

## Bachelor of Science – Bioinformatics and Computational Biology Requirements (BINF)

88-92 credits  
(updated March 2010, IE&MK)

Course	Name	Pre-requisites	Cr	Offere	Taken	Grade
<b>Biology</b>			29			
BIOL 141	Foundations of Biology I	MATH150 <sup>[CR]</sup>	4	FSZ		
BIOL 142	Foundations of Biology II	MATH150	4	FSZ		
BIOL 300L	Experimental Biology Lab	BIOL 302, CHEM 102, 102L	2	FS		
BIOL 302	Molecular & General Genetics	BIOL 141, 142 CHEM 101, 102 <sup>[CR]</sup>	4	FSZ		
BIOL 303	Cell Biology	BIOL 302, CHEM 102	4	FS		
BIOL 430	Biological Chemistry	BIOL 303, CHEM 352 <sup>[RW]</sup>	4	FS		
BIOL 295/313	Introduction to bioinformatics	MATH 151	3	S		
BIOL 495	Seminar in Bioinformatics <sup>+</sup>	BIOL 395, 430, CMSC 341 <sup>[CR]</sup>	4	S		
<b>Chemistry</b>			11			
CHEM 101	Principles of Chemistry I	MATH 150 <sup>[R]</sup>	4	FSZ		
CHEM 102	Principles of Chemistry II	CHEM 101	4	FSZ		
CHEM 351	Organic Chemistry I	CHEM 102	3	FS		
<b>Physics &amp; Math</b>			19			
PHYS 121	Introductory Physics I	MATH 151	4	FSZ		
MATH 151	Calculus & Analytical Geometry I	MATH 150	4	FSZ		
MATH 152	Calculus II	MATH 151	4	FSZ		
MATH 221	Linear Algebra	MATH 151	3	FSZ		
STAT 355	Intro to Prob & Stats for Sci/Eng	MATH 152	4	FSZ		
<b>Computer Sciences</b>			17			
CMSC 201	Computer Science I for Majors	MATH 150	4	FS		
CMSC 202	Computer Science II for Majors	CMSC 201, MATH 151	4	FS		
CMSC 203	Discrete Structures	CMSC 201	3	FSZ		
CMSC 341	Data Structures	CMSC 202, 203	3	FS		
CMSC 461	Database Management Systems	CMSC 341	3	FSZ		
<b>Upper-level Electives</b>			12			
List A Elective						
List A/B Elective						
List A/B Elective						
List B Elective						

- All required courses 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)

[R] Requirement      [CR] Co-Requirement      [RW] Requirement waived for BINF majors.

<sup>+</sup> BIOL 495 requires authorization from the BINF steering committee.

### 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 steering committee chair 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-dent 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 three of these courses must be completed at UMBC. A course may be repeated once to meet gateway requirements, but both 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.

## Transition to the 2010 BINF curriculum

Students wishing to switch to the 2010 BINF curriculum from the previous curriculum should contact their advisor as soon as possible.

## 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.
<i>Recommended courses</i> BIOL 304 - Plant Biology <sup>§</sup> BIOL 305 - Comparative Animal Physiology <sup>§</sup> BIOL 411 - Bacterial Physiology BIOL 414 - Eukaryotic Genetics and Molecular Biology BIOL 418 - Human Molecular Biology BIOL 426 - Approaches to Molecular Biology BIOL 428 - Computer Applications in Molecular Biology BIOL 434 - Microbial Molecular Genetics BIOL 442 - Developmental Biology BIOL 444 - Development and Cancer <sup>[R]</sup> BIOL 442 BIOL 466 - Population and Quantitative Genetics BIOL 483 - Evolution: From Genes to Genomes BIOL 486 - Genome Science CHEM 301 - Physical Chemistry CHEM 303 - Physical Chemistry for the Biochemical Sciences CHEM 352 - Organic Chemistry II CHEM 420 - Computer Applications in Chemistry <sup>[R]</sup> CHEM 302/303 CHEM 431 - Chemistry of Proteins <sup>[R]</sup> CHEM 437/BIOL 430 CHEM 432 - Advanced Biochemistry <sup>[R]</sup> CHEM 437* and CHEM 438 CHEM 433 - Biochemistry of Nucleic Acids <sup>[R]</sup> CHEM 437* CHEM 437 - Comprehensive Biochemistry I * CHEM 438 - Comprehensive Biochemistry II <sup>[R]</sup> CHEM 437* CHEM 455 - Introduction to Biomedical Chemistry <sup>[R]</sup> CHEM 352 CHEM 444 - Molecular Modeling in Biochemistry <sup>[R]</sup> CHEM 301/303 and CHEM 437	<i>Recommended courses</i> CMSC 433 - Scripting Languages CMSC 441 - Design and Analysis of Algorithms CMSC 442 - Information and Coding Theory CMSC 445 - Software Engineering CMSC 453 - Applied Combinatorics and Graph Theory CMSC 455 - Numerical Computations CMSC 471 - Artificial Intelligence CMSC 472 - Knowledge - Based Systems <sup>[R]</sup> CMSC 471 CMSC 473 - Introduction to Natural Language Processing <sup>[R]</sup> CMSC 331 CMSC 475 - Introduction to Neural Networks CMSC 476 - Information Retrieval CMSC 478 - Introduction to Machine Learning <sup>[R]</sup> CMSC 471 IS 413 - GUI Systems Using JAVA IS 428 - Data Mining Techniques and Applications formally <sup>[R]</sup> IS 410 IS 448 - Markup and Scripting Languages MATH 341 - Computational Methods STAT 419 - Introduction to Biostatistics <sup>[R]</sup> STAT 454 STAT 420 - Statistics for Bioinformatics STAT 432 - Statistical Computer Packages and Their Applications STAT 433 - Statistical Computing <sup>[R]</sup> STAT 453 STAT 451 - Introduction to Probability Theory <sup>[R]</sup> MATH 251 STAT 453 - Introduction to Mathematical Statistics <sup>[R]</sup> STAT 451 STAT 454 - Applied Statistics STAT 614 - Environmental Statistics <sup>[R]</sup> STAT 453
* CHEM 437 can be used as a substitute for BIOL 430 when completing the CHEM 437/438 sequence.	<sup>[R]</sup> Requirement
<sup>§</sup> Only one of these courses BIOL 304 / BIOL 305 may be taken as elective.	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.