The Department of Biology has extensive resources to support superior teaching and research in all the major areas of contemporary biological sciences to prepare students for medical school, other graduate or professional studies, teaching, or careers in industry or government.

Biology students study in the state-of-the-art Michael R. and Marilyn C. Quinlan Life Sciences Education and Research Center. This innovative facility features modern teaching and research labs where students learn to operate the latest equipment used in scientific experiments and engage in faculty-guided research; an artificial stream, the only one of its kind in the Chicago area; and a “green roof,” which resembles a native Illinois prairie. In addition, other greenhouses provide students with a convenient location for field research, and the indoor environments make experimentation possible no matter what the weather conditions. The building itself is energy efficient with sunshades, and the green roof holds water to help prevent street flooding. With Lake Michigan just steps away, students have another natural resource at their fingertips.

Loyola biology majors have extensive opportunities to work closely with faculty on research and experiments in the state-of-the-art Michael R. and Marilyn C. Quinlan Life Sciences Education and Research Center at the Lake Shore Campus. Biology is one of the most frequently chosen undergraduate majors.

THE PROGRAMS

The Department of Biology offers several comprehensive and challenging programs leading to the Bachelor of Science (BS) degree. These programs include the following:

Majors:
- Biology
- Ecology (the only one of its kind in Chicago)
- Molecular Biology

Minors:
- Biology
- Bioethics (interdisciplinary)
- Biostatistics (offered by Mathematics and Statistics)
- Neuroscience (interdisciplinary)

Dual-degree programs:
- BS Biology/MBA (Master in Business Administration)
- BS Biology/MEd (Master of Education)

Related majors that may be of interest include:
- Biochemistry
- Bioinformatics (interdisciplinary)
- Biophysics
- Clinical laboratory science
- Exercise Physiology
- Environmental studies/science (interdisciplinary)
- Forensic science (interdisciplinary)
THE PROGRAMS [CONTINUED]

In addition to the myriad undergraduate student research opportunities offered by Loyola’s biology program, its reputation has enabled students to secure internships in hospitals, at medical equipment companies, zoos, museums, biotech companies, and many other employers. The Loyola student acceptance rate into medical school is around 80% and double the national average.

Major Requirements

BIOLOGY

The biology major requirements include six required courses (19 credit hours) and several elective courses (19 credit hours), totaling 38 credit hours.

The courses required for the biology major are:

- Biology (BIOL) 101, 102, 111, 112, 251, 265, 282, and either 252, 266, or 283
- 19 credit hours of biology electives; two courses must have a lab component
- General Chemistry (CHEM) 101, 102, 111, and 112; or 105 and 106
- Organic Chemistry (CHEM) 223, 224, 225, and 226; or 221 and 222
- Physics (PHYS) 111, 112, 131, and 132; or 113, 114, 133, and 134
- Mathematics (MATH) 131 and 132; or 161 and 162

For titles of biology courses, please see the course offerings section on pages 5-6.

For courses offered in other academic areas, please visit the corresponding program brochures at LUC.edu/undergrad/academics.

ECOLOGY

The ecology major provides students with the scientific skills needed to solve environmental problems. Loyola’s ecology major, the only one of its kind in Chicago, is known nationally for its focus on urban ecology, and its research on local lakes and streams. With the Quinlan Life Sciences Education and Research Center and its indoor stream, research opportunities are convenient, giving students the kind of hands-on training needed to continue research in graduate studies or as employees of environmental agencies or companies. This major requires 38 credit hours, including the basic courses required for the biology major, plus Evolution (BIOL 319) and specific elective courses (16 credit hours) that allow students to focus on key areas of ecology and evolution.

MOLECULAR BIOLOGY

Students major in molecular biology for a rigorous, laboratory-intensive curriculum that prepares them for health-related professions, research jobs, or graduate programs in a number of areas related to molecular biology. This major requires a total of 38 credit hours, including the basic courses required of biology majors. Upper-level courses are mostly specified in the areas of genetics, biochemistry, and molecular biology, with eight credit hours of upper-level elective courses also part of the program.

