MICROBIOLOGY, BS

Microbiology is the study of microorganisms (bacteria, archaea, protists, fungi) and viruses. The Department offers a BS in microbiology with research opportunities to conduct original research and investigate different aspects of microbial structure and function.

Microorganisms were the first living things on earth, and they remain the most abundant and the most diverse of all organisms. They can cause diseases of plants, animals and humans; they play critical roles in biogeochemical cycles and bioremediation; and they are important in the food and biotechnology industries.

As a microbiologist, students will be on the cutting edge of developments in public health, industrial production processes, biotechnology, and drug discovery. The microbiology major prepares students for a variety of careers in the fields of microbiology, virology, molecular biology, biotechnology, and health related professions, for graduate studies in medical microbiology, industrial microbiology, environmental microbiology, microbial biotechnology, and molecular biology, and for professional studies in pharmacy, dentistry, and medicine.

Requirements

Code	Title	Credits
General Education Requirements		30
L&S Requirements (general and major requirements)		105
Total Credits		**135**

Credit numbers reflect total possible credits towards degree. Due to the ability to count courses towards more than one requirement, credit amounts will vary. Please work with your academic advisor on your plan of study.

Preparatory Coursework

Based on individual placement results, some students may be required to complete preparatory coursework before enrolling in the courses listed here. This may include English language or composition preparation, developmental math, introductory chemistry, and/or student support courses for students participating in the First Year Bridge program.

General Education Requirements (GER)

UW-Milwaukee has General Education Requirements (https://catalog.uwm.edu/policies/undergraduate-policies/#generaleducationtext) that must be met in order to earn a bachelor's or associate degree. They include at minimum 30 credits (10 courses) in six categories that are designed to assure basic student competencies and provide a broad body of knowledge as a context for specialization.

Some degree requirements may fulfill GERs. Please review the requirements and consult with your academic advisor.

Code	Title	Credits
General Education Categories and Credits		
Civics and Perspectives (CP)		6
Communication and Literacy (CL)		6
Humanities and Arts (HA)		6
Mathematics and Quantitative Reasoning (MQR)		3
Natural Science and Wellness (NSW/NSWL)		6
Social and Behavioral Science (SBS)		3
Total Credits		**30**

Letters and Science Course of Study – Bachelor of Science Degree

Complete 120 credits including 75 credits in the College of Letters & Science, with 36 of the 75 credits in L&S upper-level (numbered 300 or above) courses and 30 of those 36 credits in designated L&S Advanced Natural Science courses (https://catalog.uwm.edu/letters-science/approved-courses-advanced-natural-science/).

The College requires that students complete, in residence at UWM, at least 15 credits in upper-division (numbered 300 or above) courses in their major. The College also requires that students complete at least 30 credits overall in residence at UWM. For additional residency and transfer credit limitations, see L&S Undergraduate Policies and Regulations (https://catalog.uwm.edu/letters-science/#policiesandregulationstext).

Students are also required to complete the University-wide General Education Requirements (https://catalog.uwm.edu/policies/undergraduate-policies/#bachelorsdegreegeneraleducation) and the specific L&S requirements listed below.

To complete a major, students must satisfy all the requirements of the major as stated in this catalog. Students who declare their majors within five years of entering the UW System as a degree candidate may satisfy the requirements outlined in any catalog issued since the time they entered. Credits used to satisfy the major also may be used to satisfy other degree requirements.

College of Letters & Science Requirements

The degree requirements in the College of Letters and Science build on the University General Education Requirements to provide a broad base of knowledge as well as an array of skills cited by employers as critical to professional success: critical thinking, problem solving, oral and written communication, ability to work well with others, and adaptability to change.

For the Bachelor of Science (B.S.), students must complete the UWM General Education Requirements as well as these L&S requirements: the International requirement, the Breadth requirement (with extra courses in Advanced Natural Science required), a Natural Science Lab requirement, the Research requirement, and a Language other than English requirement. The International requirement develops student potential for cross-cultural understanding in a globalizing world. The Breadth requirement ensures that students take classes in a wide variety of subjects, across humanities, natural sciences, and social sciences. The Research requirement calls for students to build critical thinking and oral and written communication skills through conducting an independent research project in their major. The Language other than English requirement further develops student proficiency in a language other than English. And, the requirement that students take an L&S Natural Science lab ensures exposure to and practice with the scientific method in action.

