Name: **Campus ID:**

Bachelor of Science – Bioinformatics and Computational Biology Requirements (BINF)
85-88 credits
(Updated Sept 2018)

Course	Name	Pre-requisites	Credits	Grade
Biology			29	
BIOL 141	Foundations of Biology I	MATH 150 or higher, or placement in MATH 151	4	
BIOL 142	Foundations of Biology II	BIOL 141, and MATH 150 or higher, or placement in MATH 151	4	
BIOL 300L	Experimental Biology Lab	MATH 150 or higher, or placement in MATH 151; BIOL 141; BIOL 142; BIOL 302; CHEM 102; and CHEM 102L	2	
BIOL 302	Molecular & General Genetics	MATH 150 or higher, or placement in MATH 151, BIOL 141, BIOL 142; CHEM 101/123, and CHEM 102/124 [CR]	4	
BIOL 303	Cell Biology	MATH 150 or higher, or placement in MATH 151; BIOL 141; BIOL 142; BIOL 302; CHEM 102	4	
BIOL 430	Biological Chemistry	BIOL 303 and CHEM 351	4	
BIOL 313	Introduction to Bioinformatics	MATH 151, and BIOL 141 or CMSC 104 [*]	3	
BIOL 495	Seminar in Bioinformatics [+]	BIOL 142, BIOL 313, CMSC 202]	4	
Chemistry			11	
CHEM 101	Principles of Chemistry I	MATH 106 or higher	4	
CHEM 102	Principles of Chemistry II	CHEM 101	4	
CHEM 351	Organic Chemistry I	CHEM 102	3	
Physics & Math			19	
PHYS 121	Introductory Physics I	MATH 151[CR]	4	
MATH 151	Calculus & Analytical Geometry	MATH 150	4	
MATH 152	Calculus II	MATH 151	4	
MATH 221	Linear Algebra	MATH 151	3	
STAT 355	Intro to Prob & Stats for Sci/Eng	MATH 152	4	
Computer Sciences			17	
CMSC 201	Computer Science I for Majors	MATH 150 or higher[**]	4	
CMSC 202	Computer Science II for Majors	CMSC 201; MATH 150 or higher	4	
CMSC 203	Discrete Structures	MATH 151	3	
CMSC 341	Data Structures	CMSC 202 and CMSC 203	3	
CMSC 461	Database Management Systems	CMSC 341	3	
Upper-level Electives			9-12	
List A Elective	(see List)	(see Catalog)		
List A/B Elective	(see List)	(see Catalog)		
List B Elective	(see List)	(see Catalog)		

‣ All courses used to meet the major requirements must be completed with a grade of C or better
‣ All courses taken as pre-requisites for other courses must be passed with a C or better.
Semester Legend: F=Fall, S=Spring, Z=Possible Summer (For indicative purposes only. Please check online course availability)

[CR] Co-Requirement

[*] CMSC 201 can be used to meet the pre-requirement
[**] Requires previous programming experience or CMSC 104

Itinerary

‣ A student planning to complete the B.S. in Bioinformatics & Computational Biology should begin a first course in chemistry during the first semester of the freshman year. The mathematics sequence should also be started as soon as possible.

‣ Transfer students with an interest in Bioinformatics should contact the BINF program director as early as possible upon their arrival to UMBC in order to receive proper advising in degree planning.

‣ Different career options and optional minors in other disciplines are available to BINF students. Please consult the attached itinerary guidelines. These itineraries are meant only as *illustrative* guidelines of different pathways in the major. They do not define nor constitute strict or fixed pathway requirements for completion of the major.

‣ On its own, the BINF major *does not* satisfy pre-med / pre-pharm / pre-dental requirements.

Gateway requirements

Students must complete the courses below with a Grade Point Average (GPA) no lower than 3.0 and with no grade lower than "C" in any of the courses. At least <u>three</u> of these courses must be completed at UMBC. A course may be repeated <u>once</u> to meet gateway requirements, but <u>both</u> grades will be used to compute the gateway GPA. (e.g. a student receiving a grade of "B" in all six gateway courses with one enrollment in each course will have a gateway GPA of 3.0. A student receiving an initial grade of "C" and a repeated grade of "B" in CHEM 101, with a "B" in all other gateway courses, will have a gateway GPA of 2.86).

