

MAJOR IN DATA SCIENCE, BIOINFORMATICS CONCENTRATION

Data Science is the discovery of knowledge and insight through the analysis of data. As such, it draws on the study of algorithms and their implementation from computer science, the power of abstraction and of geometric and topological formalism from mathematics, and the modeling and analysis of data from statistics. It has emerged as a separate field in response to the avalanche of data from web enabled sensors and instrumentation, mobile devices, web logs and transactions, and the availability of computing power for data storage and analysis. Modern data is challenging not only due to its large scale, but also because it is increasingly heterogeneous and unstructured. Information gleaned from this data none-the-less is revolutionizing diverse areas of human endeavor from health policy to high energy physics.

Learning Objectives

Upon successful completion of this program, students will be able to:

1. Select appropriate data analysis techniques for diverse biological contexts, develop and evaluate statistical models, perform analyses on biological data, and effectively communicate the results.
2. Effectively communicate analysis results and ideas through graphical, oral, and written methods. Develop the skills to collaborate and engage with professionals across diverse fields, translating complex biological concepts for varied audiences.
3. Work effectively in teams, collaborating toward the achievement of shared goals and contributing to collective success.
4. Develop algorithms and methodologies to integrate genetic, cellular, molecular, and biochemical data from large datasets, enabling them to formulate and test rigorous hypotheses about the cellular and biochemical processes that maintain normal physiological function and contribute to disease mechanisms.

Requirements Effective Fall 2026

Freshman

		AUCC	Credits
CO 150	College Composition (GT-CO2)	1A	3
CS 150B	Culture and Coding: Python	3B	3
CS 164	CS1–Computational Thinking with Java		4
DSCI 100	First Year Seminar in Data Science		1
DSCI 369	Linear Algebra for Data Science		4
LIFE 102	Attributes of Living Systems (GT-SC1)	3A	4
MATH 156 ¹	Mathematics for Computational Science I (GT-MA1)	1B	4
STAT 158	Introduction to R Programming		1
STAT 315	Intro to Theory and Practice of Statistics		3
1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)		1C	3
Total Credits			30

Sophomore

CHEM 111	General Chemistry I (GT-SC2)	3A	4
CHEM 112	General Chemistry Lab I (GT-SC1)	3A	1
CS 165	CS2–Data Structures		4
CS 220	Discrete Structures		4
DSCI 235	Data Wrangling		2
MATH 256 ¹	Mathematics for Computational Science II		4
STAT 341	Statistical Data Analysis I		3
STAT 342	Statistical Data Analysis II		3
Social and Behavioral Sciences (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences)		3C	3
Total Credits			28

Junior

CHEM 113	General Chemistry II		3
CS 201/PHIL 201	Ethical Computing Systems	3B	3
DSCI 320/MATH 320	Optimization Methods in Data Science		3
DSCI 335	Inferential Reasoning in Data Analysis		3

DSCI 336	Data Graphics and Visualization		1
LIFE 201B	Introductory Genetics: Molecular/Immunological/Developmental (GT-SC2)	3A	3
LIFE 210	Introductory Eukaryotic Cell Biology		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	
Data Science Elective			3
Historical Perspectives (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)			3D
Elective			3
Total Credits			31
Senior			
BZ 360	Bioinformatics and Genomics		4
CS 425	Introduction to Bioinformatics Algorithms		4
DSCI 445	Statistical Machine Learning	4B	3
DSCI 478	Capstone Group Project in Data Science	4A,4C	4
Data Science Electives			4
Life Science Electives			8
Electives ²			4
Total Credits			31
Program Total Credits:			120

Data Science Electives List

Code	Title	AUCC	Credits
CS 214	Software Development		3
CS 250	Computer Systems Foundations		4
CS 270	Computer Organization		4
CS 314	Software Engineering		3
CS 320	Algorithms--Theory and Practice		3
CS 370	Operating Systems		3
CS 435	Introduction to Big Data		4
CS 440	Introduction to Artificial Intelligence		4
CT 301	C++ Fundamentals		2
DSCI 473	Introduction to Geometric Data Analysis		2
DSCI 475	Topological Data Analysis		2
DSCI 510	Linux as a Computational Platform		1
DSCI 512	RNA-Sequencing Data Analysis		1
ECON 202	Principles of Microeconomics (GT-SS1)	3C	3
ECON 204	Principles of Macroeconomics (GT-SS1)	3C	3
ECON 435	Intermediate Econometrics		3
MATH 301	Introduction to Combinatorial Theory		3
MATH 317	Advanced Calculus of One Variable		3
MATH 331	Introduction to Mathematical Modeling		3
MATH 345	Differential Equations		4
MATH 360	Mathematics of Information Security		3

MATH 450	Introduction to Numerical Analysis I	3
MATH 451	Introduction to Numerical Analysis II	3
STAT 400	Statistical Computing	3
STAT 420	Probability and Mathematical Statistics I	3
STAT 430	Probability and Mathematical Statistics II	3
STAT 440	Bayesian Data Analysis	3

