

# Biology

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(Bachelor of Science)

Biology is one of UW-Green Bay's most popular academic programs. The curriculum explores living systems from subcellular organelles to ecosystems. Biology majors can customize their academic plans to emphasize cell and molecular biology, animal biology, or ecology and conservation science. These tracks prepare students for a wide variety of interdisciplinary careers in resource management, fisheries and wildlife biology, health sciences, genetics, microbiology, science communications (technical writing, journalism, and nature interpretation), and many other fields. About 40 percent of Biology graduates pursue advanced degrees in graduate or professional schools in medicine, dentistry, veterinary science, biological sciences, wildlife biology, or ecology and conservation biology. Students at UW-Green Bay also can combine a Biology degree with a program in primary or secondary school education.

Graduates of UW-Green Bay's Biology program are employed today in government agencies (U.S. Environmental Protection Agency, Food and Drug Administration, Fish and Wildlife Service, Forest Service, Bureau of Land Management, Department of Agriculture, Wisconsin Department of Natural Resources, local government agencies); hospitals and clinics, including veterinary hospitals and zoos; private corporations (pharmaceuticals, food processing, agriculture, etc.); environmental consulting firms; conservation organizations; and educational institutions ranging from elementary schools to universities.

Biology majors often combine their studies with a minor. Human Biology is commonly chosen as a minor by Biology majors with interests in pre-medicine, health sciences or exercise science. Students interested in ecology, biodiversity conservation, and management of biological resources such as wildlife, forests, and fisheries, typically combine a minor in Environmental Science. Other popular subjects for Biology majors include Business Administration and Environmental Policy and Planning.

Students who prefer a Biology minor (rather than a major) often choose majors in Environmental Science or Human Biology. Students who desire to become science teachers often combine the Biology major with the professional program in Education. Information about teacher certification requirements can be found at the UW-Green Bay Education Office (<http://www.uwgb.edu/education>).

UW-Green Bay's Biology program provides outstanding opportunities for students to gain practical experience. Many undergraduates work with faculty on field or laboratory research projects. Internships are widely available with private industry, public agencies, and non-profit organizations. These hands-on experiences are critical for developing a competitive resume for the job market or admission to graduate and professional schools.

The Biology program has well-equipped laboratories for coursework and faculty-guided research. In cellular and molecular biology laboratories, students become familiar with techniques of tissue culture, in situ hybridization, affinity chromatography, agarose and polyacrylamide gel, electrophoresis, polymerase chain reaction, and the use of monoclonal antibodies. In physiology laboratories, students learn techniques to study physiological functions. Teaching and research facilities available to ecology and conservation biology students include the Cofrin Center for Biodiversity, the 290-acre Cofrin Memorial Arboretum surrounding the UW-Green Bay campus, four off-campus natural areas managed by the University, the Richter Natural History Museum, small animal laboratory, the Gary A. Fewless Herbarium, a greenhouse, and state-of-the-art computer labs. Advanced undergraduates are able to participate in research projects on Great Lakes ecosystems, northern forests, agroecosystems, rivers, lakes, wetlands, and even tropical forests and mangroves.

Students in the Biology major develop basic skills such as statistical design and analysis, laboratory proficiency, and familiarity with major taxonomic groupings of plants, animals, and microorganisms. Many high paying occupations today require a college-educated individual who can write and speak well, solve problems using a scientific approach, learn new information quickly, and work well with others on a team. UW-Green Bay's Biology students acquire and apply these skills with excellence.

## Biology Program Mission Statement

*The Biology Program at the University of Wisconsin-Green Bay provides a quality educational curriculum in the study of life and living systems, from the molecular level to the ecosystem level. The disciplinary major and minor complement UW-Green Bay's interdisciplinary programs, especially those in Human Biology, Environmental Science, and the professional program in Education. The biology major prepares students for careers in ecology, organismal biology, physiology, genetics, cell and molecular biology, medicine and human health, veterinary science, wildlife management, education, agriculture, and science communication. Faculty and staff teach students to think critically and to solve complex problems scientifically by providing hands-on laboratory and field experiences as well as meaningful scientific research opportunities. The Biology Program contributes intellectual, cultural, and economic outreach activities and scientific research that enriches the quality of life for people in northeastern Wisconsin and elsewhere.*

