

BIOINFORMATICS

LUC.EDU/CAS

Loyola University Chicago's College of Arts and Sciences (CAS) offers undergraduates a comprehensive liberal arts education that introduces them to various disciplines and viewpoints in the natural sciences, social sciences, and humanities. CAS students develop valuable career and life skills, including critical thinking, strong verbal and writing abilities, comprehensive general knowledge, social awareness, and research competencies. As the largest of Loyola's 10 schools, CAS has extensive resources, providing students with modern labs and electronic classrooms, opportunities to participate actively in research, and a distinguished faculty of teacher-scholars.

Recent growth and renovation at both Loyola's Lake Shore and Water Tower Campuses have enhanced living and learning for students. Recent additions to the Lake Shore Campus include the Norville Center for Intercollegiate Athletics, a state-of-the-art facility that includes a new strength and conditioning center, a sports medicine facility, student athlete activity spaces, and offices for athletics administrators. Future enhancements include a new student union and academic building, among others.

For more information about what's new at Loyola, visit

» LUC.edu/undergrad/whatsnew.



As early as their sophomore year, Loyola Bioinformatics majors engage in a wide variety of faculty-mentored research projects that utilize the skills and knowledge they acquire in their lecture and lab classes.

THE MAJOR

BS in Bioinformatics

Bioinformatics, an exciting new field, combines the latest advances in genetics and biochemistry with the powerful tools of computer science and statistical analysis. Because DNA sequencing projects and advances in molecular biology are yielding new data at unimaginably fast rates, comprehensive interpretation and management of this data require highly sophisticated analytical and data management computer systems. This emerging field has already led to countless scientific, agricultural, and medical breakthroughs—including major advances in understanding gene interactions and evolutionary mechanisms—in the development of disease-resistant crops and in new infectious disease and cancer diagnostic methods and treatments.

Loyola is one of only a handful of schools in the U.S. that offers an undergraduate bioinformatics major. 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. Engaging in faculty-directed, independent research is an integral and vital element of the program. Many bioinformatics majors have presented their research at regional, national, and international conferences and have co-authored publications in highly-regarded, peer-reviewed research journals.

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Graduates in bioinformatics will:

- Acquire advanced knowledge and technical skills at the interface of biology, computer science, chemistry, and mathematics.
- Gain an appreciation for the power of interdisciplinary approaches for the solutions of biological, biochemical, and biomedical questions.
- Master biological and chemical laboratory techniques.
- Develop computer programming and database management capabilities.
- Engage mathematical and statistical tools to analyze results from laboratory experiments and computer outputs.
- Understand key problems, proposed solutions, and future challenges of the bioinformatics field.
- Be cognizant of the complex ethical, social, and legal issues surrounding the acquisition, storage, and dissemination of personal genetic data.

Post-graduate and Career Opportunities

Undergraduate bioinformatics majors often choose to pursue advanced degrees in bioinformatics, molecular genetics, computational biology, computer science, genetics, and biochemistry. Others have gone on to medical school. Recent Loyola Bioinformatics majors are pursuing advanced degrees at the University of Michigan, the University of Texas, the University of Chicago, the Mayo Clinic, Duke, Johns Hopkins, Princeton, Ohio State, and Northwestern. Many MS degree programs and all PhD programs in these fields award generous, full fellowships, grants, and/or assistantships covering tuition and living expenses.

Bioinformatics is one of the fastest growing fields in the biological, biochemical, agricultural, and medical sciences. Individuals with the kind of strong, interdisciplinary training that the Loyola Bioinformatics program provides are especially attractive to employers at the ever-growing interface between computational and life sciences, including pharmaceutical, medical diagnostic, and software development companies, academic and medical institutions, and government agencies. For the most recent job postings, students are encouraged to google "bioinformatics jobs" or visit Web sites such as <http://www.bioinformatics.org/jobs> and <http://www.bioinformaticsjobs.org/jobs>.

