

# BIOLOGY (BIOL)

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## **BIOL 1100 The Mississippi River – 4 credits**

In this introductory science course, students will learn principles of environmental science and gain an understanding of complex systems by examining multiple disciplines (chemistry, geology, biology, ecology, etc). The Upper Mississippi River System and the Mississippi River Gorge will be utilized as a unique, local resource throughout the course as students explore the complex interactions within this ecosystem. The lecture and lab are fully online. This course has no prerequisites. Offered in the College for Women and the College for Adults.

## **BIOL 1110 Environmental Biology with Lab – 4 credits**

A study of the nature of scientific inquiry and basic biological, chemical, ecological and earth science principles in the context of environmental issues. Areas of study may include biodiversity, global climate change, acid rain, agriculture and the environment, air and water pollution, and the role of economics, politics and ethics in environmental concerns. Three hours of class and two hours of laboratory per week. Designed for non-majors and the STEM minor. Offered annually. Offered in the College for Women and the College for Adults.

## **BIOL 1120 Biology of Women with Lab – 4 credits**

A study of the nature of scientific inquiry and basic biological principles in the context of issues relevant to women. Areas of study include reproductive anatomy and physiology, the cardiovascular system, genetics and sexual differentiation, women and cancer, sexually transmitted diseases, pregnancy, infertility, contraception, menopause, women and exercise, women and nutrition, and women and aging. Three hours of class and two hours of laboratory per week. Designed for non-majors. Also offered as WOST 1120. Offered in the College for Women and the College for Adults.

## **BIOL 1710 Foundations of Biology: Diversity and Evolution with Lab – 4 credits**

This course is the first in a three-semester sequence of introductory biology courses. It is required of all biology majors and designed for students majoring in the sciences as well as those preparing for graduate school in the sciences or professional programs such as medicine, physical therapy, dentistry, veterinary medicine, or psychology. Topics include: the nature of science and how scientific methods are used to address questions; how evolution has resulted in the unity and diversity of living organisms and how and why scientists classify organisms into taxonomic groups; and the diversity of living organisms using the theme of how organisms reproduce to ensure the continuity of life from generation to generation. Class meets three hours per week and involves lecture, discussion and case studies. Laboratory involves investigative semester-long scientific research projects conducted by teams of students and meets for three hours each week with additional time as needed. Offered fall semester. Offered in the College for Women.

**Prerequisite:** NONE.

## **BIOL 1720 Foundations of Biology: Cell and Molecular Biology with Lab – 4 credits**

This course is the second in a three-semester sequence of introductory biology courses. It is required of all biology majors and designed for students majoring in the sciences as well as those preparing for graduate school in the sciences or professional programs such as medicine, physical therapy, dentistry, veterinary medicine, or psychology. BIOL 1720 is an introduction to biology from the perspective of cells—how molecules interact to organize the structure and function of cells and how the resulting specialization of cells produces functional organs and well-regulated organisms. The concepts will be constructed through analysis of biological processes such as cellular respiration, photosynthesis, signal transduction, plant protective mechanisms, basic inheritance of traits, and plasticity of organisms within environments, epigenetics, gene expression, and regulatory mechanisms. Broad questions and scenarios will highlight various aspects of biology, including medicine, evolutionary paths/adaptations, environmental connections, and structure-function relationships. Students will become proficient in a variety of cellular, molecular and physiological techniques and will learn how and when to apply them to answer biological questions. Class meets three hours a week for an exploration of biological concepts and three hours a week for laboratory experiences. Offered in the College for Women.

## **BIOL 2200 Introduction to Microbiology with Lab – 4 credits**

Study of microorganisms with special reference to those that cause disease. Topics include microbial structure, physiology, growth, genetics, mechanisms of pathogenicity, host defenses, and bacterial, viral, protozoan and fungal diseases of organ systems. Three hours of class and two hours of laboratory per week. Intended for majors in health professions and foods and nutrition. Does not fulfill the requirements for the biology major. Offered fall semester, spring semester and during the summer. Offered in the College for Women and College for Adults.