## Biology Student Learning Outcomes

**Students in the Biology Program will:**

1. Describe the organization and diversity of life at levels of complexity from subcellular to ecosystem.
2. Demonstrate an understanding of genetic information, hereditary processes, and their relevance to evolutionary change as a product of mutation and natural selection
3. Explain the important processes and pathways that sustain living organisms including functional systems for exchange of energy and matter

4. Solve problems by applying a scientific process of inquiry, including the effective use of appropriate techniques, instrumentation, and data analysis
5. Identify and interpret findings of scientists and communicate results of scientific work to others in the scientific community and the general public

## Area of Emphasis

Students must complete requirements in one of the following areas of emphasis:

- Animal Biology (<http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/biology/major/animal-emphasis>)
  - Animal Biology (Accelerated) - Integrated with graduate Environmental Science & Policy program (<http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/biology/major/animal-emphasis-acc>)
- Biology for Educators (<http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/biology/major/educator-emphasis>)
- Cell/Molecular (<http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/biology/major/cell-emphasis>)
- Ecology and Conservation (<http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/biology/major/ecology-emphasis>)
  - Ecology and Conservation (Accelerated) - Integrated with graduate Environmental Science & Policy Program (<http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/biology/major/ecology-emphasis-acc>)
- Microbiology (<http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/biology/major/microbiology>)
- Pre-Veterinary (<http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/biology/major/pre-vet>)
- Biology Minor (<http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/biology/minor>)

The following are curriculum guides for a four-year Biology degree program and is subject to change without notice. Students should consult a Biology program advisor to ensure that they have the most accurate and up-to-date information available about a particular four-year degree option.

- Biology Major with Emphasis in Animal Biology Curriculum Guide Example (<http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/biology/cg/animal>)
- Biology Major with Emphasis in Ecology & Conservation Biology Curriculum Guide Example (<http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/biology/cg/ecology>)
- Biology Major with Emphasis in Cell/Molecular Biology Curriculum Guide Example (<http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/biology/cg/cell-molecular>)
- Biology Major with Emphasis in Biology for Educators Curriculum Guide Example (<http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/biology/cg/educ>)

**Chris Houghton**; Post-Doctoral Associate

**Rebecca Abler**; Professor; Ph.D., Virginia Polytechnic Institute and State University

**Mathew E Dornbush**; Professor; Ph.D., Iowa State University\*

**Michael L Draney**; Professor; Ph.D., University of Georgia\*

**Richard Hein**; Professor; Ph.D., University of Rhode Island

**Robert W Howe**; Professor; Ph.D., University of Wisconsin - Madison

**Amy T Wolf**; Professor; Ph.D., University of California - Davis, chair\*

**Patrick S Forsythe**; Associate Professor; Ph.D., Michigan State University\*

**Lisa Grubisha**; Associate Professor; Ph.D., University of California - Berkeley

**James C Marker**; Associate Professor; Ph.D., Brigham Young University\*

**Daniel J Meinhardt**; Associate Professor; Ph.D., University of Kansas\*

**Brian J Merkel**; Associate Professor; Ph.D., Virginia Commonwealth University

**Uwe Pott**; Associate Professor; Ph.D., University of Zurich (Switzerland)

**Carly Kibbe**; Assistant Professor; Ph.D., University of Wisconsin - Madison

**Paul R Mueller**; Assistant Professor; Ph.D., California Institute of Technology

**Renee Richer**; Assistant Professor; Ph.D., Harvard University

**Karen Stahlheber**; Assistant Professor; Ph.D., University of California - Santa Barbara

## Courses

### **BIOLOGY 198. First Year Seminar. 3 Credits.**

First Year Seminar, topics vary.  
Reserved for New Incoming Freshman  
Fall Even.