Summer Internship Opportunities

Students are strongly encouraged to apply to the many summer fellowship and internship opportunities available to undergraduates. Many of these provide students with stipends and some even include

room, board, and travel. Loyola's Bioinformatics majors have been especially successful in competing for prestigious National Science Foundation-sponsored undergraduate research fellowships across the U.S. Sites change from year to year and updates of the most recent opportunities can be found on sites like <http://people.rit.edu/gtfsbi/Symp/bioinformatics.htm> and http://www.nsf.gov/crssprgm/reu/reu_search.cfm.

Student Activities

Loyola students may cultivate their interests and develop leadership, administrative, and networking skills beyond the classroom through participation in more than 175 Loyola student organizations. Bioinformatics majors may have particular interest in joining the Association for Computing Machinery, the Tri-Beta Biology Honor Society, the American Chemical Society, or the Pi Mu Epsilon Math Honor Society.

The Faculty

Loyola's superb faculty members in biology, chemistry, computer science, mathematics, and statistics are working together at the interface of these disciplines, combining their expertise to offer students this unique educational opportunity.

Biology

Program Director: Howard M. Laten, PhD, University of Wisconsin

Jeffrey L. Doering, PhD, University of Chicago

Terry Grande, PhD, University of Illinois, Chicago

Stefan M. Kanzok, PhD, University of Heidelberg, Germany

John J. Kelly, PhD, Rutgers University

F. Bryan Pickett, PhD, Indiana University

Catherine Putonti, PhD, University of Houston (also Computer Science)

Sushma Reddy, PhD, Columbia University

Eric H. Schroeter, PhD, Indiana University

Kim Williamson, PhD, Boston University

Chemistry

Miguel A. Ballicora, PhD, University of Buenos Aires

Dali Liu, PhD, University of Oklahoma

Kenneth W. Olsen, PhD, Duke University

Computer Science

Ronald Greenberg, PhD, Massachusetts Institute of Technology

Andrew Harrington, PhD, Stanford University

Konstantin Läufer, PhD, New York University

Chandra Sekharan, PhD, Clemson University

George Thiruvathukal, PhD, Illinois Institute of Technology

Mathematics and Statistics

Martin Buntinas, PhD, Illinois Institute of Technology

John G. Del Greco, PhD, Purdue University

Timothy O'Brien, PhD, North Carolina State University

Liping Tong, PhD, University of Chicago

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Students majoring in bioinformatics are assigned a faculty advisor who helps them plan their curriculum and offers them valuable assistance in finding job prospects or seeking admission to a graduate or professional school.

Major Requirements

The interdisciplinary Bioinformatics curriculum provides students with the knowledge and tools necessary to perform and integrate experimental, computational, and statistical aspects of bioinformatics at a highly comprehensive level. Required courses have been carefully selected to maximize student preparation for a wide range of post-graduate opportunities. For Bioinformatics majors, course prerequisites for some of the required 200- and 300-level classes are streamlined to accelerate student progression to the more advanced courses that collectively define the field. Beginning with the first semester, careful course scheduling is essential for completion of the degree program in four years. Bioinformatics majors are assigned a bioinformatics advisor who can help them plan and coordinate their course schedule.

BIOINFORMATICS (BIOI) 24–26 credit hours

BIOI 337 (STAT 337)	Quantitative Methods in Bioinformatics (four credit hours)
<i>or</i>	
STAT 336	Advanced Biostatistics (three credit hours)
BIOI 363 (COMP 363)	Design and Analysis of Algorithms (three credit hours)
BIOI 383 (COMP 383)	Computational Bioinformatics (four credit hours)
BIOI 386 (CHEM 365)	Proteomics (three credit hours)
BIOI 387 (BIOL 387)	Genomics (three credit hours)
BIOI 388 (BIOL 388)	Bioinformatics (three credit hours)
BIOI 390 (BIOL 390)	Molecular Biology Laboratory (four credit hours)
<i>or</i>	
BIOL 391	Forensic Molecular Biology (five credit hours)
BIOI 398	Bioinformatics Internship (one to four credit hours)
<i>or</i>	
BIOI 399	Bioinformatics Research (one to four credit hours)