In addition to fulfilling major requirements to earn an undergraduate degree, students complete Loyola’s Core Curriculum, which teaches them important skills and values. Students also develop their own interests by taking general electives.

Transfer students majoring in biology must take a minimum of 20 credit hours in biology courses at Loyola. No more than 18 credit hours in biology transferred from another institution may be applied toward the biology major for the BS degree.

Ordinarily, transfer of credit from professional or graduate schools for the purpose of obtaining a major or minor in biology is not permitted.

Minors

BIOLOGY

The minor in biology requires 24 credit hours, including 17 credit hours of required biology courses (BIOL 101, 102, 111, 112, 251, 265, and 282) and seven credit hours of biology electives. Transferring students who seek a minor in biology must take a minimum of 12 credit hours in biology at Loyola.

BIOETHICS

Loyola’s bioethics minor encompasses work in the fields of biology, natural science, philosophy, sociology, and theology. Students study topics in which the life sciences and ethics converge, such as biological and chemical weapons, human stem cell research, global warming, human and animal experimentation, pollution, genetic screening and gene therapy, and human population growth. Selected bioethics courses are team-taught by professors in distinct disciplines. The program helps prepare students for a range of careers or for advanced study in ministry, the health professions, the sciences, teaching, law, journalism, research, government, or social work.

The bioethics minor requires at least seven courses or 21 credit hours. The science requirement is satisfied by four courses in biology or three courses in life sciences. The ethics requirement is satisfied by three courses in philosophy, theology, or biology. An interdisciplinary, team-taught course that examines a specific bioethical topic is also required. The biology and interdisciplinary courses also count toward the biology major.
BIOL.EDU/CAS 3

BIOLoGY CONTINUED

BIOSTATISTICS
Designed for students interested in the growing number of jobs that apply quantitative skills to problems in biomedical research, statistical genetics, and bioinformatics, this minor requires three statistics courses as well as Introductory Biology (BIOL 101, 102, 111, 112) and Basic Calculus (MATH 131, 132 or 161, 162). Four statistics courses (BIOL/Statistics (STAT) 310, 335, 366, and 337) are cross-listed in biology and also count toward the biology major.

NEUROSCIENCE
The neuroscience minor is the interdisciplinary liberal arts study of the nervous system that exposes students to issues of the relationships of the brain, the mind, behavior, evolution, and the nature of humans and other animals in our complex world. The minor is intended for Loyola undergraduates who plan to attend graduate or professional school in the life sciences. The interdisciplinary neuroscience minor includes rich opportunities for neuroscience education at the Lake Shore Campus and at the Loyola University Medical Center. The minor exposes students to programs at both campuses, including the Neuroscience and Aging Institute and the neuroscience graduate program. Students are challenged to understand issues of both basic neuroscience research and its applications, including those related to health care. The neuroscience minor requires 20 credit hours, including coursework in neuroscience, biology, anthropology, and philosophy.

Dual-Degree Programs

BS IN BIOLOGY/MBA
This five-year dual-degree program provides the type of broad training that contemporary employers in the biotechnology and pharmaceutical industries value. Students complete the normal requirements for any of the biology BS major programs and take five of the required MBA courses during their four years of undergraduate study. The fifth year consists of full-time enrollment in MBA courses. Following this plan reduces the typical two-year MBA program to one additional year of study beyond the BS degree.

BS IN BIOLOGY/MEd
The dual-degree program takes five years to complete, and enables students to earn both the BS and MED degrees along with state certification necessary to teach middle- and high-school grades. Numerous job opportunities are available for students interested in becoming science teachers for grades 6-12. In fact, in Illinois the need for science teachers is critical. This dual-degree program is an appealing option because it offers greater opportunities for advancement and a higher salary base for the graduate than earning certification at the undergraduate level. Because the BS in Biology and certification are difficult to complete in four years, students are advised to go ahead and complete the master’s degree program.