### **BIOLOGY 200. Principles of Biology Discussion: Cellular and Molecular Processes. 1 Credit.**

This discussion course is designed to supplement the concepts presented in BIOLOGY 201. Activities will focus on deeper exploration of the biology of organisms at the molecular and cellular level and will emphasize skills necessary for success in the introductory biology sequence.  
P: Concurrent enrollment in BIOLOGY 201  
Fall and Spring.

### **BIOLOGY 201. Principles of Biology: Cellular and Molecular Processes. 3 Credits.**

Study of biological principles, focusing on cellular structure and function, metabolism, genetics, evolution and development. This introductory course is intended for science majors.  
P: CHEM 207 or conc enr AND ACT Science Score of 24 or greater, OR grade of C or better in HUM BIO 102, OR grade of C or better in BIOLOGY 203 AND BIOLOGY 202 (or concurrent enrollment) or concurrent enrollment in BIOLOGY 200 and consent of instructor.  
Fall and Spring.

### **BIOLOGY 202. Principles of Biology Lab: Cellular and Molecular Processes. 1 Credit.**

This lab course offers an introduction to the biology of organisms at the molecular and cellular level. Labs will focus on the chemical, genetic, and microscopic properties shared by cells. This is a beginning biology course for students who wish to major in Biology, Human Biology or Environmental Science.  
P: CHEM 207 or conc enr AND ACT Science Score of 24 or greater, OR grade of C or better in HUM BIO 102, OR grade of C or better in BIOLOGY 203 & BIOLOGY 201 (or concurrent enrollment) or concurrent enrollment in BIOLOGY 200 and consent of instructor.  
Fall and Spring.

### **BIOLOGY 203. Principles of Biology: Organisms, Ecology, and Evolution. 3 Credits.**

Survey of the evolution and diversity of life, with focus on general biological principles, anatomy and physiology, and consideration of interactions from the cellular to organismal level.  
P: Biology 204 or concurrent enrollment.  
Fall and Spring.

### **BIOLOGY 204. Principles of Biology Lab: Organisms, Ecology, and Evolution. 1 Credit.**

Hands-on laboratory reinforcing material covered in Biology 203. Laboratory activities explore the structure of seed plants, comparative morphology of animal phyla, dichotomous taxonomic keys, phylogeny, and experimental approaches to plant and animal physiology. This writing emphasis course covers the process and techniques of scientific writing.  
P: BIOLOGY 203 or concurrent enrollment.  
Fall and Spring.

### **BIOLOGY 298. Independent Study. 1-4 Credits.**

Independent study is offered on an individual basis at the student's request and consists of a program of learning activities planned in consultation with a faculty member. A student wishing to study or conduct research in an area not represented in available scheduled courses should develop a preliminary proposal and seek the sponsorship of a faculty member. The student's advisor can direct him or her to instructors with appropriate interests. A written report or equivalent is required for evaluation, and a short title describing the program must be sent early in the semester to the registrar for entry on the student's transcript. Course is repeatable for credit.  
P: fr or so st with cum gpa > or = 2.50; or jr or sr st with cum gpa > or = 2.00.  
Fall and Spring.

### **BIOLOGY 299. Travel Course. 1-6 Credits.**

Travel courses are conducted to various parts of the world and are led by one or more faculty members. May be repeated to different locations.  
P: cons of instr & prior trip arr & financial deposit.

### **BIOLOGY 302. Principles of Microbiology. 4 Credits.**

Microorganisms and their activities; their form, structure, reproduction, physiology, metabolism, and identification; their distribution in nature and their relationship to each other and other living things.  
P: Biology 201/202 with at least a C grade AND Chem 207 or concurrent enrollment  
Fall and Spring.

### **BIOLOGY 303. Genetics. 3 Credits.**

Mechanisms of heredity and variation, their cytological and molecular basis and their implications in biological technology.  
P: Biology 201/202 with at least a C grade; Chem 108 or 212 with at least a C grade; Math 260 with at least a C grade;  
Fall and Spring.

**BIOLOGY 304. Genetics Laboratory. 1 Credit.**

Basic techniques of genetic research; laboratory investigation and analysis of animal, plant, and human patterns of inheritance.

P: Biology 303 with at least a C grade AND Chem 207 or concurrent enrollment

Fall Only.