I. Total Credits and Upper-Division Courses Requirement

Students must complete 120 credits including 75 credits in the College of Letters & Science with 36 of those 75 credits in L&S upper-level (numbered 300 and above) courses.

II. L&S Advanced Natural Sciences Requirement

For the Bachelor of Science, students must complete 30 credits of the 36 credits required in upper-division courses in designated L&S Advanced Natural Science courses (https://catalog.uwm.edu/letters-science/approved-courses-advanced-natural-science/).

III. Language other than English Requirement

Students doing the B.S. must fulfill a language other than English requirement by successfully completing the second semester of university work or equivalent in one language other than English (including all languages other than English and American Sign Language).

Language courses (including American Sign Language) other than English taken in high school may be used to satisfy all or part of this requirement. One year of high school language equates to one semester of college work. Proficiency tests approved by the Languages faculty may be used to satisfy all or part of this requirement.

IV. International Requirement

To meet the International Requirement, students must successfully complete some two-course (minimum 6 credits) combination of:

1. Courses with L&S approved international content (see Courses Approved for the L&S International Requirement (https://catalog.uwm.edu/letters-science/approved-courses-international-requirement/) for course options).
2. Any study-abroad course(s).

Students who graduated secondary school in a country other than the U.S. are exempt from this requirement.

IV. Breadth Requirement

In addition to completing the University General Education Requirements, L&S students must complete the Breadth requirement to obtain deeper experience across our three substantive divisions.

The L&S Breadth requirement calls for 9 credits each in L&S courses designated L&S Humanities, L&S Natural Sciences, and L&S Social Sciences breadth. One of the L&S Natural Science breadth courses must be a laboratory or fieldwork course.

Please refer to the list of Courses Approved for the L&S Breadth Requirement (https://catalog.uwm.edu/letters-science/breadth-requirement-course-list/).

V. The Major

The College requires that students attain at least a 2.0 GPA in all credits in the major attempted at UWM. In addition, students must attain a 2.0 GPA on all major credits attempted, including any transfer work. Individual departments or programs may require higher GPAs for graduation. Some departmental majors require courses from other departments. Students should contact their major department for information on whether those credits will count as part of the major GPA. The College requires that students must complete, in residence at UWM, at least 15 credits in upper-division (numbered 300 or above) courses in their major.

Research Requirement

Within their majors, students must complete a research experience approved by the L&S faculty. A list of courses satisfying the research requirement in each major can be found here (https://catalog.uwm.edu/letters-science/approved-courses-research-requirement/).

VI. The Minor

Students are encouraged to consider completing a minor, but it is not required. To complete a minor, the College of Letters and Science requires that students attain at least a 2.0 GPA in all credits in the minor attempted at UWM. In addition, students must attain a 2.0 GPA on all minor credits attempted, including any transfer work. The minor must contain at least 9 credits in upper-division (numbered 300 and above) courses at UWM.

Microbiology Major Requirements

Microbiology is the study of microorganisms such as bacteria, archaea, protists, fungi, and viruses. Prospective Microbiology majors should consult with a faculty advisor as early as possible, preferably before the beginning of the junior year, in order to outline an appropriate course of study. Students should consult their advisor at least once each semester.

At least 15 credits of advanced (300 and above) Microbiology courses must be taken in residence at UWM. Students must attain an average GPA of 2.0 in Microbiology courses attempted at UWM. In addition, students must attain a 2.0 GPA on all major credits attempted, including any transfer work.

Requirements

The Microbiology major requires a minimum of 34 credits in Microbiology. The required and elective courses in Biological Sciences, CHEM 501, and BMS 534, BMS 535, BMS 539, and BMS 540 count as "Microbiology" courses for this purpose. A combined limit of 6 credits in BIO SCI 290, BIO SCI 695, BIO SCI 697, BIO SCI 698, and BIO SCI 699 counts toward the major.

