Biology - Course Descriptions

**BIO 101 Essential Biology 4R-OL-4C F,W,S**
**Prerequisites:** There are no prerequisites for this course.
**Corequisites:** There are no corequisites for this course.
Surveys basic concepts in the biological sciences and describes how new advances related to these concepts affect contemporary society. Students who have completed BIO110, BIO120 or BIO130 cannot receive credit for taking BIO101.

**BIO 102 Nutrition 4R-0L-4C W**
**Prerequisites:** There are no prerequisites for this course.
**Corequisites:** There are no corequisites for this course.
This course surveys essential concepts in the nutritional sciences, including food composition, diet construction and analysis, physiological processes, and special nutritional needs for certain groups. This course counts as a free elective for BIO or BE majors and not as an BIO elective.

**BIO 110 Cell Structure and Function 3R-3L-4C F,S**
**Prerequisites:** There are no prerequisites for this course.
**Corequisites:** There are no corequisites for this course.
Introduces structures, mechanisms, and laboratory techniques in cellular and molecular biology. Discusses biomolecules, bioenergetics, biosynthesis, enzymatic function, genetics, and cellular regulatory systems.

**BIO 120 Comparative Anatomy & Physiology 3R-3L-4C W**
**Prerequisites:** There are no prerequisites for this course.
**Corequisites:** There are no corequisites for this course.
The structural and functional relationships between tissues and organ systems are discussed using a comparative approach. The lecture is combined with laboratory exercises and observations, which may require dissection of biological specimens.

**BIO 130 Evolution and Diversity 3R-3L-4C S**
**Prerequisites:** There are no prerequisites for this course.
**Corequisites:** There are no corequisites for this course.
Introduces fundamental principles, important applications, and field and laboratory techniques in organismal biology. Discusses mechanisms of evolution, the history of life on earth, biological diversity, and ecology.

**BIO 191 Special Topics in Biology XR-0L-XC**
**Prerequisites:** Arranged prerequisite by consent of instructor
**Corequisites:** There are no corequisites for this course.
Introduces structures, mechanisms, and laboratory techniques in cellular and molecular biology. Discusses biomolecules, bioenergetics, biosynthesis, enzymatic function, genetics, and cellular regulatory systems.

**BIO 205 Cellular Physiology 4R-0L-4C F**
Prerequisites: BIO 110 F,S
Corequisites: There are no corequisites for this course.
The flow of information in biological systems provides a framework for detailed discussion of cell structure and function, with particular attention paid to the physiology of excitable cells. Cellular communication and the interactions of cells in tissues and the immune system are also examined. Reproduction and organismal development will also be addressed at the cellular level. A student who earns credit for BIO205 cannot earn credit for BIO210 or BIO230 without departmental consent.

**BIO 210 Mendelian & Molecular Genetics 3R-3L-4C F**
Prerequisites: BIO 110 F,S or instructor consent
Corequisites: There are no corequisites for this course.
A discussion of Mendelian genetics including the molecular mechanisms of nuclear and cytoplasmic inheritance. Information flow and control of gene expression are addressed at the molecular level. Basic genetic techniques are covered in both lecture and laboratory.

**BIO 220 Microbiology 3R-3L-4C W**
Prerequisites: BIO 110 F,S or instructor consent.
Corequisites: There are no corequisites for this course.
Discusses the essential properties of eubacteria and archa. Bacterial nutrition, growth, genetics and structural and metabolic diversity are discussed in detail. The basics of virology are also addressed. Fundamental laboratory methodologies are also covered.

**BIO 230 Cell Biology 3R-3L-4C S**
Prerequisites: BIO 110 F,S or instructor consent
Corequisites: There are no corequisites for this course.
Examines the structure and function of various eukaryotic cells. Biomembranes, organelles, the cytoskeleton, energetics, protein sorting, signal transduction and cell interactions are discussed in detail. Essential methods in cell biology are addressed in both lectures and laboratories.

**BIO 310 Plant Structure & Function 3R-3L-4C S**
Prerequisites: BIO 130 S or instructor consent.
Corequisites: There are no corequisites for this course.
Surveys the structure, physiology, diversity, evolution, and ecological importance of plants and related groups of organisms.

**BIO 320 Ecology 3R-3L-4C F**
Prerequisites: BIO 130 S or instructor consent
Corequisites: There are no corequisites for this course.
Surveys adaptations of organisms, population dynamics, species interactions, and the structure and function of natural communities and ecosystems.