## **BIOL 2400 General Anatomy and Physiology with Lab – 4 credits**

The content of this course includes the basic anatomy and physiology of the body. After a preliminary introduction to such areas as terminology, overview of the body, the chemical basis of life, and morphology of cells and tissue, the larger interactions between structures and functions of the different body systems are summarized and integrated. Students will then apply this knowledge to critical questions. There is a laboratory requirement for the course. This course serves as an essential link to the University's healthcare and human-service programs. Offered in the College for Adults.

## **BIOL 2410 Advanced Anatomy and Physiology with Lab – 4 credits**

This course is designed to enable students to gain a comprehensive, correlated knowledge of the anatomical structures and physiological mechanisms of the human body. The course provides an organizational framework of unifying principles and concepts together with factual data presented in a way that facilitates application to subsequent pathophysiological and clinical courses. The course format includes both lecture and discussion. Students will learn anatomical and physiological concepts through structured collaborative learning exercises, including the analysis of case studies. There is a laboratory requirement for this course. Offered in the College for Adults.

**Prerequisite:** BIOL 2400.

**BIOL 2420 Human Disease – 2 credits**

This course introduces the fundamental concepts of disease. Students will study a range of infectious, chronic and genetic diseases; students will learn the etiology of these diseases, their clinical manifestations, principles of treatment and prevention where applicable. Offered in the College for Adults.

**Prerequisite with concurrency:** BIOL 2400.

**BIOL 2610 Human Anatomy and Physiology I with Lab – 4 credits**

This course covers the core principles of human anatomy and physiology, as well as the specific anatomical structure and physiologic function of the cell, tissues, integumentary system, skeletal system, joints, muscular system, central and peripheral nervous systems, and the ear and eye. This course does not fulfill the requirements for the biology major. Three lecture hours and two laboratory hours per week, with additional time for lab practicals. The course is offered fall semester and during first summer session. Offered in the College for Women and the College for Adults.

**BIOL 2620 Human Anatomy and Physiology II with Lab – 4 credits**

This course covers the core principles of human anatomy and physiology, as well as the specific anatomical structure and physiologic function of the autonomic system, endocrine system, cardiovascular system, lymphatic system, respiratory system, digestive system, urinary system, and reproductive system. This course does not fulfill the requirements for the biology major. Three lecture hours and two laboratory hours per week, with additional time for lab practicals. The course is offered spring semester and during second summer session. Offered in the College for Women and the College for Adults.

**Prerequisites:** BIOL 2610 and at least sophomore standing.

**BIOL 2650 Understanding Medical Research: Drugs, Devices and Complementary Therapies – 4 credits**

This course deals with the basics of clinical research and how the efficacy and effectiveness of drugs, devices and other medical therapies are tested. The course also includes a section on drug physiology and reviews the specific physiology underlying representative clinical trials. Students should be able to critically evaluate clinical trial literature at the end of the course. Not recommended for majors. Hybrid. One three-hour lecture session every other week. Does not meet core lab science requirement. Offered in the College for Women and the College for Adults.

**BIOL 2684 Directed Study – 4 credits****BIOL 2710 Introduction to Ecology with Lab – 4 credits**

This is the third course in a foundational sequence for biology majors and is intended to familiarize students with concepts in the modern sciences of ecology, evolution and behavioral biology, providing a solid foundation in the genetics, evolution and dynamics of populations, behavioral ecology, the ecology of interacting species and communities, element cycling and ecosystem dynamics. Experimental design and quantitative analysis are key components of both class and lab. Class meets three hours per week and involves lecture, discussion and case studies. Laboratory involves investigative field research projects conducted by teams of students and meets for three hours each week with additional time as needed. Offered fall semester. Liberal Arts Distribution Requirement: Although this is a lab science course, it does not meet the core liberal arts and sciences laboratory science requirement. Offered in the College for Women.