Students must have a GPA of 3.0 or better to be admitted to the program, and must begin the program no later than the start of their junior year. Requirements include nine credit hours of graduate-level courses that will apply toward the 128 credit hours needed for the BS degree, and 30 credit hours of graduate-level work required for the MEd degree. Students must also take and pass the Illinois State Board of Education Test of Basic Skills and the Content Examination in Biology. As students progress through this program, they will compile a portfolio of their work to be presented at the completion of all coursework.

Graduate Program
The Master of Science (MS) degree allows specialization in a particular area of study. Current research interests of the faculty include cellular physiology, biochemistry, bioinformatics, ecology, organismal biology, molecular genetics, microbiology, plant biology, immunology, evolutionary biology, ichthyology, entomology, limnology, cell biology, molecular biology, cell ultrastructure, neurobiology, and developmental biology.

The Master of Arts (MA) in Medical Sciences degree is designed to help students enhance their understanding of the biological disciplines that are the foundation of medical school curricula. For more information, please visit LUC.edu/gpem.

Distinguishing Features
• Our biology program offers closer student/faculty interactions than found in biology programs at most other large institutions. Research-active faculty members are highly engaged in the education of undergraduates.
• It is typical for senior faculty members to teach freshman-level courses, and graduate students do not teach classes.
• Personal advising is provided; every biology major has his or her own faculty advisor.
• Off-campus classes have been offered in Costa Rica and northern Minnesota, and opportunities are available for classes at European and other international universities.
• Loyola’s nationally recognized pre-health professions advising program has an acceptance rate of 80% for first-time applicants to medical school, which is double the national average.
• The Chicago College of Pharmacy of Midwestern University offers a dual acceptance program with Loyola University Chicago leading to a doctoral degree in pharmacy. Students spend two years at Loyola before matriculating to Midwestern University. Only entering freshmen are eligible to apply to this program.
Distinguishing Features [continued]

- Graduate school acceptances at major programs in the nation include Stanford, Cornell, Johns Hopkins, the University of Chicago, Albert Einstein, and Washington University.
- An annual Life Sciences Career and Job Fair is held on campus.

Opportunities For Student Research

Research (BIOL 396) or the Senior Honors Thesis (BIOL 397) provide opportunities for students to work on independent research projects under the direction of faculty members. At least 15% of biology majors are involved in research. Those students planning employment in laboratory settings or application to graduate school are strongly urged to engage in research. Students frequently publish the results of their work in major journals. Fellowship stipends are also available for students participating in research projects.

Examples of recent student research efforts include:

- Steroid Effects in a Mouse Model of Nerve Regeneration
- Eph/Ephrin Signaling During Early Taste Nerve Development
- Characterization of Telomeric and Subtelomeric Regions of Human Acrocentric Chromosomes
- Automating Consensus Sequence Construction of Retrotransposons in the Soybean Genome

Internships

Students may pursue a supervised internship in business, industry, federal or state agencies, a research laboratory, or other type of field activity. Generally, only seniors who have completed most, if not all, of their required coursework may participate in an internship. In order to be eligible to register for the Internship in Biology course, students must have the department chairperson’s permission.

The Internship in Biology (BIOL 398) course offers opportunities for students to engage in specialized laboratory and/or field experiences not ordinarily available to students at the University.

Examples of internship sites include Abbott Labs, Baxter, Northwestern Medical School, Illinois State Police Forensic Lab, Children’s Memorial Hospital, Field Museum, and Shedd Aquarium.

