BIOLOGICAL SCIENCES (BS)

Director of Undergraduate Studies:
Jennifer Robichaud

Program in Biological Sciences

The Department of Biological Sciences at Notre Dame is committed to understanding the fundamental mechanisms by which living systems operate. The Department is highly interdisciplinary and in excellent position to fulfill the promise of the new integrative approach to biology. Basic research is at the center of our endeavors and fuels and inspires our teaching and training. We seek solutions to human health and environmental crises facing our society—such as finding treatments, cures and preventions for human diseases, maintaining biodiversity on land and in our natural water sources, ensuring an adequate supply of food and fresh water, and reversing the effects of pollution and climate change.

Research in the department spans the wide realm of the life sciences, across scales of complexity—from cells and organs to whole organisms and ecosystems—and across foci as varied as infectious disease, cancer, organ regeneration, climate change and biodiversity. *United through the ultimate goals of fostering human and environmental health*, we believe that real-world solutions require integrative biological inquiry and multidisciplinary collaboration. Our department serves as a hub connecting different academic units across campus and different universities worldwide, through life science-related investigation and problem solving.

Students choosing an undergraduate major in biological sciences will be prepared for graduate study (M.S., Ph.D., MD/Ph.D.) leading to a research career, or for admission to medical, veterinary, and other professional schools. Graduates with a bachelor's degree may enter careers in industry, government, or health-related research laboratories. Those who wish to teach at the elementary or secondary level should be sure to include required education courses such as those offered through Saint Mary's College.

The biological sciences majors take the following basic sequence of courses in the College of Science:

Code	Title	Hours
College of Science Basic Sequence		
CHEM 10171 & CHEM 11171	Introduction to Chemical Principles and Introduction to Chemical Principles Laboratory	4
CHEM 20274 & CHEM 21274	Chemistry across the Periodic Table and Chemistry Across the Periodic Table Laboratory	4
CHEM 10172 & CHEM 11172	Organic Structure and Reactivity and Organic Structure and Reactivity Laboratory	4
CHEM 20273 & CHEM 21273	Organic Reactions and Applications and Organic Reactions and Applications Laboratory	4
PHYS 20210 & PHYS 21210	Physics for Life Sciences I and Physics for Life Sciences I Lab	4
PHYS 20220 & PHYS 21220	Physics for Life Sciences II and Physics for Life Sciences II Lab	4
Select one of the following sequences:		8
MATH 10350 & MATH 10360	Calculus A and Calculus B	
MATH 10550 & MATH 10560	Calculus I and Calculus II	

Biology Core Requirements

There are six components to the biology core requirement, consisting of courses in the following areas:

Code	Title	Hours
Core I: Introductory Biology Sequence		**8**
BIOS 10171 & BIOS 11173	Biology I :Big Questions and Biological Investigations Laboratory **	
BIOS 10172 & BIOS 11174	Biology II: Molecules to Ecosystems and Research Experience in Biology Laboratory **	
Core II: Genetics		**3-4**
Core III: Evolution		**3**
Core IV: Cell Biology and Physiology		**3**
Core V: Ecology and the Environment		**3**
Core VI: Laboratory Courses *		**3**

* Students complete five laboratory courses (Biological Investigations Laboratory (BIOS 11173), Research Experience in Biology Laboratory (BIOS 11174), and 3 additional labs). Three semesters of undergraduate research can fulfill one of five laboratory courses.

** These labs are designated lab #1 and lab #2 of the five required for the major.

Note that select overseas courses that have been approved for science credit may satisfy the Core II through VI requirement if approved by the Director of Undergraduate Studies in Biological Sciences before taking the class.

Concentrations

The Department of Biological Sciences offers eight concentrations within the Biological Sciences major. Concentrations provide structure to elective selection to assist students' development in their fields of interest, and provide experience in a field within biology for students seeking admission to graduate school, medical school, or other programs/jobs.

Each concentration requires a minimum 14 credits with 5 credits allowed to "double-count" and 9 Biology electives unique to the concentration. These credits are in addition to the 73 total science credits required off the Biological Sciences major listed above.

Concentrations include:

- Biomedical Sciences
- Cell and Developmental Biology
- Computational Biology
- Ecology and Environment
- Evolution and Genomics
- Infectious Disease and Global Health
- Medical Neurobiology
- Integrative Biology

For full descriptions of each concentration, see https://biology.nd.edu/undergraduate/programs-of-study/biology-major (https://biology.nd.edu/undergraduate/programs-of-study/biology-major/)

BIOS Electives

The minimum required credits in the core including labs is 23. An additional 18 credits of electives in biological sciences are chosen to complete the required total of 41 credits. All biological sciences majors are encouraged to include non-science among their free electives.

