

BIOLOGICAL DATA SCIENCES GRADUATE MINOR

The graduate minor in Biological Data Sciences will familiarize MS and PhD graduate students in the life sciences with research concepts and methodologies in quantitative sciences, and those in the quantitative sciences with research concepts and methodologies in life sciences. The disciplinary learning goals of the minor are by nature foundational. Thus, for example, students with advanced expertise in life sciences would receive foundational training in computer science, statistics and/or mathematics. Students with advanced expertise in computer science would receive foundational training in life science, statistics and, if needed, mathematics. A capstone collaborative problem-solving course will be required by all students. Students may complete all the course work in a single year (encouraged), or may choose spread the courses out over several years. With approval by the director of the minor, students may receive credit for courses taken for their major.

The minor is open to both MS and PhD students.

Minor Code: 1375

PhD students must complete at least 18 credits for the minor and MS students must complete 15 credits.

Students must select courses from at least two disciplinary focal areas outside their undergraduate and graduate majors. For example a life sciences student might take courses in mathematics and computer science, while a statistics student might take courses in computer science and life sciences. In each focal area, PhD students must take at least 5 credits and MS students at least 3 credits. Some courses span more than one focal area; these courses may not be counted towards two focal areas simultaneously.

Some courses that are electives in an MS or PhD major may also be counted towards the BLDS minor. For example, a PhD student in Molecular and Cellular Biology (MCB) may select MCB 576 as an elective for their MCB requirements, and also as computer science credit for the BLDS minor.

Required by All Students:

Code	Title	Hours
BOT 599	SPECIAL TOPICS (Collaborative Problem-Solving in Biological Data Science)	3

Students who do not complete an ethics and professionalism class as part of their PhD major must take MCB 557 or an equivalent course.

Students are recommended to choose their courses from the following lists, depending on their prior preparation as an undergraduate. Equivalent or more advanced courses may be substituted after consultation with the BLDS director. Some courses require prerequisites. Some courses span more than one focal area; such courses can be counted towards one or other of those focal areas, but not both.

Life Sciences Focal Area

Code	Title	Hours
BB 585	APPLIED BIOINFORMATICS ¹	3
BOT 599	SPECIAL TOPICS (Introduction to Genome Biology) ²	3
BOT 575/MCB 575	COMPARATIVE GENOMICS	4
IB 592	THEORETICAL ECOLOGY	4

IB 594	COMMUNITY ECOLOGY	5
MB 668	MICROBIAL BIOINFORMATICS AND GENOME EVOLUTION ²	4
MTH 527	INTRODUCTION TO MATHEMATICAL BIOLOGY	3
MTH 528	STOCHASTIC ELEMENTS IN MATHEMATICAL BIOLOGY	3
VMB 631	MATHEMATICAL MODELING OF BIOLOGICAL SYSTEMS ²	3
VMB 670	INTRODUCTION TO SYSTEMS BIOLOGY ²	2
Total Hours		34

¹ Recommended prerequisites may be waived with instructor approval

² No prerequisites

Mathematics Focal Area

Code	Title	Hours
MTH 527	INTRODUCTION TO MATHEMATICAL BIOLOGY	3
MTH 528	STOCHASTIC ELEMENTS IN MATHEMATICAL BIOLOGY	3
Select one of the following:		3-4
MTH 563	PROBABILITY I ¹	
ST 521	INTRODUCTION TO MATHEMATICAL STATISTICS ²	
Select one of the following:		3-4
MTH 564	PROBABILITY II ¹	
ST 522	INTRODUCTION TO MATHEMATICAL STATISTICS ²	
VMB 631	MATHEMATICAL MODELING OF BIOLOGICAL SYSTEMS ³	3
Total Hours		15-17

¹ Recommended prerequisites may be waived with instructor approval

² The following sequences qualify for Mathematics Focal Area credit: MTH 563–MTH 564, MTH 564–ST 521, ST 521–MTH 564. ST 521–ST 522 does not qualify. Only one pair of courses can be claimed for credit.

³ No prerequisites

Statistics Focal Area

Code	Title	Hours
H 524	INTRODUCTION TO BIostatISTICS ¹	4
H 566	DATA MINING IN PUBLIC HEALTH ²	3
H 580	LINEAR REGRESSION AND ANALYSIS OF TIME TO EVENT DATA	4
H 581	GENERALIZED LINEAR MODELS AND CATEGORICAL DATA ANALYSIS	4
MCB 599	SPECIAL TOPICS (Data Programming in R and I) ¹	2
Select one of the following:		3-4
MTH 563	PROBABILITY I ^{2,3}	
ST 521	INTRODUCTION TO MATHEMATICAL STATISTICS ⁴	
Select one of the following:		3-12
MTH 564	PROBABILITY II ^{2,3}	
ST 522	INTRODUCTION TO MATHEMATICAL STATISTICS ⁴	
ST 511 & ST 512 & ST 513	METHODS OF DATA ANALYSIS and METHODS OF DATA ANALYSIS and METHODS OF DATA ANALYSIS ⁴	
ST 537	DATA VISUALIZATION (Via Ecampus only)	3
ST 592	STATISTICAL METHODS FOR GENOMICS RESEARCH ²	3
ST 599	SPECIAL TOPICS (Introduction to Quantitative Genomics) ¹	3
Total Hours		32-42

¹ No prerequisites

² Recommended prerequisites may be waived with instructor approval

³ The following sequences qualify for Mathematics Focal Area credit: MTH 563–MTH 564, MTH 564–ST 521, ST 521–MTH 564. ST 521–ST 522 does not qualify. Only one pair of courses can be claimed for credit.

⁴ The following sequences qualify for Statistics Focal Area credit: ST 511–ST 513, MTH 563–MTH 564, MTH 564–ST 521, ST 521–MTH 564, or ST 521–ST 522. Only one of these sequences can be claimed for Statistics focal area credit.

Computer Science Focal Area

Code	Title	Hours
BB 585	APPLIED BIOINFORMATICS ¹	3
CS 519	SELECTED TOPICS IN COMPUTER SCIENCE (Algorithms for Computational Biology) ¹	3
or BB 599	SPECIAL TOPICS	
CS 534	MACHINE LEARNING ²	4
CS 546	NETWORKS IN COMPUTATIONAL BIOLOGY ¹	3
ECE 560	STOCHASTIC SIGNALS AND SYSTEMS	4
ECE 564	DIGITAL SIGNAL PROCESSING	4
FW 599	SPECIAL TOPICS IN FISHERIES AND WILDLIFE (Machine Learning Topics in Species Distribution Modeling)	3
MCB 599	SPECIAL TOPICS (Introduction to Linux and the Command Line) ²	2
MCB 599	SPECIAL TOPICS (Introduction to Python I and II) ¹	2
MCB 599	SPECIAL TOPICS (Data Programming in R I and II) ¹	2
MCB 599	SPECIAL TOPICS (Simulating Natural Systems) ¹	1
MCB 576/BOT 576	INTRODUCTION TO COMPUTING IN THE LIFE SCIENCES ¹	3
VMB 670	INTRODUCTION TO SYSTEMS BIOLOGY ²	2
Total Hours		36

¹ Recommended prerequisites may be waived with instructor approval

² No prerequisites

Note: All of the 599 classes here represent classes that are in transition to becoming regular offerings.