BIOINFORMATICS (BS)

The field of Bioinformatics is rooted in the massive databases generated by worldwide DNA sequencing projects and by ever-widening 3-dimensional protein structure studies. Mining the wealth of biological and chemical information contained in these databases requires the tools of computer science and statistics.

Bioinformatics approaches have already led to countless scientific, medical, and agricultural breakthroughs that would have taken decades to achieve without the foresight of a small number of visionary scientists and programmers. This major provides students with the training, skills, and opportunity to become charter members of this exciting, ground-breaking discipline with virtually limitless post-graduate educational and career advancement possibilities for years to come.

Loyola is home to a superb group of faculty members already working at the interfaces of these four disciplines, who are combining their expertise to offer students this unique educational opportunity. This interdisciplinary major has its own detailed web pages at https://www.luc.edu/bioinformatics/.

Curriculum

The following degree requirements are for students who have declared the BS Bioinformatics Major after Spring 2020. For students who declared prior to this time, please see archived class schedules.

Code	Title	Hours
Bioinformatics Electives		
Select two of the following:		6
BIOI 365	Exploring Proteins	
or CHEM 365	Proteomics	
BIOL 390	Molecular Biology Laboratory	
COMP 353	Database Programming	
or COMP 379	Machine Learning	
Bioinformatics Fundamental Courses		
BIOL 388	Bioinformatics	3
BIOL 387	Genomics	3
or BIOL 392	Metagenomics	
COMP 383	Computational Biology	4
STAT 337	Quantitative Methods in Bioinformatics	3
BIOI 397	Bioinformatics Survey	1-4
or BIOI 398	Bioinformatics Internship	
Select one of the following:		1-4
	Bioinformatics Internship	
BIOI 399	Bioinformatics Research	
Biology Fundamental Courses		
BIOL 101	General Biology I	3
BIOL 282	Genetics	3
BIOL 283	Genetics Laboratory	1
Chemistry Fundamental Courses		
CHEM 101	General Chemistry A Lecture/Discussion	3
CHEM 102	General Chemistry B Lecture/Discussion	3
CHEM 223	Organic Chemistry A Lec/Disc	3
CHEM 224	Organic Chemistry B Lec/Disc	3
CHEM 361	Principles of Biochemistry	3

Code	Title	Hours
Computer Science Fundamental Courses		
COMP 141	Introduction to Computing Tools and Techniques	3
MATH 215	Object-Oriented Programming with Mathematics	3
COMP 231	Data Structures & Algorithms for Informatics	3
Math/Stats Fundamental Courses		
MATH 131	Applied Calculus I	3
MATH 132	Applied Calculus II	3
STAT 335	Introduction to Biostatistics	3
Total Hours		**61-67**

Required courses within the major also satisfy the following university Core Curriculum (https://catalog.luc.edu/undergraduate/university-requirements/university-core/) requirements: scientific literacy (6 credits) and quantitative analysis (3 credits).

Sample Course Schedules

These course schedules display how students may complete the bioinformatics major in addition to their university Core requirements in four years of study:

New (F2020) Major Sample Schedule

The below sequence of courses is meant to be used as a suggested path for completing coursework. An individual student's completion of requirements depends on course offerings in a given term as well as the start term for a major or graduate study. Students should consult their advisor for assistance with course selection

Course	Title	Hours
Year 1		
Fall		
BIOL 101	General Biology I	3
CHEM 101	General Chemistry A Lecture/Discussion [1]	3
MATH 131	Applied Calculus I [2]	3
CORE: College Writing Seminar		3
CORE: Theology and Religious Studies Tier 1		3
UNIV 101	First Year Seminar	1
	Hours	**16**
Spring		
CHEM 102	General Chemistry B Lecture/Discussion [3]	3
COMP 141	Introduction to Computing Tools and Techniques	3
MATH 132	Applied Calculus II [4]	3
CORE: Ethics		3
CORE: Theology and Religious Studies Tier 2		3
	Hours	**15**
Year 2		
Fall		
BIOL 282	Genetics	3
BIOL 283	Genetics Laboratory	1
CHEM 223	Organic Chemistry A Lec/Disc [5]	3
MATH 215	Object-Oriented Programming with Mathematics [6]	3
CORE: Historical Knowledge Tier 1		3
CORE: Philosophical Knowledge Tier 1		3
	Hours	**16**

Spring

CHEM 224	Organic Chemistry B Lec/Disc [7]	3
COMP 231	Data Structures & Algorithms for Informatics	3
CAS Elective		3
CORE: Historical Knowledge Tier 2		3
CORE: Philosophical Knowledge Tier 2		3
	Hours	**15**