**Prerequisites with concurrency:** BIOL 1710 and BIOL 1720 (C- or better).

**BIOL 2720 Sophomore Seminar – 2 credits**

Sophomore Seminar is required of all biology majors. Each section of the course will focus on a current topic, and students will learn the biology necessary to understand it, read articles to evaluate evidence for multiple perspectives on the issue, and discuss the social context of the problem. Students will read and discuss primary literature, learn to process and synthesize information, build an argument based on evidence, and write a scientific review paper. Students will also hone oral presentation skills. This course and BIOL 4850 together constitute the Writing Intensive Course in the Biology Major. The course will emphasize the process of writing in a formal scientific style as well as the quality of the final product. Informal writing will be used as a learning tool to reflect on concepts and respond to issues. Class meets twice per week. Offered spring semester. Offered in the College for Women.

**Prerequisites with concurrency:** BIOL 1710 and BIOL 1720 (C- or better).

**BIOL 2810 Genetics with Lab – 4 credits**

A study of the transmission of genetic information between generations of organisms, and of the mechanisms of expression of information within an individual organism. The main emphasis will be on the molecular basis of heredity, mutational and functional analysis of the genetic material, gene regulation, and genome structure and variation. Course topics studied in depth will vary from semester to semester. Prerequisite(s): Grade of C- or above in BIOL 1720.

**BIOL 3050 Algal Ecology in a Modern World – 4 credits**

Study of the interrelationships between organisms and their environment within the framework of the various levels of ecology: organismal (including physiological and behavioral ecology), population, community and ecosystem ecology. Course topics studied in depth will vary from semester to semester. Laboratory involves investigative field research projects conducted by teams. Three class and three laboratory hours per week, with additional time for field trips. A course in statistics is recommended. Offered fall semester in alternate years.

**Prerequisite:** BIOL 2720.

**BIOL 3100 Plant Biology with Lab – 4 credits**

A study of plants in which all representatives of the kingdom are included with special emphasis on flowering plants. Such areas as physiology, morphology, reproduction, life cycles and ecological implications are covered in depth. Three class and three laboratory hours per week. Offered fall semester in alternate years with BIOL 3450. Offered in the College for Women.

**Prerequisite:** BIOL 1720.

**BIOL 3120 Human and Comparative Vertebrate Anatomy with Lab – 4 credits**

Using humans as model vertebrates, this course explores fundamental themes in vertebrate anatomy (development, evolution, adaptation, structure-function relationships) in an integrative and comparative context. Classroom lecture is combined with cooperative analysis of standard vertebrate organ systems (3 hours per week). Laboratory time (3 hours per week) provides dissection experience with a variety of representative vertebrates – including human, amphibian, shark, and lamprey. Offered every third semester.

**Prerequisites:** BIOL 1720, BIOL 2710.

**Prerequisite with concurrency:** BIOL 2720. Offered in the College for Women.

**BIOL 3140 Human and Comparative Animal Physiology with Lab – 4 credits**

Using humans as model vertebrates, this course explores fundamental themes in physiology (homeostasis, structure-function relationships, consequences of scale, feedback systems) in an integrative and comparative evolutionary context. Students learn through case-based work in teams and individual competencies (3 hours per week). Laboratory time (3 hours per week) provides hands-on, experimental engagement with organismal level physiological questions. Offered every third semester.

**Prerequisite:** BIOL 1720.

**Prerequisite with concurrency:** BIOL 2710.

**BIOL 3210 Biology of Microorganisms with Lab – 4 credits**

A study of microbial diversity, structure, physiology, growth and control of growth, with particular emphasis on bacteria, fungi and viruses. Topics include genetics, biotechnology, pathogenicity, microbial diseases and host responses. Microbiological concepts and laboratory techniques are integrated in a hands-on, interactive approach to learning. Two three-hour sessions per week. Offered in alternate years in spring semester.

**Prerequisite:** BIOL 2710.

**Prerequisite with concurrency:** BIOL 2720.

**BIOL 3222 Cell Biology – 2 credits**

Using a seminar format, this course will explore the structure and function of plant, animal and bacterial cells, cellular organelles and compartmentalization, properties of cell membranes, signal transduction, intracellular processing and transport of macromolecules, intercellular junctions, cytoskeleton, extracellular matrix, cell cycle and control of cell division. Course topics studied in depth will vary from semester to semester. Two class sessions per week. Offered in the College for Women.

