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.

Course of Study – Bachelor of Science Degree

Complete 120 credits including 90 credits in the College of Letters & Science and with 36 of the 90 credits in L&S upper-level (numbered above 300) courses and 30 of those 36 credits in designated Advanced Natural Science courses (https://uwm.edu/letters-science/advising/degree-requirements/advanced-natural-science-approved-courses-list/). 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. Students are also required to complete University-wide General Education Requirements 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.

University General Education Requirements (GER)

Code	Title	Credits
Oral and Written Communication		
Part A		
Achieve a grade of C or better in the following course:		
ENGLISH 102	College Writing and Research (or equivalent)	
Part B		
Course designated as OWC-B; may be completed through a major-specific course requirement		
Quantitative Literacy		
Part A		
Earn at least 3 credits with a grade of C or higher in one of the following courses or an equivalent course, or achieve a placement code of at least 30 on the mathematics placement test (or other appropriate test, as determined by the Mathematical Sciences Department)		
MATH 102	Mathematical Literacy for College Students II	
MATH 103	Contemporary Applications of Mathematics	
MATH 105	Introduction to College Algebra	
MATH 108	Algebraic Literacy II	
MATH 111	Introduction to Logic - Critical Reasoning [1]	
or PHILOS 111	Introduction to Logic - Critical Reasoning	
MATH 116	College Algebra	
Or equivalent course		
Part B		
Course designated as QL-B; may be completed through a major-specific course requirement		
Arts		
Select 3 credits		3
Humanities		
Select 6 credits		6
Social Sciences		
Select 6 credits		6
Natural Sciences		
Select 6 credits (At least two courses including one lab)		6
UWM Foreign Language Requirement		
Complete Foreign Language Requirement through:		
Two years (high school) of a single foreign language		
Two semesters (college) of a single foreign language		
Or equivalent		
UWM Cultural Diversity Requirement		
One course from the Arts, Humanities, or Social Sciences must also satisfy UWM's Cultural Diversity requirement		

[1] Math 111 and Philosophy 111 are jointly offered and count as repeats of one another. Students cannot receive credit for both courses.

College of Letters & Science Requirements

I. English Composition Requirement

Students must satisfy the English Composition Requirement with one of the following options:

1) Completing ENGLISH 102 with a grade of C or higher; or

2) placing beyond English 102 on the English Placement Test (EPT) (or other assessment as determined by the English Department); or

3) transferring a course of at least 2.5 equivalent credits from another institution that is equivalent to English 102, or a UWM higher-level expository writing course, with a grade of C or higher.

Note: This requirement is the same as the University General Education Requirement for Oral and Written Communication Part A. The College of Letters & Science does not have a specific requirement for a writing course beyond English 102, but students must complete the university-wide requirement for Oral and Written Communication Part B listed above.

II. Mathematics and Formal Reasoning

To satisfy the Mathematics and Formal Reasoning Requirement, Bachelors of Sciences degree students must satisfy the following two requirements:

1. Complete one of the following courses or an equivalent course:

Code	Title	Credits
MATH 211	Survey in Calculus and Analytic Geometry I	4
MATH 213	Calculus with Life Sciences Applications	4
MATH 221	Honors Calculus I	5
MATH 231	Calculus and Analytic Geometry I	4

2. Complete one course (at least 3 credits) at the 200 level or above chosen from courses in Mathematics, PHILOS 211, or Letters and Science statistics courses:

Code	Title	Credits
Complete one of the following:		
3 or more credits in any 200-level or above Math course		
AFRIC 220	Introduction to Statistics in African and African Diaspora Studies	
ANTHRO 568	Introduction to Anthropological Statistics	
BIO SCI 465	Biostatistics	
ECON 210	Economic Statistics	
GEOG 247	Quantitative Analysis in Geography	
HIST 595	The Quantitative Analysis of Historical Data	
MTHSTAT 215	Elementary Statistical Analysis	
PHILOS 211	Elementary Logic	
POL SCI 390	Political Data Analysis	
POL SCI 392	Survey Research	
PSYCH 210	Psychological Statistics	
SOCIOL 261	Introduction to Statistical Thinking in Sociology	

Note: This requirement is NOT the same as the University General Education Requirement for Quantitative Literacy Part B. To complete the BS, students must take one of the L&S approved courses. **Not all of the courses listed here will satisfy the QL-B requirement**.