**BIOLOGY 307. Cell Biology. 3 Credits.**

A study of the fundamental biological processes that occur within a cell and its normal environment. Topics include cellular molecules and metabolic processes; membranes and organelles; synthesis and regulation of macromolecules; protein sorting and transport, cytoskeleton; signal transduction, cellular interactions, cell cycle and growth of normal and neoplastic cells.

P: Biology 201 with at least a C grade; AND Chem 108 or 212 with at least a C grade; AND Biology 303 or Hum Biol 310

Fall and Spring.

**BIOLOGY 308. Cell Biology Laboratory. 1 Credit.**

A laboratory course examining the microscopic, biochemical and molecular approaches used to investigate cellular structure and function.

P: Biology 202 with at least a C grade; AND Chem 108 or 212 with at least a C grade; AND MATH 260 with at least a C grade; AND Biology 307 with at least a C grade or conc enr; AND Chem 207 or conc enr

Fall and Spring.

**BIOLOGY 309. Evolutionary Biology. 3 Credits.**

Patterns and processes of biological evolution and their significance for modern biology. Topics include the history of life, population genetics, speciation, and evolution in populations today.

P: Biology 201/202 with at least a C grade and either Biology 203 or Human Biology 204 with at least a C grade.

Fall and Spring.

**BIOLOGY 310. Plant Biodiversity. 4 Credits.**

An introduction to the diversity of vascular plants, with an emphasis on flowering plants. Lectures cover both organismal and phylogenetic/evolutionary perspectives on plant systematics, including the use of genetic and genomic data for understanding plant evolution. The laboratory presents a survey of vascular plant diversity, covering structural characteristics of major plant families and the identification of seed plants of Wisconsin to the species level.

P: Biology 201/202 with at least a C grade and Biology 203/204 with at least a C grade, or transfer cse Biology 003.

Spring Even.

**BIOLOGY 311. Plant Physiology. 4 Credits.**

General physiology of vascular plants within the context of a plant life cycle: seed dormancy and germination, metabolism, transport systems, mineral nutrition, patterns of plant growth and development, growth regulators, reproduction and senescence.

P: Biology 201/202 with at least a C grade and Biology 203 with at least a C grade, or transfer cse Biology 003; and Chem 212.

Fall Only.

**BIOLOGY 312. Mycology. 4 Credits.**

Broad taxonomic survey of fungi. Morphology, reproduction, physiology, genetics, evolution, and ecology. Role in nutrient cycling, plant disease, human welfare and biotechnology. Techniques in collection, identification, pure culture isolation, and nucleic acid applications.

P: Biology 201/202 with at least a C grade or transfer cse Biology 003.

Fall Odd.

**BIOLOGY 317. Structure of Seed Plants. 3 Credits.**

Anatomy of seed plants, with special emphasis upon tissue differentiation and structure.

P: Biology 201/202 with at least a C grade and Biology 203 with at least a C grade, or transfer cse Biology 003.

Fall Even.

**BIOLOGY 320. Field Botany. 4 Credits.**

Identification and natural history of plants indigenous to the Great Lakes region. Students will become proficient at using keys to identify unknown plants to the species level, be able to identify at sight the woody plants of northeastern Wisconsin, be able to recognize major plant communities of Wisconsin, and gain an understanding of basic organismal botany. An all-day field trip during one weekend day in mid-September is required.

P: Biology 201/202 with at least a C grade and Biology 203/204 with at least a C grade, or transfer course Biology 003.

Fall Even.

**BIOLOGY 322. Environmental Microbiology. 4 Credits.**

This course will focus on the diversity and role of microorganisms in diverse and complex environments, including the use and management of these organisms for the benefit of ecosystems and society.

P: Biology 201/202 with at least a C AND Chem 207 or conc enr

Spring.

**BIOLOGY 340. Comparative Anatomy of Vertebrates. 4 Credits.**

A lecture and laboratory course examining the anatomy of organs and organ systems of the vertebrates with emphasis on adaptations. Specimens primarily studied in the lab are the shark and cat.