**Prerequisites:** Satisfactory completion of BIOL 1720 or CHEM 4400 and two CHEM courses (C- or better).

**BIOL 3224 Cell Biology with Lab – 4 credits**

Study of the structure and function of plant, animal and bacterial cells, cellular organelles and compartmentalization, properties of cell membranes, signal transduction, intracellular processing and transport of macromolecules, intercellular junctions, cytoskeleton, extracellular matrix, cell cycle and control of cell division. Course topics studied in depth will vary from semester to semester. Three class and three laboratory hours per week.

**Prerequisites:** Satisfactory completion of BIOL 1720 or CHEM 4400 and two CHEM courses (C- or better).

**BIOL 3250 Histology with Lab – 4 credits**

Microscopic anatomy of vertebrate tissues and organs with emphasis on humans. Includes discussions on tissue function and histogenesis. Laboratory includes processing tissue samples for examination as well as a microscopic survey of tissues in organ systems. Three class and three laboratory hours per week. Offered alternate years. Offered in the College for Women.

**Prerequisite:** BIOL 2710.

**Prerequisite with concurrency:** BIOL 2720.

**BIOL 3260 Developmental Biology – 4 credits**

An analysis of animal development (including humans) from fertilization to the establishment of the adult body form and beyond. Lectures and discussions will examine the molecular and cellular mechanisms that control key processes of animal embryogenesis. Molecular and cellular processes that are examined include differential gene expression, cell signaling, and cell differentiation through the lens of embryogenesis, gametogenesis, fertilization, morphogenesis, axis specification, and gastrulation. Primary literature analysis will further explore the molecular processes of selected developmental events beyond embryogenesis. Possible topics include organogenesis, sex determination and differentiation, aging, disease, wound repair and regeneration, and evolutionary developmental biology. Prerequisite(s): BIOL 1720 and BIOL 2810.

**BIOL 3300 Evolutionary Biology with Lab – 4 credits**

A study of the patterns and processes of evolution. Major topics include evolutionary history, variation in natural populations, mechanisms of evolution (population and quantitative genetics) and adaptation. Laboratory work may include experimental analysis of mechanisms of evolution, interpretation of evolutionary patterns found in the fossil record and experimental study of molecular evolution. Three class and three laboratory hours per week. Offered spring semester. Offered in the College for Women.

**Prerequisite:** BIOL 2710.

**BIOL 3340 Reproductive Science and Medicine with Lab – 4 credits**

A course in molecular reproductive biology designed for biology majors who have completed at least their first semester of sophomore biology major courses. This course is designed to provide students with a comprehensive understanding of the field of reproductive biology. The course will cover the physiology of the male and female reproductive systems, the process of fertilization, embryonic development, and the biology of reproduction. Additionally, the course will address the common disorders affecting male and female reproductive health, and the medical and surgical interventions used to treat these conditions. Through lectures, discussions, and case studies, students will gain an understanding of the ethical and social issues related to reproductive science and medicine, such as assisted reproductive technologies, contraception, and family planning. The course will also explore the impact of genetics on reproductive health and disease, as well as the role of environmental factors. Prerequisite(s): BIOL 1720 and BIOL 2810 or BIOL 2610 and BIOL 2620.

**BIOL 3502 Contemporary Biology – 2 credits**

A seminar-style course in contemporary biology designed for biology majors who have completed at least their first semester of sophomore biology major courses. The subject matter of this course is announced in the annual schedule of classes. Content varies from year to year but does not duplicate existing courses. Course may be discussion or lab focused. Offered in the College for Women.

**Prerequisites:** BIOL 1710, BIOL 1720, BIOL 2710.

**Prerequisite with concurrency:** BIOL 2720.

**BIOL 3504 Contemporary Biology with Lab – 4 credits**

A course in contemporary biology designed for biology majors who have completed at least their first semester of sophomore biology major courses. The subject matter of this course is announced in the annual schedule of classes. Content varies from year to year but does not duplicate existing courses.