III. Foreign Language Requirement

Two courses (minimum of 6 credits) in a language (including American Sign Language) other than English at the 100 level or above are required.

Placement testing may be used to satisfy all or part of this requirement. 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.

Completion of the L&S Language Requirement also satisfies the university-wide Foreign Language GER, but not vice versa.

IV. International Requirement

See Approved Courses for the L&S International Requirement (https://catalog.uwm.edu/letters-science/approved-courses-international-requirement/) for course options.

Code	Title	Credits
Completed in one of the following ways:		9
Complete 3 courses (min. 9 cr) in a single foreign language (not including literature-in-translation or American Sign Language) at the 3rd semester level and above		
Complete 3 non-language courses (min. 9 credits) with an international content chosen from at least 2 curricular areas.		
Complete 9 credits in combination of the two options above.		

V. Breadth Requirement

Along with completing the University General Education Requirements of 3 credits in the Arts (A); 6 credits in the Humanities (HU), Social Sciences (SS), and Natural Sciences (NS/NS+); and a course with the Cultural Diversity (CD/+) designation, L&S students must complete the Breadth requirement.

Code	Title	Credits
Arts		
Select 3 credits		3
Humanities		
Complete 12 credits of L&S courses with Humanities Breadth designation; no more than 6 credits from a single subject area. *		12
Social Sciences		
Complete 12 credits of L&S Courses with Social Science Breadth designation; no more than 6 credits from a single curricular area. *		12
Natural Sciences		
Complete 12 credits of L&S Courses with Natural Sciences Breadth designation, including laboratory or field courses from three different curricular areas. *		12
Cultural Diversity		
Complete 3 credits in a course with Cultural Diversity (CD) designation. **		3

* Students should check their course selections carefully with the list of approved L&S Breadth Courses (https://catalog.uwm.edu/letters-science/breadth-requirement-course-list/). Students are advised to select at least 6 credits worth of courses in each of the Humanities, Social Science, and Natural Sciences areas that can satisfy both the campus-wide General Education Requirements and the L&S Breadth requirement.

** Students are advised to select a course that satisfies the Cultural Diversity requirement as well as a Humanities or Social Science breadth/GER requirement.

VI. 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. Contact your 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/).

VII. The Minor

The College 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. Individual departments or programs may require higher GPAs for graduation.

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	
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]	
Microbiology Electives		
BIO SCI 315	Cell Biology	3
or CHEM 501	Introduction to Biochemistry	
Select one of the following:		4
BIO SCI 539	Laboratory Techniques in Molecular Biology	
BIO SCI 580	Experimental Microbiology	
Select additional elective credits (see below)		
Other Requirements		
CHEM 102	General Chemistry	5
CHEM 104	General Chemistry and Qualitative Analysis	5
CHEM 343	Organic Chemistry	3
CHEM 344	Organic Chemistry Laboratory	2
CHEM 345	Organic Chemistry	3
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		**63-67**

[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 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.

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 and 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 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; and
- 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; and
- 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.edu/navigate360/) 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 (uwm.edu/biology/undergraduate/advising/ (http://uwm.edu/biology/undergraduate/advising/)) as soon as possible in their freshman 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 (uwm.edu/biology/undergraduate/advising/ (http://uwm.edu/biology/undergraduate/advising/)) who will then guide the student in planning his/her course choices to accomplish his/her 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:

Biological Sciences students should be enrolled in BIO SCI 150 before officially declaring a major in Biological Sciences. Students can declare a major or minor 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 (uwm.edu/biology/undergraduate/declare-majorminor/ (http://uwm.edu/biology/undergraduate/declare-majorminor/)).

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.