MAJOR IN BIOCHEMISTRY, DATA SCIENCE CONCENTRATION

The Data Science concentration in Biochemistry builds on the general biochemistry core set of courses (24 credits of primarily upper division courses) and includes 21 data science specific course credits. This option gives the student 3 "free elective" credits, which they can use to complete either data science elective, bioscience elective, or second semester physics courses. This concentration is designed to provide a solid background in biochemistry, molecular genetics and cell biology, augmented with computer science, mathematics and statistics. The data science concentration is recommended for students interested in a career in life science data analysis. Students who graduate with this concentration obtain the skills necessary for organizing, analyzing and communicating the meaning of massive data sets.

Learning Objectives

Upon successful completion, students will be able to:

1. Explain how DNA is packaged, replicated, repaired, transcribed, and translated in both eukaryotes and prokaryotes.
2. Compare and contrast the regulatory mechanisms of transcription and translation in eukaryotes and prokaryotes.
3. Describe and discuss the molecular architecture of nucleic acids and proteins along with the non-covalent interactions responsible for stabilizing the structure of these macromolecules.
4. Outline the salient features of the central pathways of glycolysis, gluconeogenesis, citric acid cycle, pentose phosphate pathway, fatty acid metabolism, ketogenesis, urea cycle, amino acid and nucleotide metabolism and explain the principles of electron transport, ATP synthesis, and their regulation.
5. Develop critical thinking skills for concepts related to cellular functions and their regulation mechanism.
6. Perform a wide-array of biochemical techniques and discuss how these tools are currently being used in biochemical research.
7. Communicate biochemical concepts to other scientists in written and oral form.
8. Apply modern tools and methods for handling, cleaning, organizing, and mining biochemically relevant data sets.
9. Apply data science techniques to such data sets to address biochemical questions.
10. Use omics resources and computational tools to address biochemical questions.
11. Apply data visualization techniques to summarize biochemical data and present the results of analyses.

Requirements Effective Fall 2025

A minimum grade of C (2.000) must be earned for BC 493 and all biochemistry (BC) and LIFE subject code lecture and laboratory courses at or above the 200-level required in the biochemistry major.

Freshman

		AUCC	Credits
BC 192	Biochemistry Freshman Seminar		2
CHEM 111	General Chemistry I (GT-SC2)	3A	4
CHEM 112	General Chemistry Lab I (GT-SC1)	3A	1
CHEM 113	General Chemistry II		3
CHEM 114	General Chemistry Lab II		1
CO 150	College Composition (GT-CO2)	1A	3
LIFE 102	Attributes of Living Systems (GT-SC1)	3A	4
LIFE 201B	Introductory Genetics: Molecular/Immunological/Developmental (GT-SC2)	3A	3
LIFE 203	Introductory Genetics Laboratory		2
Select one course from the following:[1]			4
MATH 155	Calculus for Biological Scientists I (GT-MA1)	1B	
MATH 160	Calculus for Physical Scientists I (GT-MA1)	1B	
Select one course from the following:[1]			4
MATH 161	Calculus for Physical Scientists II (GT-MA1)	1B	
MATH 255	Calculus for Biological Scientists II	1B	
	Total Credits		**31**

Sophomore

CHEM 341	Modern Organic Chemistry I		3
CHEM 343	Modern Organic Chemistry II		3
CHEM 344	Modern Organic Chemistry Laboratory		2
CS 150B	Culture and Coding: Python (GT-AH3)	3B	3
CS 162	CS1--Introduction to Java Programming		2

DSCI 369	Linear Algebra for Data Science		4
LIFE 210	Introductory Eukaryotic Cell Biology		3
LIFE 212	Introductory Cell Biology Laboratory		2
STAT 158	Introduction to R Programming		1
1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)		1C	3
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	3
	Total Credits		**29**

Junior

BC 360	Responsible Conduct in Biochemical Research		1
BC 401	Comprehensive Biochemistry I	4A	3
BC 403	Comprehensive Biochemistry II	4B	3
BC 404	Comprehensive Biochemistry Laboratory	4B	2
BZ 360	Bioinformatics and Genomics		4
CS 165	CS2--Data Structures		4
DSCI 235	Data Wrangling		2
STAT 315	Intro to Theory and Practice of Statistics		3
Select one course from the following:			3
CO 300	Writing Arguments (GT-CO3)	2	
CO 301B	Writing in the Disciplines: Sciences (GT-CO3)	2	
CO 302	Writing in Digital Environments (GT-CO3)	2	
JTC 300	Strategic Writing and Communication (GT-CO3)	2	
Select one course from the following:			5
PH 121	General Physics I (GT-SC1)	3A	
PH 141	Physics for Scientists and Engineers I (GT-SC1)	3A	
	Total Credits		**30**

Senior

BC 411	Physical Biochemistry		4
BC 463	Molecular Genetics		3
BC 465	Molecular Regulation of Cell Function		3
BC 493	Senior Seminar	4A,4C	1
DSCI 335	Inferential Reasoning in Data Analysis		3
STAT 341	Statistical Data Analysis I		3
Select one course from the following:			3
BC 499A	Thesis: Laboratory Research-Based	4C	
BC 499F	Thesis: Literature-Based in Data Science	4C	
Historical Perspectives (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)		3D	3
Social and Behavioral Sciences (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences)		3C	3
Electives[2]			4
	Total Credits		**30**
	Program Total Credits:		**120**

1 MATH 156 and MATH 256 may also be used to satisfy the two-semester calculus requirement.

2 Select enough elective credits to bring the program total to a minimum of 120 credits, of which at least 42 must be upper-division (300- to 400-level). Students are encouraged to fulfill their elective credits with research credits, additional Data Science electives, Bioscience electives, PH 122/PH 142, or apply them to a minor.

