MAJOR IN MOLECULAR BIOLOGY, BIOCHEMISTRY AND BIOINFORMATICS

Requirements

All Molecular Biology, Biochemistry and Bioinformatics majors are required to complete 42-45 units of required courses and an additional 25-39 units within one of three concentrations (Molecular Biology, Biochemistry or Bioinformatics) for a total of 67-84 units.

Code	Title	Units
Required Courses		
BIOL 200 & 200L	BIOLOGY I: INTRODUCTION TO CELLULAR BIOLOGY AND GENETICS [LECTURE] and BIOLOGY I: INTRODUCTION TO CELLULAR BIOLOGY AND GENETICS [LAB]	4
BIOL 206 & 206L	BIOLOGY II: INTRODUCTION TO ECOLOGY AND EVOLUTION [LECTURE] and BIOLOGY II: INTRODUCTION TO ECOLOGY AND EVOLUTION [LAB]	4
BIOL 309	GENETICS	4
BIOL 409	MOLECULAR BIOLOGY	4
CHEM 131 & 131L	GENERAL CHEMISTRY I LECTURE and GENERAL CHEMISTRY I LABORATORY	4
CHEM 132 & 132L	GENERAL CHEMISTRY II LECTURE and GENERAL CHEMISTRY II LABORATORY	4
CHEM 351	BIOCHEMISTRY	3
MATH 237	ELEMENTARY BIOSTATISTICS	3-4
or MATH 231	BASIC STATISTICS	
MBBB 201	PROGRAMMING FOR BIOLOGISTS	4
or COSC 175	GEN COMPUTER SCI	
MBBB 301	INTRO TO BIOINFORMATICS	4
MBBB 493	SEMINAR IN BIOETHICS	1-3
or PHIL 361	BIOMEDICAL ETHICS	
Select one of the following (courses may be repeated for a total of 6 units toward the major): [1]		3
BIOL 491	ELECTIVE IN INDEPENDENT RESEARCH	
CHEM 491	RESEARCH IN CHEMISTRY	
COSC 495	INDEPENDENT STUDY	
MBBB 495	CAPSTONE PROJECT IN MBBB	
Total Units		**42-45**

[1] Or an approved elective in BIOL, CHEM, COSC, CIS or MBBB 3XX, 4XX.

Molecular Biology Concentration (25-33 units)

Code	Title	Units
BIOL 408	CELL BIOLOGY	4
CHEM 331 & CHEM 332	ORGANIC CHEMISTRY I and ORGANIC CHEMISTRY II	5-10
or CHEM 330	ESSENTIALS OF ORGANIC CHEMISTRY	
MATH 273	CALCULUS I	3-4
or MATH 211	CALCULUS FOR APPLICATIONS	
PHYS 211 & PHYS 212	GENERAL PHYSICS I; NON CALCULUS-BASED and GENERAL PHYSICS II; NON CALCULUS-BASED	8
Electives:		
Select one of the following:		2-3
BIOL 410	MOLECULAR BIOLOGY LABORATORY	
BIOL 412	CELL BIOLOGY LABORATORY	
BIOL 418	GENETIC ANALYSIS IN MEDICINE	
BIOL 474	MOLECULAR TECHNIQUES IN ECOLOGY, EVOLUTION, AND CONSERVATION	
BIOL 475	GENETICS LABORATORY	
CHEM 356	BIOCHEMISTRY LAB	
Select one of the following:		3-4
BIOL 318	MICROBIOLOGY	
BIOL 403	ADV GENETICS	
BIOL 411	CANCER BIOLOGY	
BIOL 415	BIOTECHNOLOGY	
BIOL 421	IMMUNOLOGY	
BIOL 428	VIROLOGY	
CHEM 480	CHEMICAL TOXICOLOGY	
MBBB 315	GENOMICS	
MBBB 401	ADVANCED BIOINFORMATICS	
Total Units		**25-33**

Biochemistry Concentration (36-37 units)

Code	Title	Units
CHEM 220 & 220L	ANALYTICAL CHEMISTRY [LECTURE] and ANALYTICAL CHEMISTRY [LAB]	5
CHEM 331 & CHEM 332	ORGANIC CHEMISTRY I and ORGANIC CHEMISTRY II	10
CHEM 345	PRINCIPLES OF PHYSICAL CHEMISTRY	3
CHEM 356	BIOCHEMISTRY LAB	2
CHEM 357	ADVANCED BIOCHEMISTRY	3
or BIOL 450	ECOLOGICAL BIOCHEMISTRY	
CHEM 372	PHYSICAL CHEMISTRY LABORATORY	2
MATH 273	CALCULUS I	3-4
or MATH 211	CALCULUS FOR APPLICATIONS	
PHYS 211 & PHYS 212	GENERAL PHYSICS I; NON CALCULUS-BASED and GENERAL PHYSICS II; NON CALCULUS-BASED	8
or PHYS 241 & PHYS 242	GENERAL PHYSICS I CALCULUS-BASED and GENERAL PHYSICS II CALCULUS-BASED	
Total Units		**36-37**

Bioinformatics Concentration (34–39 units)

Code	Title	Units
CHEM 330	ESSENTIALS OF ORGANIC CHEMISTRY [1]	5-10
or CHEM 331 & CHEM 332	ORGANIC CHEMISTRY I and ORGANIC CHEMISTRY II	

COSC 236 & COSC 237	INTRODUCTION TO COMPUTER SCIENCE I and INTRODUCTION TO COMPUTER SCIENCE II	8
COSC 336	DATA STRUCTURES AND ALGORITHM ANALYSIS	4
COSC 457 or CIS 458	DATABASE MANAGEMENT SYSTEMS ORGANIZATIONAL DATABASE MANAGEMENT	3
MATH 263 or MBBB 315	DISCRETE MATHEMATICS GENOMICS	3
MATH 273	CALCULUS I	4
MATH 274	CALCULUS II	4
MBBB 401	ADVANCED BIOINFORMATICS	3
Total Units		**34-39**

[1] Note: Many graduate and professional programs require two terms of physics and two terms of organic chemistry and/or calculus. Students who are contemplating education beyond the undergraduate level (graduate school, medical school, etc.) should consult their adviser.