Career Opportunities

Allied Health

- Health systems management
- Occupational therapy
- Pharmacy
- Physical therapy
- Physician assistant
- Speech therapy

Animal Care and Research

- Fisheries and aquaculture
- Gamekeeper
- Marine biologist
- Zookeeper

Artistic

- Bio-animation and films
- Medical illustrator
- Molecular visualization

Education

- Biology teacher (primary or secondary)
- Museum curator and researcher
- Professor (two- or four-year institution)

Environmental

- Agricultural scientist
- Conservation biologist
- Environmental research
- Forest ranger

Government

- Biotechnology policy
- City or community health official
- Environmental protection (federal, state, or local)
- National health (FDA, CDC, NIH)
- USDA

Advanced Placement

The Department of Biology will award credit for a score of 4 or 5 on the Advanced Placement Biology Examination, which merits eight hours of transfer credit for BIOL 101, 102, 111, and 112.
Honors and Awards

Each year, the department recognizes outstanding graduating seniors by awarding departmental honors based on excellence in academic performance. Additional recipients are chosen for awards by faculty for participation in research, or for service to the Department of Biology.

Professional Honors Societies

- **Beta Beta Beta (Tri-Beta)** — An honor and professional biological society open to undergraduate students who have completed at least four courses in biological science and have a GPA of 3.0
- **Alpha Epsilon Delta (AED)** — An international pre-health professional honor society that is open to any student interested in the health professions who has completed three semesters of college work with a science GPA of 3.0

Faculty

Chairperson: Domenic Castignetti, PhD, University of Massachusetts
Martin B. Berg, PhD, University of Notre Dame
Ian Boussy, PhD, University of California, Davis
Domenic Castignetti, PhD, University of Massachusetts
Jeffrey L. Doering, PhD, University of Chicago
Terry Grande, PhD, University of Illinois, Chicago
Robert W. Hamilton, PhD, Ohio State University
Timothy Hoellein, PhD, University of Notre Dame
Warren Jones, PhD, Indiana University
Stefan M. Kanzok, PhD, University of Heidelberg, Germany
John J. Kelly, PhD, Rutgers University
Howard M. Laten, PhD, University of Wisconsin
Louis R. Lucas, PhD, Tulane University
F. Bryan Pickett, PhD, Indiana University
Catherine Putoni, PhD, University of Houston
Sushma Reddy, PhD, Columbia University
William Rochlin, PhD, University of North Carolina
Eric H. Schroeter, PhD, Washington University
Sapna Sharma, PhD, University of Toronto
Nancy Tuchman, PhD, University of Louisville
William J. Wasserman, PhD, University of Toronto
Kim C. Williamson, PhD, Boston University

INSTRUCTORS

Peter Breslin, S.J., PhD, Northwestern University
Gerald Buldak, PhD, University of Illinois, Chicago
G. Hunter Cole, PhD, University of Wisconsin
Arden Davidson, MS, University of California
Hariklia Dimitropoulos, PhD, University of Illinois, Chicago
G. Patrick Duffie, EdD, Ball State University
Emma Feeney, PhD, Loyola University Chicago
Mary Ann Glogowski, MS, Roosevelt University
Barbara Haas, PhD, University of Paris
Erin Hayes, PhD, Northwestern University
Diane Jokinen, MS, Northwestern University
William Kroll, PhD, Indiana University
Robert Lammers, PhD, University of Minnesota
Robert Morgan, PhD, University of Illinois, Chicago
Pamela Osenkowski, PhD, Wayne State University
Bree S. Sines, PhD, Iowa State University
Raymond Ulbrich, MS, Loyola University Chicago

Course Offerings (credit hours)

**Biology (BIOL)**

101  Introduction to Biology I Lecture (3)
102  Introduction to Biology II Lecture (3)
110  Biology Through Art (3)
111  Introduction to Biology I Laboratory (1)
112  Introduction to Biology II Laboratory (1)
195  Special Topics (1–4)
205  Plant Biology (4)
210  Laboratory Techniques (2)
215  Ornithology (3)
240  Psychology and Biology of Perception (Psychology, PSYC 240) (3)
241  Brain and Behavior (PSYC 305) (3)
242  Human Structure and Function I (4)
243  Human Structure and Function II (4)
251  Cell Biology (3)
252  Cell Biology Laboratory (2)
265  Ecology (3)
266  Ecology Laboratory (2)
280  Evolution of Human Disease (Anthropology, ANTH 280) (3)
282  Genetics (3)
283  Genetics Laboratory (2)
296  Introduction to Research (1)
300  Seminar in Biological Sciences (1)
302  General Microbiology (4)
### Course Offerings (credit hours) [continued]

