**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.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOI 365</td>
<td>Exploring Proteins</td>
<td>3</td>
</tr>
<tr>
<td>or CHEM 365</td>
<td>Proteomics</td>
<td></td>
</tr>
<tr>
<td>BIOL 390</td>
<td>Molecular Biology Laboratory</td>
<td>3</td>
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<tr>
<td>COMP 353</td>
<td>Database Programming</td>
<td>3</td>
</tr>
<tr>
<td>or COMP 379</td>
<td>Machine Learning</td>
<td></td>
</tr>
<tr>
<td>BIOL 388</td>
<td>Bioinformatics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 387</td>
<td>Genomics</td>
<td>3</td>
</tr>
<tr>
<td>or BIOL 392</td>
<td>Metagenomics</td>
<td></td>
</tr>
<tr>
<td>COMP 383</td>
<td>Computational Biology</td>
<td>3</td>
</tr>
<tr>
<td>STAT 337</td>
<td>Quantitative Methods in Bioinformatics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 397</td>
<td>Bioinformatics Survey</td>
<td>3</td>
</tr>
<tr>
<td>or BIOL 398</td>
<td>Bioinformatics Internship</td>
<td></td>
</tr>
<tr>
<td>BIOL 101</td>
<td>General Biology I</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 282</td>
<td>Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 283</td>
<td>Genetics Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 101</td>
<td>General Chemistry A Lecture/Discussion</td>
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<tr>
<td>CHEM 102</td>
<td>General Chemistry B Lecture/Discussion</td>
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</tr>
<tr>
<td>CHEM 223</td>
<td>Organic Chemistry A Lect &amp; Disc</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 224</td>
<td>Organic Chem B Lec/Disc</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 361</td>
<td>Principles of Biochemistry</td>
<td>3</td>
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**Computer Science Fundamental Courses**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
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<tbody>
<tr>
<td>COMP 141</td>
<td>Introduction to Computing Tools and Techniques</td>
<td>3</td>
</tr>
<tr>
<td>MATH 215</td>
<td>Object-Oriented Programming with Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>COMP 231</td>
<td>Data Structures &amp; Algorithms for Informatics</td>
<td>3</td>
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**Math/Stats Fundamental Courses**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>MATH 131</td>
<td>Applied Calculus I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 132</td>
<td>Applied Calculus II</td>
<td>3</td>
</tr>
<tr>
<td>STAT 335</td>
<td>Introduction to Biostatistics</td>
<td>3</td>
</tr>
</tbody>
</table>

**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**

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>BIOL 101</td>
<td>General Biology I</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CHEM 101</td>
<td>General Chemistry A Lecture/Discussion</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MATH 131</td>
<td>Applied Calculus I</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CORE: College Writing Seminar</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CORE: Theology and Religious Studies Tier 1</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>UNIV 101</td>
<td>First Year Seminar</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Hours</strong></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>Spring</td>
<td>CHEM 102</td>
<td>General Chemistry B Lecture/Discussion</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>COMP 141</td>
<td>Introduction to Computing Tools and Techniques</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MATH 132</td>
<td>Applied Calculus II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CORE: Ethics</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CORE: Theology and Religious Studies Tier 2</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Hours</strong></td>
<td></td>
<td>15</td>
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</table>

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>BIOL 282</td>
<td>Genetics</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CHEM 223</td>
<td>Organic Chemistry A Lect &amp; Disc</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MATH 215</td>
<td>Object-Oriented Programming with Mathematics</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CORE: Historical Knowledge Tier 1</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CORE: Philosophical Knowledge Tier 1</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Hours</strong></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>Spring</td>
<td>CHEM 224</td>
<td>Organic Chem B Lec/Disc</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>COMP 231</td>
<td>Data Structures &amp; Algorithms for Informatics</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CAS Elective</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CORE: Historical Knowledge Tier 2</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>
CORE: Philosophical Knowledge Tier 2 3

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

Spring
STAT 335 Introduction to Biostatistics 3
BIOL 387 Genomics (Spring only) 9
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

Year 4
Fall
BIOL 365 Exploring Proteins (Fall only) 11,12
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

Spring
COMP 383 Computational Biology (Spring only) 4
STAT 337 Quantitative Methods in Bioinformatics (Spring only) 13
CAS Elective 3
CAS Elective 3
CORE: Artistic Knowledge and Experience 3

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 Chem 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 Chem 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. BIOL 365 Exploring Proteins or CHEM 365 Proteomics
   2. COMP 379 Machine Learning (Fall only) or COMP 353 Database Programming
   3. BIOI 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; BIOI 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

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 1 2
CHEM 111 General Chemistry Lab A 1 1
MATH 131 Applied Calculus I 3

Total 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 2 3
CHEM 112 General Chemistry Lab B 1 1
MATH 132 Applied Calculus II 3

Total Hours 17

Year 2
Fall
BIOL 282 Genetics 3
BIOL 283 Genetics Laboratory 1
CHEM 223 Organic Chemistry A Lect & Disc 6 3
CHEM 225 Organic Chemistry Lab A 1 1
MATH 215 Object-Oriented Programming with Mathematics 7

Total Hours 14

Spring
CHEM 224 Organic Chem B Lec/Disc 3
CHEM 226 Organic Chemistry Lab B 1 1

Total Hours 10
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 3
CORE: Literary Knowledge & Experience Tier 1 3
PHYS 111 College Physics I Lec / Dis 3
PHYS 111L College Physics Laboratory I 1

Hours 16

Spring
BIOL 387 Genomics (Spring only) 3
Select one of the following: 1-4
BIOL 397 Bioinformatics Survey
BIOL 398 Bioinformatics Internship
BIOL 399 Bioinformatics Research
CAS Language Requirement 2 3
CORE: Societal and Cultural Knowledge Tier 1 3
PHYS 112 College Physics II Lec/Disc 3
PHYS 112L College Physics Lab II 1

Hours 14-17

Year 4
Fall
STAT 355 Introduction to Biostatistics 3
BIOL 365 Exploring Proteins (Fall only) 3
Select one of the following: 3-4
B.S. Bioinformatics COMP elective
BIOL 390 Molecular Biology Laboratory (B.S. Bioinformatics COMP elective)
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) 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 MATH 162 Calculus II
5 May substitute with CHEM 106 Basic Inorganic Chemistry
6 May substitute with CHEM 221 Organic Chem 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 Chem 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 BIOL 397 Bioinformatics Survey, BIOL 398 Bioinformatics Internship, and BIOL 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. BIOL 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. 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.