

Department: BIOL

Course No: 107

Credits: 4

Title: Principles of Biology

Contact: Randall Walikonis

Content Area: Grp 3 Science and Technology

Catalog Copy: BIOL 107, 108. Principles of Biology. Either semester. May be taken in either order. Four credits. Three class periods and one 3-hour laboratory period. Students may not receive more than 12 credits for courses in biology at the 100's level. A course in high school level chemistry or concurrent enrollment in CHEM 127 are recommended for students enrolling in 107. A course designed to provide a foundation for more advanced courses in Biology and related sciences. Topics covered include molecular and cell biology, animal anatomy and physiology (BIOL 107); ecology and evolution, genetics, and plant biology (BIOL 108). Laboratory exercises in BIOL 107 include dissection of preserved animals.

Course Information: BIOL 107 is a comprehensive, rigorous survey course for majors in the biological sciences and related fields and provides a general introduction to concepts and principles of cell biology and animal physiology and anatomy. While designed for majors, the course will also provide non-majors with a broad introduction to the biochemistry and molecular biology of the cell, animal physiology, and vertebrate anatomy. The course goals are to provide critical skills and background information necessary for advanced study in the biological sciences and related fields, to provide students with a varied and in-depth laboratory experience in content areas closely tied to lectures, and to improve scientific writing skills.

The course requires that students average passing grades on two to three in-class hour exams and one final. These exams are usually multiple choice. For most instructors, reading assignments (approximately 1-2 Chapters per week of the text book) are treated as supplementary to the lecture material. The laboratory component comprises between 25 and 33% of the final grade, depending on the instructor, and is evaluated on the basis of quizzes, written problem sets and exercises and rigorously evaluated lab reports. Dissection of preserved animals is included in the laboratory exercises.

Course content includes: Cell physiology (eukaryotic and prokaryotic cellular structures, organic and inorganic chemicals, enzymes and metabolism, DNA and chromosomes, cell division, and protein synthesis) and animal physiology and anatomy (homeostasis, tissues and organs, hormones, animal development, and digestive, circulatory, respiratory, immune, reproductive, nervous, muscle, and skeletal systems).

Meets Goals of Gen Ed: BIOL 107 is proposed as a course to be included in the Science and Technology Content Area.

Goal 2. Intellectual breadth and versatility. It is increasingly important that students understand cellular and human biology in order to make rational decisions as they deal with issues and problems in an era of global epidemics, crises in health care, animal cloning and other dramatic technical advancements in life science. BIOL 107 introduces the cell as the basic unit of life and describes the organization of cells into tissues and organs that comprise vertebrate animals. It also provides an introduction into methods by which biological investigation at the cellular and subcellular levels is conducted. For many students, BIOL 107 will provide their only introduction into cellular and human biology.

Goal 7. Acquire a working understanding of the processes by which they can continue to acquire and use knowledge. The material taught in BIOL 107 is derived from the scientific processes of hypothesis testing, collecting and interpreting data, deductive reasoning, and refinement of the hypothesis. In class lectures the students are exposed to the knowledge obtained through the scientific method, and the laboratory exercises, they gain experience in formulating and testing hypotheses. We challenge students to present arguments or observations that would question accepted facts. In the laboratory portion of the course, students learn the scientific method by conducting laboratory experiments that involve formulation of hypotheses, data analysis and interpretation, and reporting of results in either a lab report or in a formal report written in scientific style

CA3 Criteria: 1. Explore an area of science by introducing students to a broad, coherent body of knowledge. In recent years there has been an explosion of knowledge of the molecular biology, biochemistry, and physiology of cells, tissues, and organs. Understanding the impact of these advancements and understanding the health-related issues individuals encounter requires a broad knowledge of cellular and human physiology. BIOL 107 provides the core biological concepts and principles needed to understand cellular and systems-level physiology. The molecular biology, biochemistry, and cellular physiology of individual cells are studied, and the continuity between the functions of single cells and the functions of tissues, organs and systems is emphasized. Specializations in function of individual cells in tissues and organs are also explored.