BIOLOGY (BIOL) 8 credit hours

BIOL 101	General Biology I (three credit hours)
BIOL 282	Genetics (three credit hours)
BIOL 283	Genetics Lab (two credit hours)

CHEMISTRY (CHEM) 17–19 credit hours

CHEM 101	General Chemistry A (three credit hours)
<i>or</i>	
CHEM 105	Chemical Principles (four credit hours)
CHEM 111	General Chemistry Lab A (one credit hour) (not required if enrolled in CHEM 105)
CHEM 102	General Chemistry B (three credit hours)
<i>or</i>	
CHEM 106	Basic Inorganic Chemistry (four credit hours)
CHEM 112	General Chemistry Lab B (one credit hour) (not required if enrolled in CHEM 106)
CHEM 223	Organic Chemistry A (three credit hours)
<i>or</i>	
CHEM 221	Organic Chemistry I (four credit hours)
CHEM 224	Organic Chemistry B (three credit hours)
<i>or</i>	
CHEM 222	Organic Chemistry II (four credit hours)
CHEM 361	Survey in Biochemistry

COMPUTER SCIENCE (COMP) 9 credit hours

COMP 163	Discrete Structures (three credit hours)
COMP 170	Introduction to Programming (three credit hours)
COMP 271	Data Structures (three credit hours)

MATHEMATICS AND STATISTICS (MATH, STAT) 10–12 credit hours

MATH 131	Elements of Calculus I (three credit hours)
<i>or</i>	
MATH 161	Calculus I (four credit hours)
MATH 132	Elements of Calculus II (three credit hours)
<i>or</i>	
MATH 162	Calculus I (four credit hours)
STAT 335	Introduction to Biostatistics (four credit hours)

In addition to fulfilling major requirements to earn an undergraduate degree, students are required to complete Loyola's Core Curriculum (see page 4), which teaches them important skills and values, and develop their own interests by taking general electives. Required courses within the major also satisfy the following Core Curriculum requirements: scientific literacy (six credit hours) and quantitative analysis (three credit hours).

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Facilities

Bioinformatics courses on both the Water Tower and Lake Shore Campuses use Loyola's computer facilities including high-speed servers with relevant software, a server/workstation, a local area network of computers, database files, and high-speed Internet connections.

In addition, bioinformatics majors complete selected science courses at the Michael R. and Marilyn C. Quinlan Life Sciences Education and Research Center, located at the Lake Shore Campus, and Flanner Hall, both of which feature spacious teaching and research labs, where students operate sophisticated equipment and may engage in faculty-guided research. A 30-seat bioinformatics classroom/computer lab gives students access to Web resources through high-speed Internet connections and to Web-based and locally licensed bioinformatics software packages.

Transfer Credit

Transfer students must complete the majority of their major requirements at Loyola. Majors in bioinformatics will not be given permission to take any 300-level courses at other institutions in order to complete degree requirements at Loyola.

Core Curriculum

- Focuses on desired knowledge, skills, and values in addition to academic disciplines.
- Includes 45 credit hours of coursework, developing important skills through 10 required areas of knowledge:
 - Important skills include communication, critical thinking, ethical awareness, information literacy, quantitative and qualitative analysis, research methods, and technological literacy.
 - Required areas include college writing seminar(s), artistic knowledge and experience, historical knowledge, literary knowledge, scientific literacy, societal and cultural knowledge, philosophical knowledge, theological and religious studies, and ethics.
- "Values Across the Curriculum" requirements:
 - 12 credit hours completed through the Core, major, or electives, focusing on:
 - Understanding and promoting justice
 - Understanding diversity in the United States and the world
 - Understanding spirituality or faith in action in the world
 - Promoting civic engagement or leadership
- Makes up about one-third of a student's Loyola academic experience, complemented by the major and electives.
- Incorporates great flexibility with myriad courses from which to choose for each required area. Courses may be completed at any time during a student's Loyola education.
 - For more information, please visit
 - » LUC.edu/core

CONTACT US

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P 800.262.2373 **E** admission@luc.edu **W** LUC.edu/undergrad

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Information in this brochure is correct as of July 2011.
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