Perris Union High School District
Course of Study

A. COURSE INFORMATION

Course Title:
PLTW Honors Biomedical Innovations
- ☐ New
- ☒ Revised

If revised previous course name if changed
PLTW Biomedical Innovations

Transcript Course Code/Number:
(To be assigned by Educational Services)

Subject Area:
- ☐ Social Science
- ☐ English
- ☐ Mathematics
- ✔ Laboratory Science
- ☐ World Languages
- ☐ Visual or Performing Arts
- ☐ College Prep Elective
- ☐ Other

Is this classified as a Career Technical Education course?
- ☐ Yes
- ✔ No

Grade Level
- ☐ MS
- ☐ HS
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ✔ 10
- ✔ 11
- ✔ 12

Required for Graduation:
- ☐ Yes
- ✔ No

Meets UC/CSU Requirements?
- ✔ Yes
- ☐ No

Was this course *previously approved by UC* for PUHSD?
- ✔ Yes
- ☐ No

(Will be verified by Ed Services)

Meets "AP" Requirements?
- ☐ Yes
- ✔ No

Submitted by: Jennifer West
Site: PVHS Science
Date: 5/21/21

Credential Required to teach this course:
Single Subject: Biological Sciences
To be completed by Human Resources only.

Signature: [signature] Date: 6-2-21

Meets "Honors" Requirements?
- ✔ Yes
- ☐ No

Unit Value/Length of Course:
- ☐ 0.5 (half year or semester equivalent)
- ✔ 1.0 (one year equivalent)
- ☐ 2.0 (two year equivalent)
- ☐ Other:

Approvals	Name/Signature	Date
Director of Curriculum & Instruction	[signature]	6/4/21
Asst. Superintendent of Educational Services	[signature]	6/7/21
Governing Board		

Prerequisite(s) (REQUIRED):

Required (prerequisite OR corequisite):

Chemistry or AP Chemistry
Biology or AP Biology
Algebra 1

Recommended (prerequisite):

PLTW Principles of Biomedical Science
Honors PLTW Human Body Systems
Honors PLTW Medical Interventions

Corequisite(s) (REQUIRED):

See above

Brief Course Description (REQUIRED):

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 work 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 may include representatives from the local business and healthcare community.

In the Biomedical Innovation course, students will be asked to apply what they have learned in the previous three courses to solve unique problems in science, medicine, and healthcare. Students will work systematically through required problems before completing optional directed problems or independent work. Each problem is staged as a mission – a unique set of tasks the students must work through to achieve their desired objective. Students are presented with each problem in a Mission File – a document that includes a case brief, a list of completion tasks, links to available resources, as well as a reflection section.

Working through the missions not only exposes students to current issues in biomedical science, but it also provides skills-based instruction in research and experimentation – tools students will use to design innovative solutions to real-world problems. Students will use what they learn in these missions as they develop and implement their independent project at the end of the year. A teacher may use additional resources in the community – the guidance of other teachers in the school, the advice of scientists or biomedical professionals, or the knowledge presented in scientific literature to help students achieve each goal.

B. COURSE CONTENT

Course Purpose (REQUIRED):
What is the purpose of this course? Please provide a brief description of the goals and expected outcomes. Note: More specificity than a simple recitation of the State Standards is needed.

Problem 1: Design of an Effective Emergency Room

In this problem students apply their knowledge of emergency 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 designs, they will review research methods, practice effective presentation skills, and learn project management techniques.

Problem 2: Exploring Human Physiology

In this problem students build upon what they 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 the presentation of data.

Problem 3: Designing 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 4: Investigating 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 explore the field of toxicology and 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 and action plan for their local area.

Problem 5: Combating a Public Health Issue

In this problem students draw on information they have learned in the 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 a local, national, or global public health crisis 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 6: Molecular Biology in Action

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 bacterial 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 bacterial 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 projects, they will learn new laboratory skills, practice laboratory troubleshooting techniques, and review proper protocol for research notebook documentation.

Problem 7: Forensic Autopsy

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

Problem 8: Independent Project

In this problem students will work independently to determine an area of interest in the biomedical sciences and work on 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 completing a literature review, writing and carrying out the methodology for their project, analyzing the results, making adjustments as needed, and finally presenting the results of their work to an adult 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.

Course Outline (REQUIRED):
Detailed description of topics covered. All historical knowledge is expected to be empirically based, give examples. Show examples of how the text is incorporated into the topics covered.