2. The nature of modern scientific inquiry and the process of investigation. BIOL 107 has both lecture and laboratory components. In the lecture, the facts and concepts of biology are taught with emphasis on what is known. The limits in our knowledge are also presented where appropriate. In addition, the stories behind some discoveries are also presented to illustrate how the scientific method can be used to test hypotheses derived from observations. These stories illustrate the use of the scientific process in acquiring knowledge. Some questions on exams are also designed so the students are required to synthesize information from different topics. The second component of BIOL 107 is the laboratory in which students gain first-hand experience in designing experiments, proposing testable hypotheses, analyzing data they have collected, and interpreting the results. The students gain experience in communicating scientific information in the form of written reports.

3. The discovery of scientific information is a continual process. In the BIOL107 lectures it becomes apparent that there are many areas in which information is rapidly being updated. In these areas, the recent discoveries and the remaining significant unknowns are discussed in class.

In addition, the students often ask questions on areas that have not been investigated in sufficient detail for a clear answer. In these cases, the questions the students ask illustrate that there are many things about cell and system physiology that remain to be discovered. In the lab sections, the scientific method is taught as a system to answer these questions.

4. Promoting interest, competence and commitment to continued learning. The lectures are presented by instructors who are knowledgeable about the material and committed to excellence in undergraduate education. Most of the lecturers are active scientists who are involved in research in topics presented in the lectures and thus have a personal connection to the material. This becomes evident in the lectures and helps promote interest, and ensures that accurate and cutting-edge information is given to the students. Clearly presented material that challenges students to engage in the lectures and laboratory helps promote these traits in students. Highlighting the unanswered questions in the field also helps, and learning laboratory techniques and appropriate ways to formulate questions aids in the commitment to continued learning.

CA3 Lab Criteria: Each lab requires three hours in class per week. The sequence of labs, and occasionally the content are varied depending on the instructors. Each laboratory begins with a short lecture by the TA and a quiz on the previous week's material. Each laboratory has written exercises that are completed and graded. Two laboratory experiments are written in formal scientific style.

Weeks 1-2. Introduction to laboratory safety and equipment, data analysis, pH and buffers, and writing of lab reports. Students are introduced to basic laboratory procedures and taught how to report their results. Experiments on pH and buffers introduce methods of data collection and use of lab equipment.

Weeks 3-4. Characterization of Biological Molecules and Cell Structure and Function. In Week 3, students set up experiments to identify, quantify, or characterize starches, proteins, lipids, and nucleic acids. In week 4, students learn to use the microscope, stain cells, and identify cellular organelles and structures. Various cell types are viewed and drawn by the students in their lab notebook.

Weeks 5. Enzymes. Students conduct experiments on enzymatic activity. The effects of reversible and nonreversible inhibitors, pH, and concentrations of substrate and enzyme on enzymatic activity are studied. This lab introduces dependent and independent variables and teaches graphing techniques.

Week 6. Cell division, chromosomes and karyotyping, and DNA isolation. Cell division is observed and described from cells on prepared slides. Karyotypes are studied from chromosomal spreads that represent either normal male or female or a genetic anomaly. DNA is isolated from fresh tissue and viewed under a microscope.

Week 7. Protein synthesis and gel electrophoresis. Students design and conduct experiments on DNA with the use of restriction enzymes and electrophoresis, and study how DNA sequence encodes protein sequence.

Weeks 8-12. Vertebrate Anatomy. Students study vertebrate anatomy with the use of models, histological samples, and by dissection of preserved specimens. Organ systems and topics studied are body plan and orientation, the digestive system, the cardiovascular system, excretory, respiratory, reproductive systems, nervous and sensory systems, and the skeletal system. Students complete their laboratory manuals by answering questions, drawing structures, and conducting experiments that relate to the systems under study.

Week 13. Practical exam. Cumulative exam on the material from weeks 8-12.

Role of Grad Students: Graduate student TA's teach all laboratory sections, with two TA's per section. Supervision is by a laboratory coordinator and instructors in the course. All TA's are required to attend weekly meetings in which all aspects of the upcoming labs are discussed by the coordinator and instructors. New TA's are required to attend teaching workshops offered to all incoming teaching assistants in the university.