BIOLOGICAL SCIENCES, BA

Biology is the study of life. Biologists analyze organism functions at the cellular and molecular levels using genetics, biochemistry, and microscopy. They also study interactions between organisms and with the environment by examining behavior, morphology, physiology and genetics. Students can take a broad curriculum within Biological Sciences or focus on specific areas, such as ecology, evolution and behavior, cell and molecular biology, or microbiology. Studies in Biological Sciences have applications across many areas including agriculture, medicine, and the environment. Biological Sciences is a popular choice for students preparing for careers in healthcare, agriculture, natural resources and environmental sciences, food management, bioremediation, as well as the biomedical and biotechnology fields. A degree in Biological Sciences also prepares students for professional careers in medicine, dentistry, pharmacy, veterinary science, and education, and graduate studies in the life sciences.

Related Areas of Study
The Conservation and Environmental Science (http://catalog.uwm.edu/letters-science/conservation-environmental-science) major is an alternative, interdisciplinary program for students with specific interests in conservation or environmental science.

Requirements

Course of Study – Bachelor of Arts 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. 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 the requirements outlined in any catalog issued since the time they entered.

University General Education Requirements (GER)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Oral and Written Communication</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Part A</strong></td>
<td>Achieve a grade of C or better in the following course:</td>
<td></td>
</tr>
<tr>
<td>ENGLISH 102</td>
<td>College Writing and Research (or equivalent)</td>
<td></td>
</tr>
<tr>
<td><strong>Part B</strong></td>
<td>Course designated as QWC-B; may be completed through a major-specific course requirement</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Quantitative Literacy</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Part A</strong></td>
<td>Achieve a grade of C or better in one of the following:</td>
<td></td>
</tr>
<tr>
<td>MATH 102</td>
<td>Mathematical Literacy for College Students II</td>
<td></td>
</tr>
<tr>
<td>MATH 103</td>
<td>Contemporary Applications of Mathematics</td>
<td></td>
</tr>
<tr>
<td>MATH 105</td>
<td>Introduction to College Algebra</td>
<td></td>
</tr>
<tr>
<td>MATH 108</td>
<td>Algebraic Literacy II</td>
<td></td>
</tr>
<tr>
<td>MATH 111</td>
<td>Introduction to Logic - Critical Reasoning ¹</td>
<td></td>
</tr>
<tr>
<td>or PHILOS 111</td>
<td>Introduction to Logic - Critical Reasoning</td>
<td></td>
</tr>
<tr>
<td>MATH 116</td>
<td>College Algebra</td>
<td></td>
</tr>
<tr>
<td>Or equivalent course</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Part B
Course designated as QL-B; may be completed through a major-specific course requirement

Arts
Select 3 credits

Humanities
Select 6 credits

Social Sciences
Select 6 credits

Natural Sciences
Select 6 credits (at least two courses including one lab)

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) by 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, students must satisfy the following two requirements:

1. Achieve a Math Placement score of at least 30 or earn at least 3 credits with a grade of C or higher in one of the following courses or an equivalent course:
III. Foreign Language Requirement
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.

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/+); L&S students must complete the Breadth requirement.

* 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 of Letters and Science 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 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.

Biological Sciences Major Requirements
The Biological Sciences major requires the following:

- A minimum of 34 credits in Biological Sciences, of which 26 must be at the advanced (300 and above) level.
- At least 15 of the advanced credits must be taken in residence at UWM.
- Completion of four (4) laboratory courses
- A GPA of 2.0 in Biological Sciences courses attempted at UWM.
- A GPA of at least 2.0 in all major credits attempted, including any transfer work.

No more than eight (8) credits in 100-level courses in Biological Sciences may be applied toward the major, and students may not combine BIO SCI 150, BIO SCI 202, and BIO SCI 203 for more than 9 credits toward the major. A combined limit of 6 credits in BIO SCI 290, BIO SCI 489, BIO SCI 695, BIO SCI 697, BIO SCI 698, BIO SCI 699, HONORS 686, HONORS 687, and HONORS 689 counts toward the major.

Additional requirements for the major include the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 105</td>
<td>Introduction to College Algebra (or equivalent)</td>
<td>3</td>
</tr>
</tbody>
</table>

Physics Foundation

Select one of the following options: 9-10

Option 1:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 120</td>
<td>General Physics I (Non-Calculus Treatment)</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 122</td>
<td>General Physics II (Non-Calculus Treatment)</td>
<td></td>
</tr>
</tbody>
</table>

Option 2:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 209</td>
<td>Physics I (Calculus Treatment)</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 210</td>
<td>Physics II (Calculus Treatment)</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 214</td>
<td>Lab Physics I (Calculus Treatment)</td>
<td></td>
</tr>
</tbody>
</table>

Option 3:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 219</td>
<td>Physics I: Calculus-Based, Studio Format</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 220</td>
<td>Physics II: Calculus-Based, Studio Format</td>
<td></td>
</tr>
</tbody>
</table>

Chemistry Foundation

Part A:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 102</td>
<td>General Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 104</td>
<td>General Chemistry and Qualitative Analysis</td>
<td>5</td>
</tr>
</tbody>
</table>

Part B:

Select one of the following options: 5-8

Option 1:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 341</td>
<td>Introductory Survey of Organic Chemistry</td>
<td></td>
</tr>
<tr>
<td>CHEM 342</td>
<td>Introductory Organic Chemistry Laboratory</td>
<td></td>
</tr>
</tbody>
</table>

Option 2: ¹

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 343</td>
<td>Organic Chemistry</td>
<td></td>
</tr>
<tr>
<td>CHEM 344</td>
<td>Organic Chemistry Laboratory</td>
<td></td>
</tr>
<tr>
<td>CHEM 345</td>
<td>Organic Chemistry</td>
<td></td>
</tr>
</tbody>
</table>

¹ For students in the Cell and Molecular Biology (CMB) option, CHEM 343, CHEM 344, and CHEM 345 are required, and a second physics lab is strongly recommended.

