

Course Outline for: BIOL 1501 Principles of Biology 1**A. Course Description:**

1. Number of credits: 5
2. Lecture hours per week: 4
Lab hours per week: 3
3. Prerequisites:
MATH 1080 OR
MATH1090 OR
MATH 700 (C- or better, valid for 2 years) OR
High School GPA of 2.80+ and passed Algebra II or a higher-level math course OR
ACT Math Sub-Score of 22+ OR
ACT Math Sub-Score of 20+ and High School GPA of 2.70+ OR
SAT Math Composite score of 530+ OR
SAT Math Composite score of 520-529 and High School GPA of 2.70+ OR
Accuplacer Advance Algebra score of 250+ OR
Accuplacer Advance Algebra score of 236-249 and High School GPA of 2.70+ OR
MCA Algebra score of 1158+ OR
MCA Algebra score of 1152-1157 and High School GPA of 2.70+;
AND
ENGC 0960 (C- or better) OR
READ 0960 (C- or better) OR
High School GPA of 2.60+ OR
ACT Sub-Score of 21+ OR
ACT Sub-Score of 19+ and High School GPA of 2.50+ OR
SAT Read/Write score of 480+ OR
SAT Read/Write score of 440+ and High School GPA of 2.50+ OR
Accuplacer Reading score of 250+ OR
Accuplacer Reading score of 236+ and High School GPA of 2.50+ OR
MCA Reading score of 1047+ OR
MCA Reading score of 1042-1046 and High School GPA of 2.50+
4. Corequisites: None
5. MnTC Goal: #3 Natural Sciences

This course is designed for students majoring in biology and other science related fields, including the health professions. Students will explore major biological processes occurring at the cellular level, with emphasis on cell structure and function, metabolism, reproduction, development, genetics and gene expression, and evolution. Students will engage in techniques appropriate to the study of biological processes and gain experience in experimental design, data analysis and interpretation, and the communication of results. Lecture 3 credits, 3-hour lab 1 credit.

B. Date last reviewed/updated: January 2023

C. Outline of Major Content Areas:

Lecture: Subtopics listed under each main topic may vary due to recent developments in the field and current events.

1. Introduction
 - a. The scientific process, the nature of biological inquiry, and data analysis and interpretation
 - b. Hypotheses, predictions, and scientific theories
 - c. Evolution and natural selection
 - d. Unity and diversity of life
 - e. Systematics – taxonomy, classification, phylogeny
 - f. Organic molecules
 - g. Microscopy
2. Cells and Membranes
 - a. Origins of life
 - b. Structure and function of prokaryotic and eukaryotic cells
 - c. Structure and function of biological membranes
 - d. Passive and active membrane transport mechanisms
 - e. Endosymbiotic theory of the origin of eukaryotic cells
3. Energy Relationships
 - a. Characteristics of metabolic reactions
 - b. Structure and function of enzymes
 - c. Structure and function of adenosine triphosphate (ATP)
 - d. Electron transport chains/systems
 - e. Photosynthesis
 - f. Aerobic and anaerobic cellular respiration
4. Cell Division
 - a. Mechanisms of cell division
 - b. Eukaryotic cell cycle
 - c. Mitosis
 - d. Meiosis
5. Genetics
 - a. Principles of Mendelian genetics
 - b. The chromosomal basis of inheritance
 - c. X-linked recessive inheritance
 - d. Human inheritance
 - e. Overview of molecular genetics
 - f. Structure and function of deoxyribonucleic acid (DNA)
 - g. DNA replication
 - h. Transcription
 - i. Translation
 - j. Genetic code
 - k. Recombinant DNA technology
 - l. Genetic engineering

- m. Polymerase chain reaction
- 6. Reproduction and Development
 - a. Viral replication
 - b. Life cycles
 - c. Growth and development of angiosperms, both monocots and eudicots
- 7. Biology specific skills
 - a. Metric measurements
 - b. Graphing data
 - c. Statistical analysis of biological data
 - d. Discerning reliable web resources
 - e. Familiarization with the variety of scientific publications (primary research article, review article, essay, note, etc.)
 - f. Searching the biological literature
 - g. References and citations in science (Council of Science Editors, CSE format)
 - h. A beginner's approach to reading primary literature

Laboratory: Students will actively participate in individual and collaborative lab exercises designed to stimulate thoughtful engagement in studies related to:

- 1. Microscopy
 - a. Compound light microscope
 - b. Stereo dissecting microscope
- 2. Scientific inquiry
 - a. Formulating hypotheses and predictions
 - b. Conducting experiments and collecting data
 - c. Searching scientific literature
 - d. Evaluating quantitative data
 - e. Compiling and reporting results in oral, written, and graphic forms
- 3. Biology of the cell
 - a. Eukaryotic & prokaryotic cells
 - b. Membranes & transport
 - c. Sampling, culturing, and identifying microbes
- 4. Bioenergetics
 - a. Enzymes: biological catalysts
 - b. Respiration
 - c. Photosynthesis
 - d. Spectrophotometry
 - e. Chromatography
- 5. Cellular reproduction
 - a. Cell cycle
 - b. Mitosis
- 6. Genetics
 - a. Mendelian genetics
 - b. Gel electrophoresis
 - c. DNA fingerprinting
 - d. PCR

D. Course Learning Outcomes:

Upon successful completion of the course, the student will be able to:

1. Understand and apply knowledge of biochemistry, general cell structure and physiology, metabolism, genetics, and evolution. (Goal 2a, 3a)
2. Recall, explain, and apply concepts, knowledge, and vocabulary of biology at the level necessary for success in a second semester general biology course for science majors. (Goal 2a, 3a)
3. Demonstrate understanding of scientific theories in biology. (Goal 3a)
4. Demonstrate quantitative reasoning skills at a level appropriate for second semester science majors. (Goal 2a, 3b)
5. Distinguish between primary and secondary scientific literature. (Goal 2a, 3a)
6. Formulate and test hypotheses by performing laboratory experiments in biology that include the collection of data, statistical analysis, graphical presentation of results, and interpretation of sources of error and uncertainty. (Goal 2a, 2b, 2c, 2d, 3b)
7. Communicate experimental findings both orally and in writing. (Goal 3c)
8. Understand and apply knowledge of the use of the microscope and other biological instruments and apply that knowledge in the proper conduct and interpretation of laboratory investigations. (Goal 2a, 2b, 2c, 2d, 3a, 3b)
9. Describe current biological issues and research and evaluate societal issues in a biological context. (Goal 2a, 2b, 2c, 2d, 3a, 3d)

E. Methods for Assessing Student Learning:

A variety of evaluation and assessment methods may be used:

1. Written examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer, and critical thinking questions)
2. Quizzes
3. Practical lab quizzes
4. Written assignments
5. Laboratory reports
6. A final comprehensive exam

F. Special Information:

Instructors will include the most recent version of the Departmental Expectations document in their course syllabus.

When offered on-campus, the laboratory portion of the course is delivered in the Biology Learning Center (BLC). Instructors will include the most recent version of the Biology Learning Center (BLC) Expectations document in their course syllabus.

Laboratory procedures may require the handling, treatment, manipulation, and killing of living organisms including but not limited to plants, insects, and microscopic organisms; there are no exceptions or alternate activities.