscopic Investigations of Organic Molecules	3
CHEM 755	Advanced Organic Chemistry	3
CHEM 777	Advanced Synthesis and Characterization	3
CHEM 762 & CHEM 763	Advanced Chemical Analysis Instrumentation and Advanced Chemical Instrumentation Laboratory	5
CHEM 684	Physical Chemistry II	3
CHBE 766	Biomaterials	4
CHBE 761	Biochemical Engineering	4
CHBE 725	Cell Phenotyping and Tissue Engineering Laboratory	4
Capstone		
CHEM 798	Senior Seminar	1
CHEM 799	Senior Thesis	8
or BMCB 795	Investigations in Molecular and Cellular Biology	

Degree Plan

Sample Degree Plan

This sample degree plan serves as a general guide; students collaborate with their academic advisor to develop a personalized degree plan to meet their academic goals and program requirements.

First Year		
Fall		**Credits**
CHEM 400	Freshman Seminar	1
CHEM 403	General Chemistry I	4
MATH 425	Calculus I	4
Discovery Course		4
	Credits	**13**
Spring		
CHEM 404	General Chemistry II	4
MATH 426	Calculus II	4
ENGL 401	First-Year Writing	4

BIOL 411	Introductory Biology: Molecular and Cellular	4
	Credits	**16**
Second Year		
Fall		
CHEM 547 & CHEM 549	Organic Chemistry I and Organic Chemistry Laboratory	5
CHEM 517 & CHEM 518	Introduction to Chemical Measurement Science and Practical Chemical Measurement Techniques and Instrumentation	5
PHYS 407	General Physics I	4
	Credits	**14**
Spring		
CHEM 548 & CHEM 550	Organic Chemistry II and Organic Chemistry Laboratory	5
CHEM 574 & CHEM 576	Chemistry Across the Periodic Table and Experimental Inorganic Chemistry	6
PHYS 408	General Physics II	4
	Credits	**15**
Third Year		
Fall		
CHEM 683	Physical Chemistry I	3
BMCB 751	Principles of Biochemistry I	4
CHEM 740	Chemical Biology	3
Discovery Course		4
	Credits	**14**
Spring		
CHEM 741	Chemical Biology Laboratory	4
BMCB 752	Principles of Biochemistry II	4
Chemical Biology Elective		3-5
Chemical Biology Elective		3-5
	Credits	**14-18**
Fourth Year		
Fall		
CHEM 799 or BMCB 795	Senior Thesis or Investigations in Molecular and Cellular Biology	4
Discovery Course		4
Discovery or Elective Course		3-5
Chemical Biology Elective		3-5
	Credits	**14-18**
Spring		
CHEM 799 or BMCB 795	Senior Thesis or Investigations in Molecular and Cellular Biology	4
CHEM 798	Senior Seminar	1
Elective or Discovery Course		3-5
Elective or Discovery Course		3-5
	Credits	**11-15**
	Total Credits	**111-123**

Student Learning Outcomes

Program Learning Outcomes

- Recognize that matter consists of atoms that have internal structures that dictate their chemical and physical behavior
- Recognize that atoms interact via electrostatic forces to form chemical bonds
- Recognize that chemical compounds have geometric structures that influence their chemical and physical behaviors
- Recognize that intermolecular forces—electrostatic forces between molecules—dictate the physical behavior of matter
- Recognize that matter changes, forming products that have new chemical and physical properties
- Recognize that energy is the key currency of chemical reactions in molecular scale systems as well as macroscopic systems
- Recognize that chemical changes have a time scale over which they occur
- Recognize that all chemical changes are, in principle, reversible, and chemical processes often reach a state of dynamic equilibrium
- Recognize that chemistry is generally advanced via experimental observations
- Recognize that chemistry constructs meaning interchangeably at the particulate and macroscopic levels.
- Employ the concept of chemical identity (how do we identify chemical substances?)
- Employ structure-property relationships (how do we predict the properties of materials?)
- Employ chemical causality (why do chemical processes occur?)
- Employ chemical mechanism (how do chemical processes occur?)
- Employ chemical control (how can we control chemical processes?)
- Employ benefits-costs-risks (how do we evaluate the impacts of chemically transforming matter?)
- Demonstrate ability to ask questions
- Develop and use models
- Construct explanations
- Plan and carry out investigations
- Engage in argument from evidence
- Analyze and interpret data
- Demonstrate mathematical and computational thinking
- Obtain, evaluate, and communicate information