

# 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 |
|--|--|---------|
| <b>Oral and Written Communication</b>  |  |         |
| <i>Part A</i>  |  |         |
| Achieve a grade of C or better in the following course:  |  |         |
| ENGLISH 102  | College Writing and Research (or equivalent) |         |
| <i>Part B</i>  |  |         |
| Course designated as OWC-B; may be completed through a major-specific course requirement   |  |         |
| <b>Quantitative Literacy</b>   |  |         |
| <i>Part A</i>  |  |         |
| 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 <sup>1</sup> |
| 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

<sup>1</sup> 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                         |         |
| ATM SCI 500   | Statistical Methods in Atmospheric Sciences                        |         |
| 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 (<http://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 |
|--|-------|---------|
| <b>Arts</b>  |       |         |
| Select 3 credits   |       | 3       |
| <b>Humanities</b>  |       |         |
| Complete 12 credits of L&S courses with Humanities Breadth designation; no more than 6 credits from a single subject area. *                                 |       | 12      |
| <b>Social Sciences</b>   |       |         |
| Complete 12 credits of L&S Courses with Social Science Breadth designation; no more than 6 credits from a single curricular area. *                          |       | 12      |
| <b>Natural Sciences</b>  |       |         |
| Complete 12 credits of L&S Courses with Natural Sciences Breadth designation, including laboratory or field courses from three different curricular areas. * |       | 12      |
| <b>Cultural Diversity</b>  |       |         |
| 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 (<http://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 (<http://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 |
|-----------------|---------------------------------------|---------|
| <b>Required</b> |                                       |         |
| 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       |
| BIO SCI 529     | Molecular Biology of Microorganisms   | 3       |
| BIO SCI 540     | Microbial Diversity and Physiology    | 3       |

### 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 <sup>1</sup>              |  |
| HONORS 686  | Research in Honors <sup>1</sup>             |  |
| HONORS 687  | Senior Honors Project <sup>1</sup>          |  |
| HONORS 689  | Senior Honors Thesis <sup>1</sup>           |  |

### Microbiology Electives

|                            |  |   |
|----------------------------|--|---|
| BIO SCI 315<br>or CHEM 501 | Cell Biology<br>Introduction to Biochemistry | 3 |
|----------------------------|--|---|

Select one of the following: 2-4

|             |  |  |
|-------------|--|--|
| 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

|                  |  |  |
|------------------|--|--|
| <b>Option 1:</b> |  |  |
| 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) |  |

|                  |                                     |  |
|------------------|-------------------------------------|--|
| <b>Option 2:</b> |                                     |  |
| PHYSICS 209      | Physics I (Calculus Treatment)      |  |
| PHYSICS 210      | Physics II (Calculus Treatment)     |  |
| PHYSICS 215      | Lab Physics II (Calculus Treatment) |  |

|                  |   |  |
|------------------|---|--|
| <b>Option 3:</b> |   |  |
| PHYSICS 219      | Physics I: Calculus-Based, Studio Format  |  |
| PHYSICS 220      | Physics II: Calculus-Based, Studio Format |  |

Total Credits 61-67

<sup>1</sup> 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 535 | Bacterial Pathogenesis   | 3 |
| BIO SCI 539 | Laboratory Techniques in Molecular Biology (if not selected above) | 4 |
| 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 <sup>2</sup>                                  | 3 |
| BMS 535     | Medical Microbiology Laboratory <sup>2</sup>                       | 2 |
| BMS 539     | Public Health Microbiology <sup>2</sup>                            | 2 |
| BMS 540     | Public Health Microbiology Lab <sup>2</sup>                        | 2 |

<sup>1</sup> 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.

<sup>2</sup> 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

The College of Letters and Science provides general academic advising for all students with a major in the College, particularly as it relates to campus' general education requirements and the College's degree requirements. We also provide specialized advising for pre-professional students (pre-med, pre-dental, pre-pharmacy, etc.) regardless if their major is in Letters and Science or not. Prospective students, including high school students and students seeking to transfer to a program in Letters and Science may also receive advising from our admissions counselors.

Upon admission, students are assigned an advisor in the College advising office. Academic advising is available Monday through Friday from 8:30 a.m. to 4:30 p.m. by appointment. Appointments outside of these times may be available and phone appointments are available for online students. The advising office (<https://uwm.edu/letters-science/advising/contact-advising/>) is located on the first floor of Holton Hall. Current students should call (414) 229-4654 to schedule an appointment or use the Navigate website (<https://uwmilwaukee.campus.eab.com>) to make an appointment with your assigned advisor; online scheduling is only available if you already have a Letters & Science advisor assigned to you. Prospective students should call (414) 229-7711 or email [let-sci@uwm.edu](mailto:let-sci@uwm.edu).

When students declare a major, they will receive an additional faculty advisor located within the major department who will assist with requirements for that major. Students should read the "Declaration of Major" information on the website of the major that they are interested in. In some cases, the student will need to choose a faculty advisor as part of the declaration process.

All students are cautioned to consult their Letters & Science academic advisor AND their major advisor prior to each registration period to

ensure they understand all requirements. Do not rely on pre-printed sample plans, as they are intended to be samples only and may not be right for your particular situation.

## 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/) (<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.

## Honors in the 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 (<http://catalog.uwm.edu/opportunities-resources/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.

### **Contact Information**

Current Students contact the Department directly, [biosci@uwm.edu](mailto:biosci@uwm.edu)  
Prospective Students contact a Letters & Science Admissions Counselor at  
(414) 229-7711 or [let-sci@uwm.edu](mailto:let-sci@uwm.edu)

<https://uwm.edu/biology/undergraduate/major-in-microbiology/>