**Prerequisites:** BIOL 1710, BIOL 1720, BIOL 2710 with a minimum grade of C-.

**Prerequisite with concurrency:** BIOL 2720.

**BIOL 3820 Biology of Longevity and Aging – 4 credits**

The Biology of Longevity and Aging course is designed to expand students' understanding of, and appreciation for, the complexity and integrative nature of "geroscience" – the most impactful and exciting frontier in biological and clinical science. This course embraces an interventional lens, emphasizes the differences between lifespan and healthspan, and highlights the impact health disparities and societal inequities have on individuals' biological experiences of aging. Students are introduced to the Hallmarks of Aging Framework, and other longevity paradigms, and discuss interventional targets of age-related biological dysfunction including: genomic instability, telomere attrition, epigenetic alterations, loss of proteostasis, disabled macroautophagy, deregulated nutrient sensing, mitochondrial dysfunction, cellular senescence, stem cell exhaustion, altered intercellular communication, chronic inflammation, and dysbiosis. Importantly, this course explores innovative technologies, interventions, and pharmacological strategies that aim to improve both healthspan and lifespan. Students work closely with the instructor and with peers to hone their graphical representation and interpretation skills by searching, discussing, and synthesizing the primary literature in this fast-growing field. This course counts towards the Longevity and Aging minor and the Biology major.

**Prerequisites:** BIOL 1710 & BIOL 1720 or BIOL 2610 & BIOL 2620 & CHEM 1110 Prerequisite(s) with concurrency.

**BIOL 3850 Biopsychology with Lab – 4 credits**

The study of biological mechanisms underlying behavior. Examines the anatomy, physiology and pharmacology of the nervous system in relation to sensation, movement and cognition. Three hours of lecture and three hours of laboratory (including independent student research) each week. Also offered as PSYC 3850. Offered in alternate years. Offered in the College for Women.

**Prerequisite:** BIOL 1720.

**Prerequisite with concurrency:** a course in statistics.

**BIOL 3994 Topics – 4 credits****BIOL 4220 Immunology with Lab – 4 credits**

Problem-based learning about the cells and tissues of the immune system and how they interact to generate an immune response. Topics include antibody structure and function, nature of antigens, innate immunity, humoral and cellular immunity, immunological responses to transplantation and tumors, immunopathology, immunodeficiencies, hypersensitivity and immunological technologies. Techniques discussed and applied to research questions in the laboratory include Western blotting, ELISA, agglutination assays, immunofluorescence, immunohistochemistry, and flow cytometry. Three class and three laboratory hours per week.

**BIOL 4354 Molecular Biology with Lab – 4 credits**

Problem-based learning about cell structure and function at a molecular level. Topics will vary from semester to semester, focusing on cutting-edge topics in structural and functional genomics, transcriptomics, protein conformation and functional domains, post-translational modification of proteins, proteomics, and molecular applications in medicine and forensics. Molecular techniques including Western blotting, PCR, DNA sequencing, bioinformatics, and protein purification will be applied to research questions. Three class and three laboratory hours per week. Offered in the College for Women.

**Prerequisites:** Satisfactory completion of BIOL 1720 or CHEM 4400 and two CHEM courses (C- or better).

**BIOL 4400 Medical Mycology and Disease Ecology with Lab – 4 credits**

Study of fungi with special reference to fungi that cause disease in addition to fungi that are of ecological, industrial and economic interest. Topics include fungal structure, physiology, and growth; fungal genetics; fungal interactions with other organisms including mechanisms of pathogenicity; fungal ecology; and fungal evolution. Three hours of class and 3 hours of laboratory per week. Intended for biology and related majors. Offered spring semesters in odd years. **PRE-REQUISITES:** Satisfactory completion of BIOL 1710 and BIOL 1720 and one upper-level biology course (C or better) or instructor permission.

