

# 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 other degree requirements.

### University General Education Requirements (GER)

Code	Title	Credits
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#### 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)	
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##### 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 <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
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#### Humanities

Select 6 credits	6
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#### Social Sciences

Select 6 credits	6
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#### Natural Sciences

Select 6 credits (at least two courses including one lab)	6
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#### 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) 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 placement code of at least 30 on the mathematics placement test (or other appropriate test, as determined by the Mathematical Sciences Department) or earn at least 3 credits with a grade of C or higher in one of the following courses or an equivalent course:

Code	Title	Credits
MATH 102	Mathematical Literacy for College Students II	3
MATH 103	Contemporary Applications of Mathematics	3
MATH 105	Introduction to College Algebra	3
MATH 108	Algebraic Literacy II	3
MATH 111	Introduction to Logic - Critical Reasoning <sup>1</sup>	3
or PHILOS 111	Introduction to Logic - Critical Reasoning	
MATH 116	College Algebra	3
MATH 175	Mathematical Explorations for Elementary Teachers I	3

<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.

**Note:** This requirement is the same as the University General Education Requirement for Quantitative Literacy Part A, listed above.

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 BA, 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

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.

Code	Title	Credits
Completed in one of the following ways:		
Successful completion of the 4th semester of college work or equivalent in one language other than English (including American Sign Language)		0-18
Successful completion of the 3rd semester of college work or equivalent in one language other than English (including American Sign Language) PLUS the 2nd semester of college work or equivalent in another language other than English (including American Sign Language)		

### 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:		
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		9
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 at least one laboratory or field course; no more than 6 credits from a single curricular area. *		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 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:

Code	Title	Credits
<b>Math Foundation</b>		
MATH 105	Introduction to College Algebra (or equivalent)	3
<b>Physics Foundation</b>		
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 121	General Physics Laboratory I (Non-Calculus Treatment) (at least one semester)
or PHYSICS 123	General Physics Laboratory II (Non-Calculus Treatment)

Option 2:

PHYSICS 209	Physics I (Calculus Treatment)
PHYSICS 210	Physics II (Calculus Treatment)
PHYSICS 214	Lab Physics I (Calculus Treatment) (at least one semester)
or 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

### Chemistry Foundation

Part A:

CHEM 102	General Chemistry	5
CHEM 104	General Chemistry and Qualitative Analysis	5

Part B:

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: <sup>1</sup>

CHEM 343	Organic Chemistry
CHEM 344	Organic Chemistry Laboratory
CHEM 345	Organic Chemistry

<sup>1</sup> 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.

Students who plan to attend graduate or professional schools are advised to take the one-year sequence of Organic Chemistry with lab, a course in Biochemistry (CHEM 501; also counts toward major), and two semesters of Calculus.

### Flexible Biological Sciences Option

Code	Title	Credits
<b>Required Biological Sciences Courses</b>		
BIO SCI 150	Foundations of Biological Sciences I	4
BIO SCI 152	Foundations of Biological Sciences II	4
BIO SCI 325	Genetics	4
Select at least one of the following:		4-5
BIO SCI 310	General Ecology	

BIO SCI 315 & BIO SCI 316	Cell Biology and Laboratory in Genetics and Cell Biology	
BIO SCI 383	General Microbiology	
<b>Research Requirement <sup>1</sup></b>		
Select one of the following:		1-6
BIO SCI 611	Seminar on Recent Advances in Limnology and Oceanography	
BIO SCI 670	Senior Seminar in Biological Sciences	
BIO SCI 671	Undergraduate Seminar in Microbiology	
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	
Research option for Biological Sciences/CES double majors only:		
CES 471	Practicum in Natural Resources Management	

**Laboratory Course Requirement**

A total of 4 labs courses are required for the major. This requirement may be satisfied by the courses listed above; if not, select additional lab courses from the list below. 1-4

BIO SCI 202	Anatomy and Physiology I	
BIO SCI 203	Anatomy and Physiology II	
BIO SCI 310	General Ecology (if not selected above)	
BIO SCI 316	Laboratory in Genetics and Cell Biology (if not selected above)	
BIO SCI 383	General Microbiology (if not selected above)	
BIO SCI 358	Birds of Wisconsin	
BIO SCI 372	Animal Physiology and Neurobiology Laboratory	
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 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**

Select electives to reach a minimum of 34 credits in Biological Sciences, of which 26 must be at the advanced (300 and above) level. <sup>2</sup> 16

Total Credits 34-43

<sup>1</sup> All courses taught as independent studies intended to fulfill the research requirement must have prior departmental approval.