P: Biology 201/202 with at least a C grade and Biology 203/204 with at least a C grade; OR transfer cse Biology 002; AND Env Sci 207 or conc enr or Hum Biol 207 or conc enr.

Fall Only.

**BIOLOGY 341. Ichthyology. 4 Credits.**

An examination of the biology of fishes including classification, phylogeny, functional morphology and population characteristics. Aspects of the ecology of the fishes will be studied in relation to behavior, distribution, diversity and production in freshwater environments.

P: Env Sci 302

Spring Even.

**BIOLOGY 342. Ornithology. 4 Credits.**

Overview of avian biology, emphasizing adaptation and ecology. Identification of North American bird species and other avian families. Region's most interesting birding areas.

P: Biology 201/202 with at least a C grade and Biology 203/204 with at least a C grade, or transfer cse Biology 002.

Spring Even.

**BIOLOGY 343. Mammalogy. 4 Credits.**

Comprehensive study of mammals, including systematics, anatomy, physiology, behavior, and ecology. Laboratory studies include work with specimens from the Richter Natural History Museum.

P: Biology 201/202 with at least a C grade and Biology 203/204 with at least a C grade

Spring Odd.

**BIOLOGY 345. Animal Behavior. 3 Credits.**

Biology of animal behavior patterns; behavioral interactions of animals with their environment.

P: Biology 201/202 with at least a C grade.

Spring Even.

**BIOLOGY 346. Comparative Physiology. 3 Credits.**

Ways in which dissimilar organisms perform similar functions. Behavioral, physiological, and biochemical solutions to problems imposed on invertebrate and vertebrate animals by their environment.

P: Biology 201/202 with at least a C grade and Biology 203/204 with at least a C grade and Chem 212; OR transfer cse Biology 002 and Chem 212.

Spring.

**BIOLOGY 355. Entomology. 4 Credits.**

Structure, function, diversity, and ecology of insects, as well as their impact on human society. Lab develops ability to identify Wisconsin insects, both in the field and by examining microscopic anatomy.

P: Biology 201/202 with at least a C grade and Biology 203/204 with at least a C grade, or transfer cse Biology 002; REC: Biology 353.

Fall Odd.

**BIOLOGY 357. Marine Biology. 4 Credits.**

The Ocean covers about 71% of the Earth's surface and so is obviously a huge part of the functioning biosphere. Life emerged in the Ocean but since we are terrestrial beings, Ocean life remains less well known than terrestrial life. This course serves as an overview of marine biodiversity and marine ecosystems in which the concepts learned in general biology courses can be applied to marine life. We will cover the abiotic functioning of the Ocean in order to understand the unique challenges that marine organisms face, and we will focus on an understanding of the diverse array of marine organisms, how they interact ecologically, and how humans are affecting marine ecosystems worldwide.

Fall Even.

**BIOLOGY 401. Fish and Wildlife Population Dynamics. 4 Credits.**

The course will introduce students to principles of population ecology and how such principles relate to basic models of wildlife and fish population dynamics. This course will also give students practical experience manipulating population dynamics models using computer applications.

P: BIOLOGY 203. REC: ENV SCI 302

Spring Odd.

**BIOLOGY 402. Advanced Microbiology. 4 Credits.**

Study of viruses, bacteria, and viruses in relationship to their environment.

P: Biology 302 with at least a C grade; Math 260 with at least a C grade; AND Chem 207 or conc enr

Fall Only.

**BIOLOGY 407. Molecular Biology. 3 Credits.**

Molecular approaches to biological problems, emphasizing study of informational macro molecules. Topics include replication, control, expression, organization, and manipulation of genes; RNA processing; protein processing; transposons; oncogenes, growth factors; genetic control of development and the immune system.

P: Biology 303 with at least a C grade or Chem 330 with at least a C grade; REC: Chem 300 or 303.

Spring Odd.

**BIOLOGY 408. Molecular Biology Laboratory. 1 Credit.**

Molecular biology of nucleic acids and the techniques that form the basis of biotechnology. Topics include electrophoresis, restriction mapping, hybridization, plasmid analysis, and DNA cloning (recombinant DNA library construction, screening, and mapping).