Notes

1. Students are required to take a total of five laboratories; two of the five labs will be part of Core I, and the remaining three of the five laboratories are chosen among the Core II through Core V and/or BIOS electives, including 50000- and 60000-level courses. Thus, there are two required "named" BIOS labs and three additional elective BIOS labs. Students who conduct a minimum of three semesters of Undergraduate Research (BIOS 48498) in a laboratory or research group at Notre Dame and earn a minimum of 3 credits (i.e., 3 x 1.0 credit), may substitute those research semesters for one of the five required labs.

2. Select non-BIOS major-level College of Science courses (i.e., those taken to meet science-major requirements and not among those designated as "Recommended University electives") that are not being used to fulfill other specific graduation requirements can be chosen with the consent of the director of undergraduate studies for the Department of Biological Sciences and counted toward the BIOS elective credits. While majors are allowed to take one 3-credit, non-BIOS lecture course and have that count toward the 41 required credits, students may also include one non-BIOS lab if it is required for that non-BIOS lecture and have that laboratory satisfy one of the six required laboratories. For example, Physical Geology (SC 20110, CE 10110/CE 20110) has a required laboratory, and majors who choose BIOS electives based on their environmental or ecological interests may elect to take Physical Geology for a total of 4 credits toward the 41 required credits. Majors who might have transferred into BIOS from BCHM and had taken the required biochemistry lecture (CHEM 30341) and laboratory (CHEM 31341) course will be allowed to count both the lecture and laboratory toward the 41 credits. The same would be true of other relevant science courses (e.g., analytical chemistry, physical chemistry) as approved by the director of their major and the associate dean of the College of Science.

3. Undergraduate Research (BIOS 48498) and Directed Readings (BIOS 46497) count toward the 41-credit biological sciences requirement; however, only a maximum of two credits per semester per course and a combined total of six credits from these two courses may be counted in fulfilling the 41-credit requirement. A maximum of two credits of Teaching Practicum in the Life Sciences (BIOS 37493) may be included in any combination of these six credits. A maximum of only nine credits in these courses may be used toward graduation; however, additional credits do remain on a student's permanent transcript record.

Students majoring in biological sciences please note

The biology survey courses (BIOS 10101– BIOS 10119) *satisfy the science requirement for* ***non-science majors*** *at Notre Dame*. They do not satisfy the science requirements for science majors at Notre Dame or elsewhere. Students may not take courses with overlapping or similar lecture material such as BIOS 10101 and BIOS 10110 or BIOS 10107, BIOS 10117, and BIOS 10119, for example. A table listing these overlapping courses is in the College of Science Science Degree Credit section.

Also, Biostatistics (BIOS 40411/BIOS 42411) is highly recommended for all students planning on a health related professional program or a graduate program, especially in ecology, environmental biology, or other field of life science. A non-BIOS/Science elective can be any 30000–50000-level course other than those required, and approved by the director of undergraduate studies for the Department of Biological Sciences. Biochemistry (e.g., CHEM 40420) is especially recommended.

In addition to the undergraduate curriculum, the Department of Biological Sciences offers programs of graduate study leading to the degrees of master of science and doctor of philosophy, as described in the Graduate School Bulletin of Information.

Summary of Requirements for Graduation for any Biological Science Major

Code	Title	Hours
Total Science		*73*
Biological Sciences [1]		
Chemistry		
Physics		
Mathematics		
Liberal Arts 4–6		*9*
Philosophy [2]		*6*
Theology [2]		*6*
WR 13100	*Writing and Rhetoric*	*3*
Language Intermediate Level Competency		*3*
Free Electives [3]		*24*
Moreau Program (First & Final year) [4]		*2*
Total Hours		**126**

1. It is essential for prospective biology majors to begin their general biology courses in the first year to schedule all required core curriculum courses within a four-year period.
2. One of these courses must be a University Seminar.
3. Minimum number of free electives based on the assumption that intermediate-level competency in language was achieved by taking a minimum of one three-credit course.
   Majors often have time to incorporate 20 or more free elective credits (i.e., a second major or minor) into their four-year course selection.
4. Students will take a 1-credit Moreau First-Year Seminar course during their first year and complete their 1-credit Moreau experience in their final year.

Sample Curriculum

The sample curriculum for the four-year program listed below is only one of a number of ways a student can complete all the requirements for a biology major. Students should discuss their specific interests with their departmental advisor and plan their semesters accordingly. Alternative sample curricula can be developed with the assistance of the biology advisor.