<sup>2</sup> CHEM 501, CES 490, PSYCH 254, and PSYCH 654 may be used as electives.

**Cell and Molecular Biology Option**

Code	Title	Credits
<b>Core Courses</b>		
BIO SCI 150	Foundations of Biological Sciences I	4
BIO SCI 152	Foundations of Biological Sciences II	4
BIO SCI 315	Cell Biology	3
BIO SCI 316	Laboratory in Genetics and Cell Biology	2
BIO SCI 325	Genetics	4

**Laboratory Course Requirement**

Select at least one of the following: 1-4

BIO SCI 203	Anatomy and Physiology II	
BIO SCI 372	Animal Physiology and Neurobiology Laboratory	
BIO SCI 383	General Microbiology	
BIO SCI 402	Immunological Techniques	
BIO SCI 501	Plant and Aquatic Ecophysiology 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	

**Research Requirement <sup>1</sup>**

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

**Electives**

Select additional Cell and Molecular Biology courses to reach a minimum of 34 credits in Biological Sciences, of which 26 must be at the advanced (300 and above) level. 15

BIO SCI 335	Mammalian Reproductive Biology	
BIO SCI 356	Developmental Biology	
BIO SCI 370	Mammalian Physiology	
BIO SCI 401	Immunology	
BIO SCI 405	General Virology	
BIO SCI 455	Cellular, Molecular and Developmental Neurobiology	
BIO SCI 490	Molecular Genetics	
BIO SCI 498	Genetics of Development and Cancer	
BIO SCI 500	Plant Physiology	
BIO SCI 529	Molecular Biology of Microorganisms	
BIO SCI 535	Bacterial Pathogenesis	

BIO SCI 540	Microbial Diversity and Physiology
BIO SCI 542	Biological Electron Microscopy
BIO SCI 564	Endocrinology
BIO SCI 565	Gene Regulation in Stem Cells and Regeneration
BIO SCI 566	Cell Biology of Human Disease
BIO SCI 572	Functional Genomics
BIO SCI 573	Cellular Evolution
BIO SCI 596	Neuropharmacology
BIO SCI 597	RNA Structure, Function, and Metabolism
CHEM 501	Introduction to Biochemistry
<b>Total Credits</b>	<b>34-39</b>

<sup>1</sup> All courses taught as independent studies intended to fulfill the research requirement must have prior departmental approval.

## Ecology, Evolution and Behavior Option

Code	Title	Credits
<b>Required Biological Sciences Courses</b>		
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 <sup>1</sup>

Select one of the following	1-6
BIO SCI 611	Seminar on Recent Advances in Limnology and Oceanography
BIO SCI 670	Senior Seminar in Biological Sciences
BIO SCI 695	Independent Study in Freshwater Sciences for Biological Sciences Students
BIO SCI 699	Independent Study
CES 471	Practicum in Natural Resources Management
HONORS 686	Research in Honors
HONORS 687	Senior Honors Project
HONORS 689	Senior Honors Thesis

### Additional Electives

Select electives to reach a minimum of 34 credits in Biological Sciences, of which 26 must be at the advanced (300 and above) level.

BIO SCI 406	Marine Biology
BIO SCI 440	Ecology and Evolution of Amphibians and Reptiles
BIO SCI 458	Community Ecology
BIO SCI 469	Genomic Data Analysis
BIO SCI 480	Ecological Genetics
BIO SCI 500	Plant Physiology
BIO SCI 505	Conservation Biology
BIO SCI 507	Environmental Microbiology
BIO SCI 511	Ichthyology
BIO SCI 512	Limnology I
BIO SCI 532	Behavioral Ecology
BIO SCI 540	Microbial Diversity and Physiology
BIO SCI 562	Topics in Field Biology:
BIO SCI 573	Cellular Evolution
BIO SCI 575	Evolutionary Biology
CES 490	Senior Seminar: Conservation and Environmental Science
<b>Total Credits</b>	<b>34-41</b>

<sup>1</sup> All courses taught as independent studies intended to fulfill the research requirement must have prior departmental approval.

## 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/) (<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/) (<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 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 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)

<http://uwm.edu/biology/undergraduate/majors/>