Code	Title	Credits
Required		
BIO SCI 150	Foundations of Biological Sciences I	4
BIO SCI 152	Foundations of Biological Sciences II	4
BIO SCI 325	Genetics	4
BIO SCI 383	General Microbiology	4
Select two of the following:		6
BIO SCI 529	Molecular Biology of Microorganisms	
BIO SCI 535	Bacterial Pathogenesis	
BIO SCI 540	Microbial Diversity and Physiology	
BIO SCI 315	Cell Biology	3
or CHEM 501	Introduction to Biochemistry	
Research Requirement		
Select credits in the following:		
BIO SCI 495	Internship in Biotechnology, Upper Division	
BIO SCI 671	Undergraduate Seminar in Microbiology	
BIO SCI 698	Independent Study in Microbiology	
BIO SCI 699	Independent Study [1]	
HONORS 686	Research in Honors [1]	
HONORS 687	Senior Honors Project [1]	
HONORS 689	Senior Honors Thesis [1]	
Select additional elective credits (see below)		
Other Requirements		
CHEM 102	General Chemistry	5
CHEM 104	General Chemistry and Qualitative Analysis	5

Select one of the following options:		5-8
Option 1:		
CHEM 341	Introductory Survey of Organic Chemistry	
CHEM 342	Introductory Organic Chemistry Laboratory	
Option 2:		
CHEM 343	Organic Chemistry	
CHEM 344	Organic Chemistry Laboratory	
CHEM 345	Organic Chemistry	
Select one of the following:		4-5
MATH 211	Survey in Calculus and Analytic Geometry I	
MATH 213	Calculus with Life Sciences Applications	
MATH 221	Honors Calculus I	
MATH 231	Calculus and Analytic Geometry I	
Select one of the following:		3-5
MTHSTAT 215	Elementary Statistical Analysis	
MATH 222	Honors Calculus II	
MATH 232	Calculus and Analytic Geometry II	
BIO SCI 465	Biostatistics	
Select one of the following options:		9-10
Option 1:		
PHYSICS 120	General Physics I (Non-Calculus Treatment)	
PHYSICS 122	General Physics II (Non-Calculus Treatment)	
PHYSICS 123	General Physics Laboratory II (Non-Calculus Treatment)	
Option 2:		
PHYSICS 209	Physics I (Calculus Treatment)	
PHYSICS 210	Physics II (Calculus Treatment)	
PHYSICS 215	Lab Physics II (Calculus Treatment)	
Option 3:		
PHYSICS 219	Physics I: Calculus-Based, Studio Format	
PHYSICS 220	Physics II: Calculus-Based, Studio Format	
Total Credits		**56-63**

[1] When determined by the student's Microbiology faculty advisor to have Microbiology content.

Additional Electives

Students choose courses from this list to complete their 26 credits of upper-level (300 or above) microbiology courses.

Code	Title	Credits
BIO SCI 315	Cell Biology	3
BIO SCI 316	Laboratory in Genetics and Cell Biology	2
BIO SCI 401	Immunology	3
BIO SCI 405	General Virology	3
BIO SCI 465	Biostatistics	3
BIO SCI 469	Genomic Data Analysis	2
BIO SCI 490	Molecular Genetics	3
BIO SCI 529	Molecular Biology of Microorganisms (if not selected above)	3
BIO SCI 535	Bacterial Pathogenesis (if not selected above)	3
BIO SCI 539	Laboratory Techniques in Molecular Biology (if not selected above)	4
BIO SCI 540	Microbial Diversity and Physiology (if not selected above)	3
BIO SCI 542	Biological Electron Microscopy	3
BIO SCI 544	Transmission Electron Microscopy Laboratory	3
BIO SCI 572	Functional Genomics	3
BIO SCI 580	Experimental Microbiology	4
CHEM 501	Introduction to Biochemistry	3
CHEM 601	Biochemistry: Protein Structure and Function	3
BMS 534	Medical Microbiology [2]	3
BMS 535	Medical Microbiology Laboratory [2]	2
BMS 539	Public Health Microbiology [2]	2
BMS 540	Public Health Microbiology Lab [2]	2

[1] Only BIO SCI 699 or HONORS 686, HONORS 687, or HONORS 689 projects that are determined by the student's microbiology faculty advisor to have microbiology content count toward the major.

[2] Students may elect to take these BMS courses to earn credit toward the Microbiology major option provided that they earn 30 advanced credits in Natural Sciences within the College of Letters and Science, as required for the BS degree.

