

Perris Union High School District

Course of Study

A. COURSE INFORMATION

Course Title: <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">PLTW Honors Medical Interventions</div> <input type="checkbox"/> New <input type="checkbox"/> Revised	Subject Area: <input type="checkbox"/> Social Science <input type="checkbox"/> English <input type="checkbox"/> Mathematics <input checked="" type="checkbox"/> Laboratory Science <input type="checkbox"/> World Languages <input type="checkbox"/> Visual or Performing Arts <input type="checkbox"/> College Prep Elective <input type="checkbox"/> Other	Grade Level <input type="checkbox"/> MS <input type="checkbox"/> HS <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> 9 <input checked="" type="checkbox"/> 10 <input checked="" type="checkbox"/> 11 <input checked="" type="checkbox"/> 12
If revised previous course name if changed <div style="border: 1px solid black; padding: 2px; margin-top: 5px;">PLTW Medical Interventions</div>	Is this classified as a Career Technical Education course? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Transcript Course Code/Number: <div style="border: 1px solid black; height: 20px; margin-top: 5px;"></div> (To be assigned by Educational Services)		
Required for Graduation: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Credential Required to teach this course: <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> <i>Single Subject: Biological Science</i> <u>To be completed by Human Resources only.</u> </div>	
Meets UC/CSU Requirements? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Was this course <u>previously approved by UC</u> for PUHSD? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No (Will be verified by Ed Services)	<div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> <div style="display: flex; justify-content: space-between;"> <div style="text-align: center;"><i>Spidey Hillton</i></div> <div style="text-align: center;">6-2-21</div> </div> <div style="display: flex; justify-content: space-between; font-size: small;"> Signature Date </div> </div>	
Meets "AP" Requirements? <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Meets "Honors" Requirements? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Submitted by: Jennifer West Site: PVHS Science Date: 5/22/21	Unit Value/Length of Course: <input type="checkbox"/> 0.5 (half year or semester equivalent) <input checked="" type="checkbox"/> 1.0 (one year equivalent) <input type="checkbox"/> 2.0 (two year equivalent) <input type="checkbox"/> Other:	
Approvals	Name/Signature	Date
Director of Curriculum & Instruction		6/4/21
Asst. Superintendent of Educational Services		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

Corequisite(s) (REQUIRED):

See above

Brief Course Description (REQUIRED):

Medical Interventions allows students to investigate the variety of interventions involved in the prevention, diagnosis, and treatment of disease as they follow the lives of a fictitious family. A “How-To” manual for maintaining overall health and homeostasis in the body, the course will explore how to prevent and fight infection, how to screen and evaluate the code in our DNA, how to prevent, diagnose, and treat cancer, and how to prevail when the organs of the body begin to fail. Through these scenarios students will be exposed to the wide range of interventions related to immunology, surgery, genetics, pharmacology, medical devices, and diagnostics.

Each family case scenario will introduce multiple types of interventions, reinforce concepts learned in the previous two courses, and present new content. Interventions may range from simple diagnostic tests to treatment of complex diseases and disorders. These interventions will be showcased across the generations of the family and will provide a look at the past, present, and future of biomedical science.

Lifestyle choices and preventive measures are emphasized throughout the course as well as the important role that scientific thinking and engineering design play in the development of interventions of the future. Students practice problem solving with structured activities and progress to open-ended projects and problems that require them to develop planning, documentation, communication, and other professional skills.

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.

Unit 1: How to Fight Infection

In this unit students are introduced to Sue Smith, the eighteen-year-old daughter of Mr. and Mrs. Smith. Sue is a college freshman who is presenting symptoms of an unknown infectious disease which students eventually identify as bacterial meningitis. Sue survives the infection but is left with hearing impairment. Through this case students will explore the diagnostic process used to identify an unknown infection, the use of antibiotics as a treatment, how bacteria develop antibiotic resistance, how hearing impairment is assessed and treated, and how vaccinations are developed and used to prevent infection. Follow the fictitious Smith family as you learn about the prevention, diagnosis, and treatment of disease. Play the role of biomedical professionals to analyze case information and diagnose and treat your patients. Investigate the medical interventions of the past and present, and begin to brainstorm the innovations of the future.

Unit 1 Lessons

- Lesson 1.1 The Mystery Infection
- Lesson 1.2 Antibiotic Treatment
- Lesson 1.3 The Aftermath – Hearing Loss
- Lesson 1.4 Vaccination

Unit 2: How to Screen What is in Your Genes

In this unit students are introduced to Mr. and Mrs. Smith, Sue's parents. Mr. and Mrs. Smith are very excited to find out they are expecting a new baby. Because the couple is in their early 40s, the doctor has suggested genetic screening and testing. Through this case students will explore how to screen and evaluate the code in our DNA, the value of good prenatal care, and the future of genetic technology.

Unit 2 Lessons

- Lesson 2.1 Genetic Testing and Screening
- Lesson 2.2 Our Genetic Future

Unit 3: How to Conquer Cancer

In this unit students are introduced to Mike Smith, the sixteen-year-old son of Mr. and Mrs. Smith. Mike is diagnosed with osteosarcoma, a type of bone cancer that often affects teenagers. Mike's treatments put him into remission; however, in order to remove all of the cancerous tissue, he had to have most of his arm amputated. Mike now needs a prosthesis. Through this case students will explore the diagnostic process used to determine the presence of cancerous cells, the risk factors and prevention of cancer, rehabilitation after disease or injury, and the design process for new medications, prosthetics, and nanotechnology.