Problem 1: Design of an Effective Emergency Room

- Use strategic and systematic design and inquiry processes to guide the development of an effective solution.
- Assess online resources for credibility and accuracy.
- Solve a problem using analytical and critical thinking skills.
- Explain why scientists must have the courage to take a calculated risk.
- Design a medical space that is conducive to patient wellness and improves patient outcomes.
- Create or improve a medical innovation using a design process.
- Analyze health and disease data to inform public health decisions.
- Demonstrate awareness of the education and skills required for biomedical science professionals.
- Use project management (Gantt charts, timelines, or other means) to successfully and efficiently complete tasks as scheduled.
- Apply professional standards as they apply to the habits and characteristics of a biomedical professional.
- Communicate effectively with a specific audience.
- Create an effective team environment to promote successful goal attainment.

Problem 2: Exploring Human Physiology

- Identify how scientists design research studies to find the most accurate answer to a question they are asking.
- Use statistical analyses to draw meaningful conclusions from experimental results.
- Design an experiment that investigates a research question.
- Select and use appropriate tools and technology for experimental and clinical data collection and analysis.
- Collect and analyze data to draw a conclusion.
- Use statistics to solve biomedical science problems.

Problem 3: Designing a Medical Innovation

- Describe advances in biomedical science that have significantly improved the quality and longevity of life.
- Describe how the design process is used to develop a new product or system.
- Solve a problem using analytical and critical thinking skills.
- Create an effective team environment to promote successful goal attainment.
- Maintain a detailed repeatable account of the experiment in a physical or digital laboratory notebook.
- Display data appropriately and accurately in multiple formats (graphs, tables, diagrams).
- Explain how breaking a large project into many smaller tasks allows modifications to be made as necessary and serves as a means to monitor progress toward completion of the project.

Problem 4: Investigating Environmental Health

- Describe how substances in the environment affect human health.
- Identify factors that help determine how a person will respond to toxins.
- Analyze how the study of trends in health in a particular community can identify potential environmental contaminants.
- Evaluate the impact of environmental factors on human health.
- Use proper techniques to identify strains of bacteria.
- Describe the impact that biomedical science research & interventions have on disease prevention & treatment.

Problem 5: Combating a Public Health Issue

- Describe how epidemiologists investigate a potential disease outbreak.
- Identify factors that determine when to use a case-control versus a cohort study.
- Explain how the distribution of infectious disease and chronic illnesses in a given area relate to lifestyle, culture, and access to medical care.
- Collect and analyze data to draw a conclusion.
- Explain the value of diverse perspectives in the problem-solving process.
- Create or improve a medical innovation using a design process.
- Analyze health and disease data to inform public health decisions.
- Analyze data from epidemiological studies to investigate the symptoms, pathogen, and transmission pattern of a mystery illness.
- Identify medical interventions that can address global health issues.
- Demonstrate awareness of the societal impacts of biomedical science professionals.

Problem 6: Molecular Biology in Action

- Use plasmids in a lab to clone a gene.
- Identify ways in which molecular biology will shape the future of pharmacology and medicine.
- Design an experiment that investigates a research question.
- Collaborate with a mentor who is an expert in their field.
- Describe why experimental design is a continual process.
- Outline how iterative processes inform biomedical science decisions, improve solutions, and inspire new ideas.

Problem 7: Forensic Autopsy

- Identify anatomical structures and functions.
- Use proper dissection techniques to expose and analyze the anatomical structures of a fetal pig.
- Use medical background information, clues left with a body, and anatomical observations to determine how a person died.

Problem 8: Independent Project

- Design an experiment that investigates a research question.
- Collaborate with a mentor who is an expert in their field.
- Write a proposal for an independent project.
- Collect and analyze data to draw a conclusion.
- Select and use appropriate tools and technology for experimental and clinical data collection and analysis.
- Research and compile information about a chosen topic.
- Communicate effectively with a specific audience.
- Follow acceptable formats for writing assignments and professional presentations.
- Evaluate the reliability and credibility of sources when gathering information.
- Properly cite references for all reports in an accepted format.

Writing Assignments (REQUIRED):
Give examples of the writing assignments and the use of critical analysis within the writing assignments.

- Students will maintain a formal laboratory notebook.
- Students will maintain a career journal.
- Technical writing will consist of formal lab reports and case reports. Reports will include background research with properly cited primary sources, analyzed experimental data, discussion, and a conclusion.

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INSTRUCTIONAL MATERIALS (REQUIRED)

Textbook #1 - None	
Title:	Edition:
Author:	ISBN:
Publisher:	Publication Date:
Usage: ❑ Primary Text ❑ Read in entirety or near	
Textbook #2 - None	
Title:	Edition:
Author:	ISBN:
Publisher:	Publication Date:
Usage: ❑ Primary Text ❑ Read in entirety or near	
Supplemental Instructional Materials	