

Anderson Districts 1&2 Career and Technology

Biomedical Innovations (BI)

Course Syllabus

Course Description:

In this capstone course, students apply their knowledge and skills to answer questions or solve problems related to the biomedical sciences. Students design innovative solutions for the health challenges of the 21st century as they work through progressively challenging open-ended problems, addressing topics such as clinical medicine, physiology, biomedical engineering, and public health. They have the opportunity to on an independent project and may work with a mentor or advisor from a university, hospital, physician's office, or industry. Throughout the course, students are expected to present their work to an adult audience that they may include representatives from the local business and healthcare community.

Course Sequence/Credit:

Semester class
1 credit

Principles of Biomedical Sciences
Human Body Systems
Medical Interventions
Biomedical Innovations

Prerequisites/Co-requisites:

Biology/Algebra
Principles of Biomedical Sciences
Human Body Systems
Medical Interventions

Teacher: Carolyn Olver

Instructional Philosophy:

In an effort to engage students and provide rigor and relevance, this course will focus on activities based learning, project based learning and problem based learning. This semester course will be presented in an exciting and challenging manner. Using Bloom's Taxonomy, students can be assured to move from memory and recall to higher thinking skills. Students will be expected to meet the standards of the classroom and course with the teacher's assistance. Ample opportunity will be given to students to evaluate their own progress.

Instructional Delivery Plan:

Introduction to assignments: The teacher introduces the course and class activities, distributes the syllabus and explains the requirements. Also, the teacher outlines the classroom and school policies and procedures. The evaluation and grading system is introduced at the beginning of the course and to advise students of the standards they are expected to meet and pass the course and achieve better grades.

Class Operation:

The teacher provides direction and manages the class but gives the students as much responsibility as possible for planning, designing, and completing projects. In brief classroom sessions, the teacher lectures, demonstrates certain concepts and provides parameters for student performance. Students are monitored by the teachers so that time lines and mastery are accomplished.

Monitoring, Evaluating, and Grading Performance:

Each student is to complete all assignments/projects. The students are to use concepts of correct grammar and medical language. The teacher conducts periodic class discussions to emphasize points and to check student progress and understanding. Students are expected to explain key concepts and their progress. The evaluation system is clearly explained at the beginning of the course.

A	90-100
B	89-80
C	79-70
D	69-60
F	59 or below

Major Grades (test, labs experiment, project, journals)	60%
Minor Grades (ERS, classwork, homework, quiz)	40%
	100%

Major Project:

Independent Project/Senior Project

Instructional Materials:

Biomedical Innovations Project Lead the Way certified curriculum

Makeup Policy:

Students should make up assignments in a timely manner. Assignments that are missed will be given the same number of days to be made up. If a student is aware an absence will occur, the student should inform the teacher and collect assignments for the periods to be missed.

Course Goals:

Help students develop skills for living in a knowledge-based, technological society.

Add relevance to the learning.

Challenge students to high rigor.

Promote lifelong learning.

Meet the needs of students with varying learning styles.

Course Outline:

Problem One: Design of an Effective Emergency Room

In this problem, students apply their knowledge of emergency room medical careers, diagnostic testing and patient evaluation, human body systems, and medical interventions to analyze the workings of an emergency room and discuss inefficiencies that may hinder appropriate clinical care. Student teams will work collaboratively to design a more efficient emergency medicine delivery system. As students work through their design, they will review research methods, practice effective presentation skills, and learn project management techniques.

Problem One: Design of an Effective Emergency Room (24 Days)

- Activity 1.1.1 – Mission: Innovation
- Activity 1.1.2 – Research and Documentation
- Activity 1.1.3 – Effective Presentations
- Activity 1.1.4 – Emergency

Problem Two: Exploring Human Physiology

In this problem, students build upon what they already know about the research process in order to design, conduct, and analyze an experimental study. Students will choose a question relating to one or more body systems that they are interested in studying and will work with a team to investigate and answer that question. As students work through the experimental process, they will review and expand what they know about experimental design, collection of data, statistical analysis of data, and presentation of data.

Problem Two: Exploring Human Physiology (23 Days)

- Project 2.1.1 – Scientific Research
- Activity 2.1.2 – Science and the Media
- Activity 2.1.3 – Making Results Meaningful
- Problem 2.1.4 – Investigating Human Physiology

Problem Three: Design of a Medical Innovation

In this problem, students review the diseases and disorders as well as the corresponding medical interventions they have investigated in the previous courses and propose a new or better medical device, pharmaceutical, surgical procedure, or genetic intervention. Students will work with a team to build a prototype, model, or schematic of the intervention as well as develop a marketing plan for the product. As students work through this problem, they will review the design process, complete a literature review, and further practice effective presentation skills.