Required Gateway Course	Credits	Semester taken	Grade
BIOL 141 - Foundations of Biology I	4		
BIOL 302 - Molecular and General Genetics	4		
CHEM 101 - Principles of Chemistry	4		
CHEM 102 - Principles of Chemistry II	4		
CMSC 201 - Computer Science I for Majors	4		
MATH 151 - Calculus & Analytical Geometry I	4		

Students who do not meet the above criteria (e.g. transfer students who transfer in more than three of the above courses) may petition the BINF steering committee for admission to the program.

Under exceptional circumstances, the Department may waive or alter a BINF degree requirement. Students seeking to petition for a waiver must consult with their academic adviser, then may submit a Petition for Waiver/Substitution of Program Requirements.

Approved Bioinformatics & Computational Biology Electives

List A	List B
Any List A recommended course or any BIOL 4xx / CHEM 4xx course approved by a BINF advisor.	Any List B recommended course or any CMSC 4xx / IS 4xx / MATH 4xx / STAT 4xx course approved by a BINF advisor and the corresponding department/instructor.
Recommended courses	*Recommended courses*
BIOL 304 - Plant Biology [§]	CMSC 433 - Scripting Languages
BIOL 305 - Comparative Animal Physiology [§]	CMSC 441 - Design and Analysis of Algorithms
BIOL 411 - Bacterial Physiology	CMSC 442 - Information and Coding Theory
BIOL 414 - Eukaryotic Genetics and Molecular Biology	CMSC 445 - Software Engineering
BIOL 418 - Human Molecular Biology	CMSC 453 - Applied Combinatorics and Graph Theory
BIOL 426 - Approaches to Molecular Biology	CMSC 455 - Numerical Computations
BIOL 428 - Computer Applications in Molecular Biology	CMSC 471 - Artificial Intelligence
BIOL 434 - Microbial Molecular Genetics	CMSC 472 - Knowledge - Based Systems [R] CMSC 471
BIOL 442 - Developmental Biology	CMSC 473 - Introduction to Natural Language Processing [R] CMSC 331
BIOL 444 - Development and Cancer [R] BIOL 442	CMSC 475 - Introduction to Neural Networks
BIOL 466 - Population and Quantitative Genetics	CMSC 476 - Information Retrieval
BIOL 483 - Evolution: From Genes to Genomes	CMSC 478 - Introduction to Machine Learning [R] CMSC 471
BIOL 486 - Genome Science	IS 413 - GUI Systems Using JAVA
CHEM 301 - Physical Chemistry	IS 428 - Data Mining Techniques and Applications formally [R] IS 410
CHEM 303 - Physical Chemistry for the Biochemical Sciences	IS 448 - Markup and Scripting Languages
CHEM 352 - Organic Chemistry II	MATH 341 - Computational Methods
CHEM 420 - Computer Applications in Chemistry [R] CHEM 302/303	STAT 419 - Introduction to Biostatistics [R] STAT 454
CHEM 431 - Chemistry of Proteins [R] CHEM 437/BIOL 430	STAT 420 - Statistics for Bioinformatics
CHEM 432 - Advanced Biochemistry [R] CHEM 437* and CHEM 438	STAT 432 - Statistical Computer Packages and Their Applications
CHEM 433 - Biochemistry of Nucleic Acids [R] CHEM 437*	STAT 433 - Statistical Computing [R] STAT 453
CHEM 438 - Comprehensive Biochemistry II [R] CHEM 437*	STAT 451 - Introduction to Probability Theory [R] MATH 251
CHEM 455 - Introduction to Biomedicinal Chemistry [R] CHEM 352	STAT 453 - Introduction to Mathematical Statistics [R] STAT 451
CHEM 444 - Molecular Modeling in Biochemistry [R] CHEM 301/303 and CHEM 437	STAT 454 - Applied Statistics
	STAT 614 - Environmental Statistics [R] STAT 453
* CHEM 437 can be used as a substitute for BIOL 430 when completing the CHEM 437/438 sequence, but cannot be used as an elective. § Only one of these courses BIOL 304 / BIOL 305 may be taken as elective.	[R] Pre-requiste course(s) CHEM 420 or CHEM 444 can be taken as List B electives if taken in conjunction with CHEM 301, CHEM 303 and CHEM 438 in List A.