Major Completion Map

A minimum grade of C (2.000) must be earned for BC 493 and all biochemistry (BC) and LIFE subject code lecture and laboratory courses at or above the 200-level required in the biochemistry major.

Freshman

Semester 1		Critical	Recommended	AUCC	Credits
BC 192	Biochemistry Freshman Seminar	X			2
CHEM 111	General Chemistry I (GT-SC2)	X		3A	4
CHEM 112	General Chemistry Lab I (GT-SC1)	X		3A	1
LIFE 102	Attributes of Living Systems (GT-SC1)	X		3A	4
Select one course from the following:		X			4
MATH 155	Calculus for Biological Scientists I (GT-MA1)			1B	
MATH 160	Calculus for Physical Scientists I (GT-MA1)			1B	
	Total Credits				**15**

Semester 2		Critical	Recommended	AUCC	Credits
CHEM 113	General Chemistry II	X			3
CHEM 114	General Chemistry Lab II	X			1
CO 150	College Composition (GT-CO2)	X		1A	3
LIFE 201B	Introductory Genetics: Molecular/Immunological/ Developmental (GT-SC2)	X		3A	3
LIFE 203	Introductory Genetics Laboratory	X			2
Select one course from the following:		X			4
MATH 161	Calculus for Physical Scientists II (GT-MA1)			1B	
MATH 255	Calculus for Biological Scientists II	X		1B	
	Total Credits				**16**

Sophomore

Semester 3		Critical	Recommended	AUCC	Credits
CHEM 341	Modern Organic Chemistry I	X			3
CS 150B	Culture and Coding: Python (GT-AH3)	X		3B	3
LIFE 210	Introductory Eukaryotic Cell Biology	X			3
LIFE 212	Introductory Cell Biology Laboratory	X			2
1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)			X	1C	3
	Total Credits				**14**

Semester 4		Critical	Recommended	AUCC	Credits
CHEM 343	Modern Organic Chemistry II	X			3
CHEM 344	Modern Organic Chemistry Laboratory	X			2
CS 162	CS1--Introduction to Java Programming	X			2
DSCI 369	Linear Algebra for Data Science	X			4
STAT 158	Introduction to R Programming	X			1
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)			X	3B	3
	Total Credits				**15**

Junior

Semester 5		Critical	Recommended	AUCC	Credits
BC 360	Responsible Conduct in Biochemical Research	X			1
BC 401	Comprehensive Biochemistry I	X		4A	3
BZ 360	Bioinformatics and Genomics	X			4
CS 165	CS2--Data Structures	X			4
STAT 315	Intro to Theory and Practice of Statistics	X			3
	Total Credits				**15**

Semester 6		Critical	Recommended	AUCC	Credits
BC 403	Comprehensive Biochemistry II	X		4B	3
BC 404	Comprehensive Biochemistry Laboratory	X		4B	2
DSCI 235	Data Wrangling	X			2
Select one course from the following:		X			3
CO 300	Writing Arguments (GT-CO3)		X	2	
CO 301B	Writing in the Disciplines: Sciences (GT-CO3)		X	2	
CO 302	Writing in Digital Environments (GT-CO3)		X	2	
JTC 300	Strategic Writing and Communication (GT-CO3)		X	2	
Select one course from the following:		X			5
PH 121	General Physics I (GT-SC1)			3A	
PH 141	Physics for Scientists and Engineers I (GT-SC1)			3A	
	Total Credits				**15**

Senior

Semester 7		Critical	Recommended	AUCC	Credits
BC 411	Physical Biochemistry	X			4
BC 463	Molecular Genetics	X			3
BC 493	Senior Seminar	X		4A,4C	1
STAT 341	Statistical Data Analysis I	X			3
Historical Perspectives (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)			X	3D	3
	Total Credits				**14**

Semester 8		Critical	Recommended	AUCC	Credits
BC 465	Molecular Regulation of Cell Function	X			3
DSCI 335	Inferential Reasoning in Data Analysis	X			3
Select one course from the following:		X			3
BC 499A	Thesis: Laboratory Research-Based	X		4C	
BC 499F	Thesis: Literature-Based in Data Science	X		4C	
Social and Behavioral Sciences (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences)		X		3C	3
Electives		X			4
The benchmark courses for the 8th semester are the remaining courses in the entire program of study.		X			
	Total Credits				**16**
	Program Total Credits:				**120**