Life Science Electives List

Code	Title	AUCC	Credits
ANeq 505	Microbiome of Animal Systems		3
BC 351	Principles of Biochemistry		4
BC 360	Responsible Conduct in Biochemical Research		1
BC 463	Molecular Genetics		3
BC 465	Molecular Regulation of Cell Function		3
BZ 220	Introduction to Evolution		3
BZ 240	Synthetic Biology-Principles and Applications		3
BZ 348/MATH 348	Theory of Population and Evolutionary Ecology		4
BZ 450	Plant Ecology		4
BZ 477	Genome Editing Laboratory		2
CHEM 114	General Chemistry Lab II		1
CHEM 245	Fundamentals of Organic Chemistry		4
LIFE 103	Biology of Organisms-Animals and Plants	3A	4
LIFE 220/LAND 220	Fundamentals of Ecology	3A	3
MIP 300	General Microbiology		3
MIP 315	Pathology of Human and Animal Disease		3
MIP 545	Microbial Metagenomics/Genomics Data Analysis		2

¹ The calculus requirement for the major may alternatively be satisfied by completion of MATH 160, MATH 161, and MATH 261, or by completion of MATH 155 and MATH 255.

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).

TO PREPARE FOR FIRST SEMESTER: The curriculum for the Major in Data Science assumes students enter college prepared to begin a year-long calculus sequence (either MATH 155/MATH 255 or MATH 160/MATH 161) in the first semester of their first year. LIFE 102 requires high school chemistry as a prerequisite; CHEM 111 requires Algebra II as a prerequisite (this prerequisite is met by having Algebra II by test credit, transfer credit, or placement out of MATH 117 and MATH 118 on Math Placement Exam).

Major Completion Map

Distinctive Requirements for Degree Program:

Freshman

Semester 1		Critical	Recommended	AUCC	Credits
CS 150B	Culture and Coding: Python	X		3B	3
DSCI 100	First Year Seminar in Data Science	X			1
LIFE 102	Attributes of Living Systems (GT-SC1)	X		3A	4
MATH 156	Mathematics for Computational Science I (GT-MA1)	X		1B	4

1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)			X	1C	3
Total Credits					15
Semester 2		Critical	Recommended	AUCC	Credits
CO 150	College Composition (GT-CO2)	X		1A	3
CS 164	CS1--Computational Thinking with Java	X			4
DSCI 369	Linear Algebra for Data Science	X			4
STAT 158	Introduction to R Programming	X			1
STAT 315	Intro to Theory and Practice of Statistics	X			3
Total Credits					15
Sophomore					
Semester 3		Critical	Recommended	AUCC	Credits
CS 165	CS2--Data Structures	X			4
CS 220	Discrete Structures	X			4
STAT 341	Statistical Data Analysis I	X			3
Social and Behavioral Sciences (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences)			X	3C	3
Total Credits					14
Semester 4		Critical	Recommended	AUCC	Credits
CHEM 111	General Chemistry I (GT-SC2)	X		3A	4
CHEM 112	General Chemistry Lab I (GT-SC1)	X		3A	1
DSCI 235	Data Wrangling	X			2
MATH 256	Mathematics for Computational Science II	X			4
STAT 342	Statistical Data Analysis II	X			3
Total Credits					14
Junior					
Semester 5		Critical	Recommended	AUCC	Credits
CS 201/PHIL 201	Ethical Computing Systems	X		3B	3
DSCI 320/ MATH 320	Optimization Methods in Data Science	X			3
LIFE 210	Introductory Eukaryotic Cell Biology	X			3
Select one course from the following:		X			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	
Historical Perspectives (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)			X	3D	3
Total Credits					15
Semester 6		Critical	Recommended	AUCC	Credits
CHEM 113	General Chemistry II	X			3
DSCI 335	Inferential Reasoning in Data Analysis	X			3
DSCI 336	Data Graphics and Visualization	X			1
LIFE 201B	Introductory Genetics: Molecular/Immunological/ Developmental (GT-SC2)	X		3A	3
Data Science Elective (see list on Concentration Requirements tab)			X		3
Elective			X		3
Total Credits					16
Senior					
Semester 7		Critical	Recommended	AUCC	Credits
BZ 360	Bioinformatics and Genomics	X			4
DSCI 445	Statistical Machine Learning	X		4B	3
Data Science Electives (see list on Concentration Requirements tab)			X		4

Life Science Electives (see list on Concentration Requirements tab)			X	4	
Total Credits				15	
Semester 8		Critical	Recommended	AUCC	Credits
CS 425	Introduction to Bioinformatics Algorithms	X			4
DSCI 478	Capstone Group Project in Data Science	X		4A,4C	4
Life Science Electives (see list on Concentration Requirements tab)		X			4
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