Microbiology BS Learning Outcomes

Students graduating from the Microbiology BS Program will be able to:

- **Use the scientific method** to test hypotheses about biological questions.
- **Use** diverse field and laboratory skills to **investigate** scientific biological problems.
- **Search** peer-reviewed literature to obtain scientific information.
- **Synthesize** and **integrate** scientific information.
- **Communicate** scientific information to other scientists, students, and the general public.
- **Explain** evolution as the cause of the diversity of life forms, patterns and processes.
- **Relate** biological information and concepts to societal and ethical questions.

Letters & Science Advising

During your time at UWM, you may have multiple members of your success team, including advisors, peer mentors and success coaches. Letters & Science students typically work with at least two different types of advisors as they pursue their degrees: professional college advisors and faculty advisors. L&S college advisors advise across your entire degree program while departmental faculty advisors focus on the major.

College advisors are located in Holton Hall (or virtually for online students) and serve as your primary advisor. They are your point person

for your questions about navigating college and completing your degree. College advisors will:

- Assist you in defining your academic and life goals.
- Help you create an educational plan that is consistent with those goals.
- Assist you in understanding curriculum, major and degree requirements for graduation, as well as university policies and procedures.
- Provide you with information about campus and community resources and refer you to those resources as appropriate.
- Monitor your progress toward graduation and completion of requirements.

Faculty advisors mentor students in the major and assist them in maximizing their development in the program. You will begin working with a faculty advisor when you declare your major. Faculty advisors are an important partner and will:

- Help you understand major requirements and course offerings in the department.
- Explain opportunities for internships and undergraduate research and guide you in obtaining those experiences.
- Serve as an excellent resource as you consider potential graduate programs and career paths in your field.

Students are encouraged to meet with both their college advisor and faculty advisor at least once each semester. Appointments are available in-person, by phone or by video.

Currently enrolled students should use the Navigate360 website (https://uwm.navigate.eab.com/) to make an appointment with your assigned advisor or call (414) 229-4654 if you do not currently have an assigned Letters & Science advisor. Prospective students who haven't enrolled in classes yet should call (414) 229-7711 or email let-sci@uwm.edu.

Department Advising

Students should contact an advisor (https://uwm.edu/biology/undergraduate/advising/) as soon as possible in their first year about required courses and the recommended course sequence within Biological Sciences programs. The student should attend fall or spring departmental Open Advising or contact a Department of Biological Sciences faculty advisor (https://uwm.edu/biology/undergraduate/advising/) who will then guide the student in planning their course choices to accomplish their goals. Students should consult their College academic advisors in Holton Hall and their faculty advisors in the Department of Biological Sciences prior to each registration period.

Major or Minor Declaration

Students can declare a major or minor (https://uwm.edu/biology/undergraduate/declare-your-major/) by contacting a faculty advisor in Biological Sciences or attending fall or spring departmental Open Advising. Students can declare more than one major or a combination of major and minors.

Failure to complete a declaration of major may result in a delay in graduation.

Honors in the Major

Students in biological sciences who meet all of the following criteria are awarded honors in the major upon graduation:

1. 3.500 cumulative GPA in all UWM graded credits attempted;
2. 3.750 GPA in UWM courses counting toward the major;
3. 3.500 GPA in all advanced credits that count toward the major; and
4. Complete a laboratory or field research independent study (BIO SCI 697, BIO SCI 698, or BIO SCI 699) or internship (BIO SCI 489 or CES 489).

Students who believe they may qualify for honors in biological sciences should apply to the Department during their last semester of study.

College of Letters and Science Dean's Honor List

GPA of 3.750 or above, earned on a full-time student's GPA on 12 or more graded credits in a given semester.

Honors College Degree and Honors College Degree with Distinction

Granted to graduating seniors who complete Honors College requirements, as listed in the Honors College (https://catalog.uwm.edu/honors-college/) section of this site.

Commencement Honors

Students with a cumulative GPA of 3.500 or above, based on a minimum of 40 graded UWM credits earned prior to the final semester, will receive all-university commencement honors and be awarded the traditional gold cord at the December or May Honors Convocation. Please note that for honors calculation, the GPA is **not** rounded and is truncated at the third decimal (e.g., 3.499).

Final Honors

Earned on a minimum of 60 graded UWM credits: Cum Laude - 3.500 or above; Magna Cum Laude - 3.650 or above; Summa Cum Laude - 3.800 or above.