303  Neuroscience Seminar (NEUR 300) (1)
304  Introduction to Developmental Biology (3)
310  Categorical Data Analysis (Statistics, STAT 310) (3)
313  Laboratory in Psychobiology (PSYC 311) (3)
314  Advanced Microbiology (3)
315  Introductory Immunology (4)
316  Limnology (4)
317  Biology of Persistent Diseases (3)
319  Evolution (3)
320  Animal Behavior (ANTH 350) (3)
323  Comparative Anatomy of Vertebrates (4)
325  Primatology: Behavior and Ecology (ANTH 325) (3)
326  Human Osteology (ANTH 326) (4)
327  Wetland Ecology (4)
328  Conservation Biology (3)
335  Introduction to Biostatistics (MATH 335) (4)
336  Advanced Biostatistics (STAT 336) (3)
337  Quantitative Bioinformatics (STAT 337) (4)
341  Histology (4)
342  Human Anatomy (4)
345  Sociobiology (3)
346  Biology of Women (Women’s Studies and Gender Studies, WSGS 346) (ANTH 346) (Bioethics, BIET 395) (3)
350  Vertebrate Physiology (4)
352  Mammalian Endocrinology (3)
354  Biology of Mammalian Reproduction (3)
358  Developmental Neurobiology (3)
359  Paleopathology (3)
360  Field Biology (3)
362  Neurobiology (3)
363  Entomology (4)
364  Medical and Veterinary Entomology (4)
366  Cellular Physiology and Biochemistry (CHEM 361) (3)
366L  Biochemistry Laboratory (2)
367  Bioimaging (4)
368  Plant Ecology (4)
369  Invertebrate Biology (3)
370  Ichthyology (4)
371  Marine Biology (3)
373  Laboratory in Neuroscience I (NEUR 301) (3)
374  Laboratory in Neuroscience II (NEUR 302) (3)
375  Aquatic Insects (4)
376  Seminar in Molecular/Cellular Neuroscience (3)
377  Molecular Pathogenesis (3)
380  Genetics and Evolution of Development (3)
382  Molecular Genetics (3)
385  Principles of Electron Microscopy (4)
387  Genomics (3)
388  Bioinformatics (3)
389  Introduction to Pharmacology (3)
390  Molecular Biology Laboratory (4)
391  Forensic Molecular Biology (5)
393  Natural Resource Conservation (Environmental Studies, ENVS 393) (3)
394  Ethical Issues in Bioinformatics (1)
395  Special Topics in Biology (1–4)
396  Research (3)
397  Senior Honors Thesis (3)
398  Internship in Biology (1–3)
399  Individual Study (1–3)

### Suggested Biology First-Year Course Sequence

#### First Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 101 and 111</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 101 and 111</td>
<td>4</td>
</tr>
<tr>
<td>MATH 131</td>
<td>3</td>
</tr>
<tr>
<td>College Writing (UCWR) 110</td>
<td>3</td>
</tr>
<tr>
<td>Historical Knowledge Core</td>
<td>3</td>
</tr>
<tr>
<td>Semester Total</td>
<td>17</td>
</tr>
</tbody>
</table>

#### Second Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 102 and 112</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 102 and 112</td>
<td>4</td>
</tr>
<tr>
<td>MATH 132</td>
<td>3</td>
</tr>
<tr>
<td>Societal/Cultural Core</td>
<td>3</td>
</tr>
<tr>
<td>Historical Knowledge Core</td>
<td>3</td>
</tr>
<tr>
<td>Semester Total</td>
<td>17</td>
</tr>
</tbody>
</table>
BIOLOGY
CONTINUED

Other Related Programs

BIOCHEMISTRY
Students interested in the chemistry of living organisms and life processes may want to consider majoring in biochemistry, offered by the Chemistry Department. Requirements for this degree include 12 courses in chemistry totaling 39 credit hours, two courses in mathematics totaling six credit hours, six courses in biology totaling 12 credit hours, and four courses in physics totaling eight credit hours. The Chemistry Department also strongly recommends Undergraduate Research (CHEM 300).

