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 (https://catalog.uwm.edu/letters-science/conservation-environmental-science/) major is an alternative, interdisciplinary program for students with specific interests in conservation or environmental science.

Course of Study – Bachelor of Arts Degree

Complete 120 credits including 75 credits in the College of Letters & Science and with 36 of the 75 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. The College also requires that students complete at least 30 credits overall in residence at UWM. For additional residency and transfer credit limitations, see L&S Undergraduate Policies and Regulations (https://catalog.uwm.edu/letters-science/#policiesandregulationstext).

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

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

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

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

For the Bachelor of Arts (B.A.), you must complete the UWM General Education Requirements as well as these L&S requirements: the International requirement, the Breadth requirement, and the Research requirement. The International requirement develops your potential for cross-cultural understanding in a globalizing world. The Breadth requirement ensures that you take classes in a wide variety of subjects, across humanities, natural sciences, and social sciences. The Research requirement calls for you to build your critical thinking and oral and

written communication skills through conducting an independent research project, usually in your major.

For the Bachelor of Arts (B.A.) you will also complete the Language other than English requirement, to further develop your understanding of cultures through language.

I. Total Credits and Upper-Division Courses Requirement

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

II. Language other than English Requirement

Students doing the BA must fulfill the language other than English requirement by either successfully completing the fourth semester of university work or equivalent in one language other than English, or by successfully completing the second semester of university work or equivalent in two languages other than English (including all world languages and American Sign Language).

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

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

III. International Requirement

To meet the International Requirement, students must successfully complete some three course (minimum 9 credits) combination of

1. language other than English (*not* including American Sign Language) at 3rd semester level or above, ***and/or***
2. non-language courses with L&S approved international content (see Courses Approved for the L&S International Requirement (https://catalog.uwm.edu/letters-science/approved-courses-international-requirement/) for course options).

IV. Breadth Requirement

In addition to completing the University General Education Requirements, L&S students must complete the Breadth requirement.

The L&S Breadth requirement calls for 6 credits each in L&S courses designated L&S Humanities, L&S Natural Sciences, and L&S Social Sciences breadth. One of the L&S Natural Science breadth courses must be a laboratory or fieldwork course. These courses must be beyond and in addition to courses in those areas used to satisfy General Education Requirements.

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

V. The Major

The College 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 (https://catalog.uwm.edu/letters-science/approved-courses-research-requirement/).

VI. The Minor

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

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 the following list count towards the major.

Code	Title	Credits
BIO SCI 290	Independent Study and Research:	
BIO SCI 489	Internship in Biological Sciences, Upper Division	
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	
HONORS 686	Research in Honors	
HONORS 687	Senior Honors Project	
HONORS 689	Senior Honors Thesis	

At least 20 credits at the advanced level (300 and above) must be taken in the BIO SCI courses.

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), and two semesters of Calculus. For those pursuing the General or Cell and Molecular Biology option, CHEM 501 will also count towards the major.

Listed below are the foundational requirements for the three options, followed by the Biological Sciences major requirements for the three options:

Code	Title	Credits
Math Foundation		
MATH 105	Introduction to College Algebra (or equivalent)	3
Physics Foundation		
For students choosing the General Biology Option or the Cell and Molecular Biology (CMB) Option, take these courses:		9-10
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)	
For students choosing the Ecology and Evolutionary Biology (EEB) Option, select at least one of the following options:		3-5
GEOG 120	Our Physical Environment	
GEO SCI 100	Introduction to the Earth	
GEO SCI 102	Evolution of the Earth	
GEO SCI 108	A History of Life	
GEO SCI 150	Introduction to Ocean Sciences	
PHYSICS 120 & PHYSICS 121	General Physics I (Non-Calculus Treatment) and General Physics Laboratory I (Non-Calculus Treatment)	
PHYSICS 122 & PHYSICS 123	General Physics II (Non-Calculus Treatment) and General Physics Laboratory II (Non-Calculus Treatment)	
Chemistry Foundation		
Part A:		
For all Biological Sciences majors		10
CHEM 102	General Chemistry	
CHEM 104	General Chemistry and Qualitative Analysis	
Part B (required for students choosing the General Biology Option or the Cell and Molecular Biology (CMB) Option): [1,2]		
Select one of the following options:		5-8
Option 1:		
CHEM 341	Introductory Survey of Organic Chemistry	
CHEM 342	Introductory Organic Chemistry Laboratory	
Option 2:		
CHEM 343	Organic Chemistry	
CHEM 344	Organic Chemistry Laboratory	
CHEM 345	Organic Chemistry	

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

2 For students choosing the Ecology and Evolutionary Biology (EEB) Option, there is no Organic Chemistry (Part B) requirement, though it is advised for certain subfields. Consultation with your departmental advisor is strongly recommended, particularly for students who plan to attend graduate or professional schools.

General Biology Option

Code	Title	Credits
Required Biological Sciences Courses		
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	
Research Requirement [1]		
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 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. [2, 3]	16
Total Credits	**34-43**

[1] All courses taught as independent studies intended to fulfill the research requirement must have prior departmental approval.

[2] Up to six credits from the following courses may be counted as electives in the major: CHEM 501, ANTHRO 301, BMS 534, BMS 535, PSYCH 254, and PSYCH 654.

[3] Students may elect to take these SFS courses (FRSHWTR 511, FRSHWTR 563, and FRSHWTR 567) to earn credit toward the Biology major.

Cell and Molecular Biology Option

Code	Title	Credits
Core Courses		
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 383	General Microbiology	
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 [1]		
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	
CHEM 501	Introduction to Biochemistry	
Total Credits		**34-39**

[1] 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
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 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	
BIO SCI 543	Scanning Electron Microscopy Laboratory	
BIO SCI 544	Transmission Electron Microscopy Laboratory	
Research Requirement [1]		
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.		12
BIO SCI 370	Mammalian Physiology	
BIO SCI 401	Immunology	
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 512	Limnology I	
BIO SCI 532	Behavioral Ecology	
BIO SCI 540	Microbial Diversity and Physiology	
BIO SCI 562	Topics in Field Biology:	
BIO SCI 575	Evolutionary Biology	
FRSHWTR 511	Ichthyology [2]	
Total Credits		**34-41**

[1] All courses taught as independent studies intended to fulfill the research requirement must have prior departmental approval.

[2] Students may elect to take SFS course FRSHWTR 511 to earn credit toward the EEB option.

Biological Sciences BA/BS Learning Outcomes

Students graduating from the Biological Sciences BA/BS Program will be able to:

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

Letters & Science Advising

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

College advisors are located in Holton Hall (or virtually for online students) and serve as your primary advisor. They are your point person for your questions about navigating college and completing your degree. College advisors will:

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

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

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

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

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

Department Advising

Students should contact an advisor (https://uwm.edu/biology/undergraduate/advising/) as soon as possible in their 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 (https://uwm.edu/biology/undergraduate/advising/) who will then guide the student in planning their course choices to accomplish their goals. Students should consult their College academic advisors in Holton Hall and their faculty advisors in the Department of Biological Sciences prior to each registration period.

Major or Minor Declaration

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

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

Honors in the Major

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

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

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.