**BIO 330 Evolutionary Biology 4R-0L-4C W**
Prerequisites: BIO 130 S or instructor consent
Corequisites: There are no corequisites for this course.
Surveys three major themes of evolutionary biology: adaptation, diversity of life, and the shared characteristics of life. Mechanisms of evolution, speciation, phylogeny, and macroevolutionary processes are discussed.

**BIO 340 Introduction to Biomedical Research: Clinical Methodology 1R-1L-1C**
**Prerequisites:** BIO 120 W and Jr/Sr standing or consent of instructor.

**Corequisites:** There are no corequisites for this course.

Designed to introduce biology/bioengineering students to the basics of biomedical research using the clinical methodology typical of patient sample analysis. Students will learn to relate testing procedures with specific diseases and to use data obtained from laboratory testing to understand more about specific patient health problems.

**BIO 350 Principles of Synthetic Biology 2R-0L-2C W**

**Prerequisites:** There are no prerequisites for this course.

**Corequisites:** There are no corequisites for this course.

Open to all majors. This course covers the biological foundations of synthetic biology. It is directed at understanding how biological information is stored and processed, and how it is expressed as biological function. Particular attention will be paid to how the expression of this information is regulated and how cells can be engineered to solve contemporary problems in health, energy, manufacturing and sustainability.

**BIO 351 Synthetic Biology Design 2R-0L-2C S**

**Prerequisites:** BIO 350 W

**Corequisites:** There are no corequisites for this course.

Open to all majors. This course focuses on the design of novel biological parts, devices and systems, and their use in engineering cell function. Bioengineering principles and the design of genetic logic circuits, memory modules, biosensors and other cellular devices will be addressed. For the final project, students will design a novel biological system that meets the standards and goals of the International Genetically Engineered Machine Competition.

**BIO 352 Synthetic Biology Laboratory 4C (studio format, 4 days x 3 hrs) Su1**

**Prerequisites:** Instructor Consent

**Corequisites:** There are no corequisites for this course.

Open to all majors. This project-based studio laboratory course focuses on the fundamental laboratory techniques employed in the synthetic biology laboratory. Relevant background and theory will be discussed and applied in the hands-on learning of core laboratory techniques. In practice, students will build and test novel genetic devices designed to advance the current International Genetically Engineered Machine Competition (iGEM) Team project. Significant contribution to the project will earn students membership on the Rose-Hulman iGEM team and attribution in iGEM competition materials.

**BIO 399 Practice of Science 4R-0L-4C**

**Prerequisites:** BIO 330 W, and MA 223 F,W,S or consent of instructor

**Corequisites:** There are no corequisites for this course.

This course focuses on skills required for implementing scientific research, including reading the primary literature, experimental design, scientific writing, oral presentations, research proposal writing, poster presentations, and investigation of research programs (through seminars or individual meetings). Each student chooses a project and research mentor by the end of the course.

**BIO 410 Infection and Immunity 4R-0L-4C Arranged**

**Prerequisites:** BIO 110 F,S or instructor consent

**Corequisites:** There are no corequisites for this course.
Discussion of various pathogens, how they cause disease, and how they elicit the innate and adaptive immune responses employed to combat them. Cellular and molecular mechanisms of immunity are addressed, as is the epidemiology of various human diseases.

**BIO 411 Genetic Engineering 4R-0L-4C Assigned**

**Prerequisites:** BIO 205 F or BIO 210 F or consent of instructor  
**Corequisites:** There are no corequisites for this course.  
Discusses the basics of molecular biology and the genetic and molecular techniques used to engineer prokaryotic and eukaryotic cells, plants, and animals for the production of useful traits or compounds. The application of DNA technology to the diagnosis and treatment of disease is also addressed.

**BIO 421 Applied Microbiology 4R-0L-4C Assigned**

**Prerequisites:** BIO 110 F,S *Arranged prerequisite or instructor consent  
**Corequisites:** There are no corequisites for this course.  
Discusses the fundamental biology of microprobes and the processes underlying their use in the production of chemicals, therapeutics and foods. The basics of microbial ecology and the environmental applications of microbial biotechnology are also discussed.

**BIO 431 Genomics and Proteomics 4R-0L-4C S**

**Prerequisites:** BIO 205 F or BIO 210 F or consent of instructor  
**Corequisites:** There are no corequisites for this course.  
Exploration of the methodologies used to generate systems-level sets of genetic and protein data, and the tools used to access and analyze the prodigious amounts of data emerging from such projects. The application of these technologies to investigate biological questions and model complex biological systems is also discussed.