Note that this sample curriculum assumes that no language CE credits are included.

Course	Title	Hours
First Year		
First Semester		
Biology I lecture and lab		4
Calculus I (or A)		4
General Chemistry I lecture and lab [1]		4
Theology or Philosophy [2]		3
Writing Requirement		3
Moreau First Year Seminar		1
	Hours	**19**
Second Semester		
Biology II lecture and lab		4
Calculus II (or B)		4
Organic Chemistry I lecture and lab [1]		4
Theology or Philosophy		3
Writing Requirement		3
	Hours	**18**
Sophomore Year		
First Semester		
BIOS Core (II, III, IV or V)		3-4
BIOS Elective lab		1-2
Organic Chemistry II lecture and lab		4
Theology or Philosophy		3
Language I		4
	Hours	**15-17**
Second Semester		
BIOS Core (II, III, IV or V)		3
BIOS Core (II, III, IV or V)		3
General Chemistry II lecture and lab		4
Theology or Philosophy		3
Language II		3
	Hours	**16**
Junior Year		
First Semester		
BIOS Core (II, III, IV or V)		3-4
BIOS Elective Lab		1-2
Physics I lecture and lab		4
Ways of Knowing IV [3]		3
Language III		3
	Hours	**14-16**
Second Semester		
BIOS Elective [4]		3
BIOS Elective		3
Physics II lecture and lab		4
Ways of Knowing V		3
Free Elective		3
	Hours	**16**
Senior Year		
First Semester		
BIOS Elective		3
BIOS Elective		3
BIOS Elective lab		1-2
Ways of Knowing VI		3
Free Elective		3
	Hours	**13-14**
Second Semester		
BIOS Elective		3
BIOS Elective		3
BIOS or Free Elective		3
Free Elective		3
Moreau Senior Capstone		1
	Hours	**13**
	Total Hours	**124-129**

1. Students who begin with the CHEM 10181–CHEM 10182 sequence and select BIOS as their major would complete the four-semester sequence with CHEM 20273–CHEM 20274.
2. One of these courses must be a University seminar
3. For premedical students, it is strongly recommended that the student take a 20000-level English literature course. This ensures that the student will be able to meet the standard medical-school admission requirement of two English courses. Medical ethics and biochemistry are also generally required or highly recommended.
4. While not required, many students choose to take a supporting 3-credit non-BIOS science course that counts toward the required 41 credits in their major.

Select Graduate-Level Courses

Many 60000-level courses in biological sciences are open to qualified undergraduates, subject to the approval of the course instructors and the director of undergraduate studies. Graduate-level courses generally include a majority of upper-class students and are recommended to undergraduate majors.

The above 60000-level courses are described in the Graduate School Bulletin of Information (https://registrar.nd.edu/courses-classrooms/bulletins-of-information/#:~:text=Graduate%20Business%20Bulletins%20of%20Information).

Biological Sciences Honors Program

The goal of the honors program is to give interested students an exceptional experience in biological research. Participation in this program will increase their level of commitment and productivity while preparing them for successful postgraduate careers.

Biological and Environmental Sciences majors are encouraged to identify a research mentor and project during their sophomore year, but final applications into the program should be completed during the fall of their junior year. Acceptance by the Undergraduate Research Committee will be based on minimum 3.0 Science GPA at time of application, cover letter, research statement, unofficial transcript, and nomination form from research mentor.

To graduate with honors, students should complete all of the requirements for their major and:

1. Maintain a minimum 3.0 Science GPA or higher throughout the program.
2. Have a minimum of three semesters of biological science research experience in the research mentors lab.
3. Generate original data in order to complete and write a thesis.
4. Complete a two to three credit graduate level course in the area of research.
5. A presentation at a national or regional meeting.
6. One disciplinary research seminar in Junior year, Spring semester (1 credit seminar).

Thesis Requirements

Over the course of the program, students will write a draft of their thesis under the guidance of the research mentor and advising mentor. The final draft of the thesis will be submitted by April 15. The thesis will be reviewed by the student's research mentor and advising mentor. If the thesis is not approved, a member of the Undergraduate Research Committee will read the thesis and confer with the mentors for a final decision. Guidelines for the thesis and thesis reviewers will be provided.

Research Seminar (Graded)

The purpose of these seminars is to create a small learning community of students interested in research. The seminar learning goals are to support and develop each student's independence, scientific communication skills, critical review skills, and understanding of their research in the context of the larger field.