**BIOL 4504 Advanced Contemporary Biology with Lab – 4 credits**

An advanced course in contemporary biology designed for biology majors in their junior or senior year. This course will deepen students' understanding of a current issue in biology and will develop leadership and independence. The subject matter of this course is announced in the annual schedule of classes. Content varies from year to year but does not duplicate existing courses. Offered in the College for Women.

**Prerequisites:** BIOL 1710, BIOL 1720, BIOL 2710, BIOL 2720, one 3000 level biology course.

**BIOL 4600 Internship – 0 credits****BIOL 4602 Internship – 2 credits**

Structured out-of-class learning experience that takes place on or off campus and includes a substantial work component. An internship involves students in a particular profession in an exploratory way to test career interests and potential. To initiate an internship experience, students need to meet with the internship coordinator in the Career Development Office and then with their faculty advisor. It is highly recommended that students complete the internship prior to January of their senior year.

**Prerequisites:** Instructor and department chair permission.

**BIOL 4604 Internship – 4 credits**

Structured out-of-class learning experience that takes place on or off campus and includes a substantial work component. An internship involves students in a particular profession in an exploratory way to test career interests and potential. To initiate an internship experience, students need to meet with the internship director in the Career Development Office and then with their faculty advisor. It is highly recommended that students complete the internship prior to January of their senior year.

**Prerequisites:** Instructor and department chair permission.

**BIOL 4682 Directed Study – 2 credits****BIOL 4684 Directed Study – 4 credits**

Directed study is provided for students whose unusual circumstances prohibit taking a regularly scheduled course but who need the material of that course to satisfy a requirement. Availability of this faculty-directed learning experience depends on faculty time and may be limited in any given term and restricted to certain courses.

**Prerequisites:** Faculty, department chair and dean approval.

**BIOL 4850W Senior Seminar – 2 credits**

A capstone course designed to refine students' ability to access and critically read scientific literature, hone abilities in scientific writing through informal assignments and preparation of a research proposal based on extensive review of the literature, and further develop oral presentation skills. Topics vary but encompass areas of current biological research. Offered fall semester, spring semester and during the summer. Offered in the College for Women.

**Prerequisites:** Senior standing, two BIOL courses at the 3000 level, and permission of instructor.

**BIOL 4860W Senior Seminar – 4 credits**

A capstone course designed to refine students' ability to access and critically read scientific literature, hone abilities in scientific writing through informal assignments and preparation of a research proposal based on extensive review of the literature, and further develop oral presentation skills. Topics vary but encompass areas of current biological research. Offered fall semester, spring semester and during the summer. Offered in the College for Women.

**Prerequisite:** Senior standing, two BIOL courses at the 3000 level, and permission of instructor.

**BIOL 4912 Research – 2 credits**

Research-based learning experience designed in collaboration with a faculty member.

**Prerequisites:** Faculty and department chair approval.

**BIOL 4913 Research – 3 credits****BIOL 4914 Research – 4 credits**

Research-based learning experience designed in collaboration with a faculty member.

**Prerequisites:** Faculty and department chair approval.

**BIOL 4952 Independent Study – 2 credits**

Independent study offers students the opportunity for specialized research not covered in a course offering, by the action project or thesis. Students work with a faculty advisor to develop a learning contract, which specifies the content and objectives of the study as well as the requirements and procedures for evaluation. The amount of credit earned for the study also is included in the learning contract.

**Prerequisites:** Permission of the faculty and department chair or program director.

**BIOL 4954 Independent Study – 4 credits**

Independent study offers students the opportunity for specialized research not covered in a course offering, by the action project or thesis. Students work with a faculty advisor to develop a learning contract, which specifies the content and objectives of the study as well as the requirements and procedures for evaluation. The amount of credit earned for the study also is included in the learning contract.

**Prerequisites:** Permission of the faculty and department chair or program director.

**BIOL 4994 Topics – 4 credits**

The subject matter of the course is announced in the annual schedule of classes. Content varies from year to year but does not duplicate existing courses.

**Prerequisites:** BIOL 1710, BIOL 1720.