Flexible Biological Sciences Option

Required Biological Sciences Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO SCI 150</td>
<td>Foundations of Biological Sciences I</td>
<td>4</td>
</tr>
<tr>
<td>BIO SCI 152</td>
<td>Foundations of Biological Sciences II</td>
<td>4</td>
</tr>
<tr>
<td>BIO SCI 325</td>
<td>Genetics</td>
<td>4</td>
</tr>
</tbody>
</table>

Select one of the following: 4-5

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO SCI 310</td>
<td>General Ecology</td>
<td></td>
</tr>
<tr>
<td>BIO SCI 315</td>
<td>Cell Biology</td>
<td></td>
</tr>
<tr>
<td>&amp; BIO SCI 316</td>
<td>and Laboratory in Genetics and Cell Biology</td>
<td></td>
</tr>
</tbody>
</table>

Research Requirement

Select one of the following: 1-6

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO SCI 611</td>
<td>Seminar on Recent Advances in Limnology and Oceanography</td>
<td></td>
</tr>
<tr>
<td>BIO SCI 670</td>
<td>Senior Seminar in Biological Sciences</td>
<td></td>
</tr>
<tr>
<td>BIO SCI 671</td>
<td>Undergraduate Seminar in Microbiology</td>
<td></td>
</tr>
</tbody>
</table>
BIO SCI 672  Undergraduate Seminar in Cell and Molecular Biology
HONORS 686  Research in Honors
HONORS 687  Senior Honors Project
HONORS 689  Senior Honors Thesis
BIO SCI 695  Independent Study in Freshwater Sciences for Biological Sciences Students
BIO SCI 697  Independent Study in Cell and Molecular Biology
BIO SCI 698  Independent Study in Microbiology
BIO SCI 699  Independent Study
Capstone option for Biological Sciences/CES double majors only:
CES 471  Practicum in Natural Resources Management

Laboratory Course Requirement
Select one of the following: 1-4
BIO SCI 202  Anatomy and Physiology I
BIO SCI 203  Anatomy and Physiology II
BIO SCI 358  Birds of Wisconsin
BIO SCI 372  Animal Physiology and Neurobiology Laboratory
BIO SCI 383  General Microbiology
BIO SCI 402  Immunological Techniques
BIO SCI 407  Plant Systematics and Evolution
BIO SCI 451  Field Methods in Conservation
BIO SCI 501  Plant and Aquatic Ecophysiology Laboratory
BIO SCI 537  Industrial Microbiology and Biochemistry Laboratory
BIO SCI 539  Laboratory Techniques in Molecular Biology
BIO SCI 543  Scanning Electron Microscopy Laboratory
BIO SCI 544  Transmission Electron Microscopy Laboratory
BIO SCI 580  Experimental Microbiology

Electives
Choose at least one U-only Cell and Molecular Biology course numbered between 350 and 399 3-4
Choose at least one U/G Cell and Molecular Biology course numbered 400 or above 3

Research Requirement
BIO SCI 672  Undergraduate Seminar in Cell and Molecular Biology 1-3
or BIO SCI 697  Independent Study in Cell and Molecular Biology

Additional Requirement
Select additional Cell and Molecular Biology courses to reach a total of at least 18 credits beyond the core courses and a total of at least 26 upper-division (numbered 300 and above) credits Total Credits 25-31

For a full listing of courses, please see the Schedule of Classes (http://uwm.edu/schedule).

Ecology, Evolution and Behavior Option

Required Biological Sciences Courses
BIO SCI 150  Foundations of Biological Sciences I 4
BIO SCI 152  Foundations of Biological Sciences II 4
BIO SCI 310  General Ecology 4
BIO SCI 325  Genetics 4
BIO SCI 465  Biostatistics 3

Laboratory Course Requirement
Select at least one of the following: 2-4
BIO SCI 358  Birds of Wisconsin
BIO SCI 383  General Microbiology
BIO SCI 407  Plant Systematics and Evolution
BIO SCI 451  Field Methods in Conservation
BIO SCI 501  Plant and Aquatic Ecophysiology Laboratory
BIO SCI 502  Introduction to Programming and Modeling in Ecology and Evolution
BIO SCI 539  Laboratory Techniques in Molecular Biology

Research Requirement
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 of 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 Student Success Collaborative 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.

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)).

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 695, 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 of Biological Sciences 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 Degree and Honors Degree with Thesis
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
Prospective Students contact a Letters & Science Admissions Counselor at
(414) 229-7711 or let-sci@uwm.edu
http://uwm.edu/biology/undergraduate/majors/