Four-Year Plan of Study

Note: Below are idealized plans of study for each of the three concentrations within the MB3 major. Actual plans of study will vary significantly between students depending on high school preparation, performance in classes, additional commitments and career goals.

Biochemistry Concentration Suggested Four-Year Plan

Based on course availability and student needs and preferences, the selected sequences will probably vary from those presented below. Students should consult with their adviser to make the most appropriate elective choices.

Freshman

Term 1	Units	Term 2	Units
CHEM 131 & 131L (Core 7)	4	BIOL 200 & 200L	4
MATH 273 or 211 (Core 3)	3-4	CHEM 132 & 132L (Core 8)	4
Core 1 (or Core 2)	3	Core 2 (or Core 1)	3
Core 4	3	Core 5	3
	13-14		**14**

Sophomore

Term 1	Units	Term 2	Units
BIOL 206 & 206L	4	BIOL 309	4
CHEM 331	5	CHEM 332	5
MBBB 201 or COSC 175	4	MATH 237 or 231	3-4
Core 6	3	Core 10	3
	16		**15-16**

Junior

Term 1	Units	Term 2	Units
CHEM 220 & 220L	5	BIOL 409 or MBBB 301	4
MBBB 301 or BIOL 409	4	CHEM 351	3
PHYS 211 or 241	4	CHEM 356	2
Core 11	3	PHYS 212 or 242	4
		Core 12	3
	16		**16**

Senior

Term 1	Units	Term 2	Units
CHEM 357 or BIOL 450	3	CHEM 345	3
Research	3	CHEM 372	2
Core 9	3	MBBB 493 or PHIL 361	1-3
Core 13	3	Core 14	3
Elective	3	Elective	3
		Elective	3
	15		**15-17**

Total Units 120-124

Molecular Biology Concentration Suggested Four-Year Plan

Based on course availability and student needs and preferences, the selected sequences will probably vary from those presented below. Students should consult with their adviser to make the most appropriate elective choices.

Freshman

Term 1	Units	Term 2	Units
BIOL 200 & 200L	4	BIOL 206 & 206L	4
CHEM 131 & 131L (Core 7)	4	CHEM 132 & 132L (Core 8)	4
Core 1 (or Core 2)	3	MATH 273 or 211 (Core 3)	3-4
Core 4	3	Core 2 (or Core 1)	3
	14		**14-15**

Sophomore

Term 1	Units	Term 2	Units
BIOL 309	4	MATH 237 or 231	3-4
MBBB 201 or COSC 175	4	MBBB 493 or PHIL 361	1-3
Core 5	3	PHYS 211	4
Core 6	3	Elective	4
Elective	3	Core 9	3
	17		**15-18**

Junior

Term 1	Units	Term 2	Units
CHEM 331 or 330	5	BIOL 409	4
PHYS 212	4	CHEM 332 (If CHEM 331 taken instead of CHEM 330)	5
Core 10	3	Elective	4
Core 11	3	Core 12	3
	15		**16**

Senior

Term 1	Units	Term 2	Units
Upper-Level Elective	2-3	BIOL 408	4
CHEM 351	3	Upper-Level Elective	3-4
MBBB 301	4	Core 14	3
Research	3	Elective	4

Core 13	3		
	15-16		**14-15**

Total Units 120-126

Bioinformatics Concentration Suggested Four-Year Plan

Based on course availability and student needs and preferences, the selected sequences will probably vary from those presented below. Students should consult with their adviser to make the most appropriate elective choices.

Freshman

Term 1	Units	Term 2	Units
BIOL 200 & 200L	4	BIOL 206 & 206L	4
COSC 175	4	COSC 236	4
Core 1 (or Core 2)	3	MATH 273 (Core 3)	4
Core 4	3	Core 2 (or Core 1)	3
	14		**15**

Sophomore

Term 1	Units	Term 2	Units
CHEM 131 & 131L (core 7)	4	BIOL 309	4
COSC 237	4	CHEM 132 & 132L (core 8)	4
MATH 274	4	COSC 336	4
Core 5	3	Core 10	3
	15		**15**

Junior

Term 1	Units	Term 2	Units
CHEM 330 or 331	5	CHEM 332 (if CHEM 331 taken instead of CHEM 330)	5
COSC 457 or CIS 458	3	MBBB 301	4
MATH 237	4	MBBB 315 or MATH 263	3
Core 11	3	MBBB 493 or PHIL 361	1-3
		Core 12	3
	15		**16-18**

Senior

Term 1	Units	Term 2	Units
BIOL 409	4	MBBB 401	3
CHEM 351	3	Research	3
Core 6	3	Core 9	3
Core 13	3	Core 14	3
Elective	2-3	Elective	3
	15-16		**15**

Total Units 120-123

Learning Outcomes

a. Demonstrate mastery of content in the disciplines of Molecular Biology, Biochemistry and Bioinformatics.
b. Ability to solve problems by the application of relevant concepts and analytical tools.
c. Ability to conduct quantitative analysis of Molecular Biology and Biochemical data.
d. Ability to correctly summarize and critically analyze new scientific information in the literature.