Problem Three: Design of a Medical Innovation (16 Days)

- Activity 3.1.1 – Evolution of a Product
- Activity 3.1.2 – Gathering the Facts
- Problem 3.1.3 – Design Innovations

Problem Four: Environmental Health

In this problem, students will explore how substances or chemicals in the environment impact human health. Students will investigate a disease cluster in a fictional family and assess the activities of the individuals for environmental risks. Students will test water samples for the presence of contaminants that could be detrimental to human health and use molecular biology techniques to identify specific microorganisms. Students will also design an experiment to test the effects of a particular chemical and doses of that chemical on plant growth. Students will

then compile a comprehensive environmental health profile for their local area. They will use publicly available databases, as well as personal contacts and visit, to uncover possible sources of environmental contamination in the community and to assess risk and level of exposure to people, wildlife and environmental resources. Students will use their compiled information to design an action plan to increase awareness, monitor resources, and ensure a clean and safe environment.

Problem Four: Investigating Environmental Health (25 Days)

Activity 4.1.1- Environmental Exposures

Activity 4.1.2- Analysis of Water Contamination

Activity 4.1.3- Testing the Waters

Activity 4.1.4- Dose Response

Problem 4.1.5- Environmental Health Community Profile

Problem Five: Combating a Public Health Issue

In this problem, students draw on information they have learned in previous courses about public health, epidemiology and disease diagnosis to work through one of two epidemiology studies. In each study, students will analyze data to define the outbreak, generate a hypothesis by diagnosing the patients' symptoms and identifying the disease pathogen, design and analyze an epidemiological study to test the hypothesis, and outline a plan for initiating control and prevention measures. Students will then identify local, national or global public health crises and write a mini-grant proposal, based on the National Institutes of Health grant structure, outlining a plan with intervention strategies. As students work through this problem, they will review evidence analysis, the design process, methodology, and analyze study data to evaluate risk,

Problem Five: Combating a Public Health Issue

Project 5.1.1-Disease Detectives

Project 5.1.2-Public Health in the News

Problem 5.1.3 Combating a Public Health Issue

Problem Six: Molecular Biology in Action (Optional)

In this problem, students will complete a multi-step, long term molecular biology experiment. Students will design and work through a protocol to construct and clone recombinant DNA. They will perform DNA ligation and transformation, as well as restriction analysis of the completed plasmid. Alternatively, students will work through a more in-depth DNA cloning and sequencing project. This laboratory investigation provides students with the opportunity to isolate plant DNA, perform a ligation and transformation, purify a plasmid, submit DNA for sequencing, and present all work to GenBank, the NIH genetic sequence database for publication. As students work through either of these problems, they will learn new laboratory skills, practice laboratory troubleshooting techniques, as well as review proper protocol for research notebook documentation.

Problem Six: Molecular Biology in Action (Optional) (19 or 45 days)

Activity 6.1.1- Restriction Enzyme Challenge

Project 6.1.2- Construction and Cloning of a Recombinant DNA

Problem 6.1.3- Cloning and Sequencing

Problem Seven: Forensic Autopsy (Optional)

In this problem, students will work as medical experts to work through mysterious deaths. First, as forensic pathologists, students will examine a fetal pig using the same protocol as a human autopsy, including examination of the tissues, organs, systems, and body fluids, and note any abnormalities. Second, students will draw on information they have learned in the previous courses about human body systems to design a fictional death. Students will showcase the clues left behind in the body and tell the story of how the person died through documents including an autopsy report, and medical history forms. Students will finally be tasked with solving another group's mystery.

Problem Seven: Forensic Autopsy (Optional) (12 days)

Activity 7.1.1- Forensic Autopsy

Problem 7.1.2- Determining Cause of Death

Problem Eight: Independent Project (Optional)

In this problem, students will work independently to determine an area of interest in the biomedical sciences and outline milestones in a long-term open-ended problem. Students will use skills learned in the previous courses as well as the previous problems to help them complete their project. Student work will include completely a literature review, writing and carrying out the methodology for their project, analyzing the results, and making adjustments as needed, and finally presenting the results of their work to an audience. Students may work with mentors or advisors from a university, hospital, physician's office, or industry partner to help guide them as they complete their work.

Problem Eight: Independent Project (Optional) (23+ Days)

Activity 8.1.1- Identifying a Project Topic

Activity 8.1.2- Literature Review

Activity 8.1.3- Methodology

Activity 8.1.4- Materials

Activity 8.1.5- Project Schedule

Completion of Independent Project

Problem 8.1.6-What did I learn?