For more information, please visit LUC.edu/chemistry.

BIOINFORMATICS
Bioinformatics is an exciting new field that combines the latest advances in genetics and biochemistry with the powerful tools of computer science and statistical analysis. This major provides students with the training, skills, and opportunities to enter this ground-breaking discipline and contribute to its important breakthroughs.

For more information about this program, please visit LUC.edu/bioinformatics.

BIOPHYSICS
The application of physics to biology and medicine has occurred for more than three centuries, and biophysics research and applications have grown exponentially during the past three decades. Offered by the Departments of Physics and Biology, Loyola’s biophysics major concentrates on the areas of molecular structures, biophysical techniques, and biophysical mechanisms. Students majoring in biophysics may pursue careers in biomechanical engineering, biotechnology, nanotechnology, and other biologically oriented high-tech fields.

For more information about this program, please visit LUC.edu/biophysics.

CLINICAL LABORATORY SCIENCE
Loyola’s clinical laboratory science program is offered in collaboration with the University’s health system in Maywood and prepares individuals for advanced careers in medical care technology and allied health care. Graduates of this program enjoy a wide array of career options including clinical laboratory positions in medical care facilities or diagnostic, pharmaceutical, or government labs, as well as positions in research and product development, insurance underwriting, forensic medicine, and veterinary medicine.

For more information about this program, please visit LUC.edu/scps.

ENVIRONMENTAL STUDIES/SCIENCE
Loyola’s environmental studies/science program (ESP) captures two unusual approaches to environmental studies programs by enhancing/updating an existing major that has now been “greened,” and by approaching environmental concerns with an interdisciplinary, holistic view. Loyola ESP majors can choose from three separate tracks according to their academic or professional interests: BA degree in Environmental Studies, BS/MBA in Environmental Studies, or BS in Environmental Science. The programs provide students with valuable knowledge, professional competency, service in the interest of social justice, and dedication to solving the environmental problems of the city and country.

For more information about these programs, please visit LUC.edu/envsci.

EXERCISE PHYSIOLOGY
This program is offered in collaboration with Loyola University’s Health System in Maywood. Exercise physiologists work as part of a clinical team in hospitals and in acute and chronic care medical facilities in the areas of physical and occupational therapy, sports medicine, cardiac rehabilitation, care of the aged, infirm, and disabled, and other forms of physical rehabilitation. The will lead students to assume careers in occupational and physical therapy, physical rehabilitation, and related physician-directed applications of exercise physiology in medical settings. For more information about this program, please visit LUC.edu/scps.

FORENSIC SCIENCE
Forensic science combines natural science and criminal justice. Forensic scientists interact with law enforcement, applying knowledge and technology from anthropology, biology, and chemistry to collect, examine, and evaluate criminal evidence. Students in this major gain a broad range of knowledge and skills in chemistry and biology, an understanding of the criminal justice system and rules of evidence; strong writing and speaking skills; technical expertise; and analytic reasoning abilities. Loyola’s strong reputation in the sciences, and its successful track record in preparing students for health professions, will enable graduates from this program to begin highly successful careers in the forensic science field.

For more information about this program, please visit LUC.edu/forensicscience.
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

Precautionary Information Concerning Laboratory Activities

Students who choose a major in biology and enroll in biology courses are required to perform laboratory exercises. Depending upon the laboratory, students may be involved in handling live or prepared animals, plant and animal tissues, equipment, biological fluids, reagents, chemicals, equipment, and numerous other laboratory items. The environment of a laboratory may include unpleasant odors and sights.

Some courses require students to participate in controlled experiments on either themselves or lab partners. Students who have physical conditions (including pregnancy) which may be aggravated by certain lab procedures should inform the faculty member or the chairperson; physicians’ letters may be required in order to fully document a student’s physical condition or limitation.