P: Biology 407 or conc enr; and Chem 207 or conc enr

Spring Odd.

**BIOLOGY 410. Developmental Biology. 3 Credits.**

This course covers both the classical experiments that contributed to our understanding of developmental biology and the recent explosion of information about development made possible by a combination of genetic, cellular, and molecular approaches. Examples from vertebrate and invertebrate systems will be used to illustrate underlying principles and concepts. Topics include axis formation, induction, morphogenesis, embryonic pattern formation, cell differentiation, and organogenesis.

P: Biology 303 or 307 or Hum Biol 310 with at least a C grade.

Spring.

**BIOLOGY 411. Developmental Biology Laboratory. 1 Credit.**

Laboratory will introduce descriptive and experimental embryological techniques using a variety of model organisms.

P: Biology 410 with at least a C grade or concurrent enrollment; AND Env Sci 207 or conc enr or Hum Biol 207 or conc enr.

Spring.

**BIOLOGY 449. Wetland Ecology. 3 Credits.**

This course explores the ecology and conservation of wetlands, including biological, physical, chemical and hydrological attributes of wetland ecosystems. The curriculum will survey major wetland types in both freshwater and marine environments, the general biogeochemical dynamics of wetland ecosystems, and the ecological diversity of wetland vegetation and fauna. Field trips and in-class exercises will provide training in the identification of wetland types and features, including biological and physical characteristics of wetlands in the western Great Lakes. A field project will focus on wetland delineation and assessment of wetland quality, including analysis of restoration methods and conservation management.

P: ENV SCI 302

Spring.

**BIOLOGY 478. Honors in the Major. 3 Credits.**

Honors in the Major is designed to recognize student excellence within interdisciplinary and disciplinary academic programs.

P: min 3.50 all cses req for major and min gpa 3.75 all UL cses req for major.

Fall and Spring.

**BIOLOGY 490. Biology Seminar. 1 Credit.**

This course provides an interdisciplinary capstone experience for upper-level students majoring in biology. Class activities introduce students to academic and professional infrastructures, career opportunities, and major conceptual issues in the biological sciences, including the socioeconomic impacts of new advances in biology. During a significant part of the course, students will read and discuss current articles from the primary scientific literature. Teams of students will lead class discussions about cutting-edge discoveries and new concepts conveyed in the selected articles. Presentations will fulfill the communication objective for a capstone experience in the UW-Green Bay General Education curriculum. The class discussions will address the interdisciplinary implications of new biology discoveries and their relevance to current socioeconomic problems. Course is repeatable for credit; may be taken 3 times for a total of 3 credits.

P: Biology major with jr st

Fall and Spring.

**BIOLOGY 495. Research in Biology. 1-5 Credits.**

Work closely with a faculty member to plan, perform, evaluate, and report on laboratory research in biology or related area. Course is repeatable for credit; may be taken 10 times for a total of 10 credits.

P: Chem 207 and approval by faculty mentor

Fall and Spring.

**BIOLOGY 497. Internship. 1-12 Credits.**

Supervised practical experience in an organization or activity appropriate to a student's career and educational interests. Internships are supervised by faculty members and require periodic student/faculty meetings. Course is repeatable for credit.

P: jr st.

Fall and Spring.

**BIOLOGY 498. Independent Study. 1-4 Credits.**

Independent study is offered on an individual basis at the student's request and consists of a program of learning activities planned in consultation with a faculty member. A student wishing to study or conduct research in an area not represented in available scheduled courses should develop a preliminary proposal and seek the sponsorship of a faculty member. The student's advisor can direct him or her to instructors with appropriate interests. A written report or equivalent is required for evaluation, and a short title describing the program must be sent early in the semester to the registrar for entry on the student's transcript. Course is repeatable for credit.

P: fr or so st with cum gpa > or = 2.50; or jr or sr st with cum gpa > or = 2.00.

Fall and Spring.

**BIOLOGY 499. Travel Course. 1-6 Credits.**

Travel courses are conducted to various parts of the world and are led by one or more faculty members. May be repeated to different locations.

P: cons of instr & prior trip arr & financial deposit.