Year 3
Fall

BIOL 388	Bioinformatics (Fall only)	3
CHEM 361	Principles of Biochemistry	3
CAS Elective		3
CAS Language Requirement 1 [8]		3
CORE: Literary Knowledge & Experience Tier 1		3
	Hours	**15**

Spring

STAT 335	Introduction to Biostatistics	3
BIOL 387	Genomics (Spring only) [9]	3
Select one Undergraduate Capstone: [10]		1-4
BIOI 397	Bioinformatics Survey	
BIOI 398	Bioinformatics Internship	
BIOI 399	Bioinformatics Research	
CAS Language Requirement 2		3
CORE: Literary Knowledge & Experience Tier 2		3
CORE: Societal and Cultural Knowledge Tier 1		3
	Hours	**16-19**

Year 4
Fall

BIOI 365	Exploring Proteins (Fall only) [11,12]	3
Select one of the following:		3-4
B.S. Bioinformatics COMP elective [12]		
BIOL 390	Molecular Biology Laboratory [12]	
CAS Elective		3
CORE: Societal and Cultural Knowledge Tier 2		3
	Hours	**12-13**

Spring

COMP 383	Computational Biology (Spring only)	4
STAT 337	Quantitative Methods in Bioinformatics (Spring only) [13]	3
CAS Elective		3
CAS Elective		3
CORE: Artistic Knowledge and Experience		3
	Hours	**16**
	Total Hours	**121-125**

[1]   May substitute with CHEM 105 Chemical Principles
[2]   May substitute with MATH 161 Calculus I
[3]   May substitute with CHEM 106 Basic Inorganic Chemistry
[4]   May substitute with MATH 162 Calculus II
[5]   May substitute with CHEM 221 Organic Chemistry I Lec/Disc
[6]   May substitute with COMP 170 Introduction to Object-Oriented Programming (offered fall, spring and summer)
[7]   May substitute with CHEM 221 Organic Chemistry I Lec/Disc

[8]   Language competency required at the 102 level by course or test (https://www.luc.edu/cas/college-requirements/)
[9]   May substitute with BIOL 392 Metagenomics (fall only)
[10] BIOI 397 Bioinformatics Survey, BIOI 398 Bioinformatics Internship, and BIOI 399 Bioinformatics Research can be taken any semester offered and Internship/research can be repeated with each semester 1-4 credit hours (although only 1 credit hour is required for the major)
[11] May substitute with CHEM 365 Proteomics (spring odd years only)
[12] Choose 2 of 3:
   1. BIOI 365 Exploring Proteins or CHEM 365 Proteomics
   2. COMP 379 Machine Learning (Fall only) or COMP 353 Database Programming
   3. BIOL 390 Molecular Biology Laboratory

[13] May substitute with STAT 336 Advanced Biostatistics

Note: College of Arts & Sciences requires 2 Writing Intensive (WI) courses; many CORE Tier 2 courses are available as WI; BIOL 390 Molecular Biology Laboratory is also WI. Note, only 1 WI course can be taken in a single semester.
Note: 120 credit hours are required for graduation.

New (F2020) Major Sample Schedule – Pre-Health
Updated 3/2020

The below sequence of courses is meant to be used as a suggested path for completing coursework. An individual student's completion of requirements depends on course offerings in a given term as well as the start term for a major or graduate study. Students should consult their advisor for assistance with course selection.

Course	Title	Hours
Year 1		
Fall		
BIOL 101	General Biology I	3
BIOL 111	General Biology I Lab [1]	1
CHEM 101	General Chemistry A Lecture/Discussion [2]	3
CHEM 111	General Chemistry Lab A [1]	1
MATH 131	Applied Calculus I [3]	3
CORE: College Writing Seminar		3
UNIV 101	First Year Seminar	1
	Hours	**15**
Spring		
BIOL 102	General Biology II [1]	3
BIOL 112	General Biology II Lab [1]	1
CHEM 102	General Chemistry B Lecture/Discussion [4]	3
CHEM 112	General Chemistry Lab B [1]	1
MATH 132	Applied Calculus II [5]	3
COMP 141	Introduction to Computing Tools and Techniques	3
CORE: Historical Knowledge Tier 1		3
	Hours	**17**
Year 2		
Fall		
BIOL 282	Genetics	3
BIOL 283	Genetics Laboratory	1
CHEM 223	Organic Chemistry A Lec/Disc [6]	3