**BIO 441 Virology 3R-3L-4C**

**Prerequisites:** BIO 110 F,S or instructor consent  
**Corequisites:** There are no corequisites for this course.  
Virology focuses on the study of viruses as well as non-viral entities such as prions and viroids. In this course, students will learn about the structures, genomes, replication strategies, and pathogenic mechanisms of various viruses. Viruses causing diseases of medical and economic importance will be emphasized. In addition, the techniques used to study viruses and the uses of viruses in the treatment of disease will be addressed.

**BIO 451 Cancer Biology 4R-0L-4C**

**Prerequisites:** BIO 205 F or BIO 210 F or consent of instructor  
**Corequisites:** There are no corequisites for this course.  
This course focuses on cancer at the molecular and cellular level. Specific cellular molecules and the changes to these cellular molecules that contribute to transformational and immortalization of cells and tumor progression will be studied. The mechanisms behind these molecular changes, cancer promotion and initiation events, and cancer molecule-specific treatment options will be addressed. In addition, students will study a variety of specific cancer types.

**BIO 461 Evolutionary Medicine 4R-0L-4C Arranged**

**Prerequisites:** BIO 130 S*, and BIO 205 F* or BIO 210 F* *Arranged prerequisite or instructor consent.  
**Corequisites:** There are no corequisites for this course.
This course examines medicine and medical practice from the perspective of evolutionary constraints, challenges, and diversity. Topics include theoretical foundations of the field, cancer patterns, mental health, genetic disease, evolutionary health promotion, and others.

**BIO 471 Genetic & Molecular Analysis of Inherited Human Disease 4R-0L-4C S**

**Prerequisites:** BIO 205 F* or BIO 210 F* *Arranged prerequisite or consent of instructor

**Corequisites:** There are no corequisites for this course. Strategies and methods used to identify and understand the genetic and molecular bases of inherited human disease are addressed. Topics include, human population genetics, pedigrees, genetic and physical mapping of human genes, linkage analysis, and diagnostic testing. Primary literature is routinely utilized.

**BIO 491 Special Topics in Biology XR-0L-XC**

**Prerequisites:** Arranged prerequisite or instructor consent

**Corequisites:** There are no corequisites for this course. Covers upper level material of mutual interest to student and instructor which cannot be acquired in any other listed BIO course.

**BIO 492 Directed Study in Biology XR-XL-XC**

**Prerequisites:** Arranged prerequisite or instructor consent

**Corequisites:** There are no corequisites for this course. Covers biology material of mutual interest to the student and instructor which cannot be experienced in any other listed BIO course. A student may take between 1-4 credits in any given term, and a maximum of 8 credits of this course are permitted. Prior approval of the BBE department is required to use this course to fulfill BIO elective credit requirements.

**BIO 496 Senior Thesis Research I 0R-6L-2C F,W,S**

**Prerequisites:** BIO 399 F and consent of instructor

**Corequisites:** There are no corequisites for this course. Initiation of senior thesis under the direction of an BBE faculty mentor. Major tasks include creation and submission of a research proposal and piloting procedures. Additional requirements for adequate progress determined by each faculty mentor.

**BIO 497 Senior Thesis Research II 0R-12L-4C F,W,S**

**Prerequisites:** BIO 399 F and consent of instructor

**Corequisites:** There are no corequisites for this course. Continuation of research under the direction of an BBE faculty mentor. Major tasks include data acquisition and methodological refinement. Additional requirements for adequate progress determined by each faculty mentor.

**BIO 498 Senior Thesis Research III 0R-12L-4C F,W,S**

**Prerequisites:** BIO 399 F and consent of instructor

**Corequisites:** There are no corequisites for this course. Continuation of research under the direction of an BBE faculty mentor. Major tasks include data acquisition and preliminary analysis. Additional requirements for adequate progress determined by each faculty mentor.

**BIO 499 Senior Thesis Research IV 0R-6L-2C W**

**Prerequisites:** BIO 399 F and consent of instructor
Corequisites: There are no corequisites for this course. Completion of senior thesis under the direction of an BBE faculty mentor. Major tasks include final analysis, public presentation of results, and submission of the written thesis. Additional requirements for adequate progress determined by each faculty mentor.

**BIO CPT Curricular Practical Training 1R-0L-1C**

Prerequisites: Consent of department head

Corequisites: There are no corequisites for this course. Any international student with an F-1 Visa employed by any company in the form of an internship, co-op, or practicum must enroll in a CPT course. The CPT experience is to be complimentary training to the student's curriculum and should contribute substantially to his/her learning experience. Students must have an offer of employment from a company prior to registering for this course. The CPT must be approved by the Department Head, Director of International Student Services, and the student's advisor. Students are required to submit a report at the conclusion of the employment to his/her instructor to receive a grade for the CPT experience.

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