CHEM 225	Organic Chemistry Lab A [1]	1
MATH 215	Object-Oriented Programming with Mathematics [7]	3
CORE: Philosophical Knowledge Tier 1		3
Hours		**14**
Spring		
CHEM 224	Organic Chemistry B Lec/Disc [8]	3
CHEM 226	Organic Chemistry Lab B [1]	1
COMP 231	Data Structures & Algorithms for Informatics	3
CORE: Historical Knowledge Tier 2		3
CORE: Philosophical Knowledge Tier 2		3
CORE: Ethics		3
Hours		**16**
Year 3		
Fall		
BIOL 388	Bioinformatics (Fall only)	3
CHEM 361	Principles of Biochemistry	3
CAS Language Requirement 1 [9]		3
CORE: Literary Knowledge & Experience Tier 1		3
PHYS 111	College Physics I Lec / Dis [1]	3
PHYS 111L	College Physics Laboratory I [1]	1
Hours		**16**
Spring		
BIOL 387	Genomics (Spring only) [10]	3
Select one of the following: [11]		1-4
BIOI 397	Bioinformatics Survey	
BIOI 398	Bioinformatics Internship	
BIOI 399	Bioinformatics Research	
CAS Language Requirement 2		3
CORE: Societal and Cultural Knowledge Tier 1		3
PHYS 112	College Physics II Lec/Disc [1]	3
PHYS 112L	College Physics Lab II [1]	1
Hours		**14-17**
Year 4		
Fall		
STAT 335	Introduction to Biostatistics	3
BIOI 365	Exploring Proteins (Fall only) [12,13]	3
Select one of the following:		3-4
B.S. Bioinformatics COMP elective [13]		
BIOL 390	Molecular Biology Laboratory (B.S. Bioinformatics COMP elective) [13]	
CORE: Societal and Cultural Knowledge Tier 2		3
CORE: Theology and Religious Studies Tier 1		3
Hours		**15-16**
Spring		
COMP 383	Computational Biology (Spring only)	4
STAT 337	Quantitative Methods in Bioinformatics (Spring only) [14]	3
CORE: Artistic Knowledge and Experience		3
CORE: Literary Knowledge & Experience Tier 2		3

CORE: Theology and Religious Studies Tier 2		3
Hours		**16**
Total Hours		**123-127**

[1]   Recommended for Pre-health students but not required for the major.
[2]   May substitute with CHEM 105 Chemical Principles
[3]   May substitute with MATH 161 Calculus I
[4]   May substitute with CHEM 106 Basic Inorganic Chemistry
[5]   May substitute with MATH 162 Calculus II
[6]   May substitute with CHEM 221 Organic Chemistry I Lec/Disc
[7]   May substitute with COMP 170 Introduction to Object-Oriented Programming (offered fall, spring and summer)
[8]   May substitute with CHEM 221 Organic Chemistry I Lec/Disc
[9]   Language competency required at the 102 level by course or test (https://www.luc.edu/cas/college-requirements/)
[10] May substitute with BIOL 392 Metagenomics (fall only)
[11] BIOI 397 Bioinformatics Survey, BIOI 398 Bioinformatics Internship, and BIOI 399 Bioinformatics Research can be taken any semester offered and Internship/research can be repeated with each semester 1-4 credit hours (although only 1 credit hour is required for the major)
[12] May substitute with CHEM 365 Proteomics (spring odd years only)
[13] Choose 2 of 3:
   1. BIOI 365 Exploring Proteins or CHEM 365 Proteomics
   2. COMP 379 Machine Learning (Fall only) or COMP 353 Database Programming
   3. BIOL 390 Molecular Biology Laboratory

[14] May substitute with STAT 336 Advanced Biostatistics

Note: College of Arts & Sciences requires 2 Writing Intensive (WI) courses; many CORE Tier 2 courses are available as WI; BIOL 390 Molecular Biology Laboratory is also WI. Note, only 1 WI course can be taken in a single semester.
Note: 120 credit hours are required for graduation.

College of Arts and Sciences Graduation Requirements

All Undergraduate students in the College of Arts and Sciences are required to take two Writing Intensive courses (6 credit hours) as well as complete a foreign language requirement at 102-level or higher (3 credit hours) or a language competency test. More information can be found here (https://www.luc.edu/cas/college-requirements/).

Additional Undergraduate Graduation Requirements

All Undergraduate students are required to complete the University Core, at least one Engaged Learning course, and UNIV 101. SCPS students are not required to take UNIV 101. Nursing students in the Accelerated BSN program are not required to take core or UNIV 101. You can find more information in the University Requirements (https://catalog.luc.edu/undergraduate/university-requirements/) area.

Learning Outcomes

The bioinformatics major at Loyola provides students with the training and opportunities to become leaders in this ground-breaking discipline, with career advancement and post-graduate possibilities for years to come. Loyola's BS Bioinformatics Program will prepare you with:

- technical skills at the interface of biology, computer science, chemistry and statistics;
- biological and chemical laboratory techniques;
- computer programming capabilities;
- statistical techniques to analyze results from laboratory experiments and computer outputs; and
- an understanding of key problems, proposed solutions, and future challenges of the bioinformatics field.