Unit 3 Lessons

- Lesson 3.1 Detecting Cancer
- Lesson 3.2 Reducing Cancer Risk
- Lesson 3.3 Treating Cancer
- Lesson 3.4 Building a Better Cancer Treatment

Unit 4: How to Prevail When Organs Fail

In this unit students are introduced to Mrs. Jones, the forty-four-year-old sister of Mrs. Smith. Mrs. Jones has been struggling with Type 1 Diabetes for twenty years. Over the years, Mrs. Jones did not take good care of herself or properly control her diabetes. She eventually began using an insulin pump and changed her lifestyle to regulate her blood sugar levels, but the damage had already been done. Mrs. Jones is now dealing with end stage renal failure and needs a kidney transplant. Through this case students will explore protein production, blood sugar regulation, dialysis, organ donation and transplantation, and non-invasive surgery techniques. In addition students will create a bionic human.

Unit 4 Lessons

- Lesson 4.1 Manufacturing Human Proteins
- Lesson 4.2 Organ Failure
- Lesson 4.3 Transplant
- Lesson 4.4 Building a Better Body

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.

Unit 1: How to Fight Infection

Lesson 1.1: The Mystery Infection

- Use DNA sequences in a bioinformatics database to determine pathogens.
- Conduct an ELISA test to determine presence and concentration of a specific pathogen.
- Write a case report that analyzes patient medical histories and diagnostic test results.

Lesson 1.2: Antibiotic Treatment

- Conduct an experiment to determine bacteria sensitivity to antibiotics.
- Experiment on bacterial conjugation, using a resistance plasmid.
- Graph and analyze data to show the effect of antibiotic resistance on bacterial populations.

Lesson 1.3: The Aftermath - Hearing Loss

- Create a model and demonstrate the anatomy and physiology of the human ear.
- Case studies on conductive and sensorineural hearing loss.
- Cochlear implant research and debate.

Lesson 1.4: Vaccination

- Types of vaccines and their development.
- Timeline showing vaccination schedules.
- Epidemiology case study and career exploration.

Unit 2: How to Screen What's in your Genes

Lesson 2.1: Genetic Testing and Screening

- Play the role of a genetic counselor. Create a case study-based presentation on a genetically inherited disorder.
- Conduct a lab experiment to amplify DNA by polymerase chain reaction.
- Conduct a DNA extraction and PCR of our own DNA. Use and a restriction enzyme digest and gel electrophoresis to analyze DNA for the PTC gene. Present the results in a formal lab report.
- Research prenatal screening and diagnostic tests. Analyze patient case studies and provide recommendations for next steps in treatment.

Lesson 2.2: Our Genetic Future

- Research mechanisms of gene therapy and viral vectors. Design appropriate therapies for patient cases.
- Learn the theory and application of gene editing with CRISPR Cas-9 technology.
- Debate the pros and cons of gene therapy. Discussion on the ethics of gene therapy and cloning.
- Research medical careers in the field of in-vitro fertilization and reproductive cloning

Unit 3: How to Conquer Cancer

Lesson 3.1: Detecting Cancer

- Analyze patterns and trends in cancer cases. Identify risk factors for cancer.
- Create a graphic organizer showing diagnostic imaging techniques and careers.
- Stain cells from healthy and cancerous tissues. Compare and contrast the cell features.
- Conduct a simulated microarray lab to view gene expression in healthy and cancerous cells
- Analyze gene expression ratios using the Pearson Correlation coefficient formula and/or a spreadsheet to calculate the ratios. Interpret the results to determine the level of gene regulation.

Lesson 3.2: Reducing Cancer Risk

- Design and conduct an experiment to determine the effect of UV radiation on mutant and wild-type yeast cells. Test the effect of a chosen variable on protecting cells against UV light. Write a formal lab report.
- Research the role of BRCA 1 and BRCA 2 genes in developing cancer. Analyze pedigrees and genetic testing for a fictional family to determine the risk of developing breast cancer.
- Conduct a marker analysis test, using gel electrophoresis to determine genotypes of the members of the Smith family to determine if they have the BRCA mutations.
- Research a career in virology and cancers linked to viral infections. Write mock interview questions and role-play the responses expected from a virologist.
- Research and create a timeline for the recommended cancer screenings.

Lesson 3.3: Treating Cancer

- Analyze cancer patients. Learn about treatment options and write journal entries describing the treatments.
- Conduct an experiment using data acquisition probes and software to simulate biofeedback. Design an experiment to test the use of biofeedback in a stressful situation.
- Research advancements in prosthetic devices. Build and demonstrate a model of a prosthetic arm.
- Collaborative group work to develop a rehabilitation plan for an assigned patient. Students play the roles of occupational and physical therapists as they present a plan to rehab the patient.

Lesson 3.4: Building a Better Cancer Treatment

- Learn how precision medicine is used to analyze genetic sequences of patients to determine the best chemotherapy treatment and outcome for a patient.
- Students will learn about new treatments that are being developed to treat cancer patients.
- Students will work in small collaborative groups to analyze the phases and ethics of clinical trials.
- Design a clinical trial for an immunotherapy for an specific type of cancer

Unit 4: How to Prevail When Organs Fail

Lesson 4.1: Manufacturing Human Proteins

- Conduct a genetic engineering experiment to transform bacteria with a recombinant plasmid.
- Use models to study the properties of amino acids and view protein shapes created by amino acid interactions.
- Conduct experiments to isolate and purify the proteins created in the bacterial recombination experiment.
- Research careers in pharmaceutical manufacturing. Write a cover letter for a job application.

Lesson 4.2: Organ Failure

- Work in a collaborative group to analyze a patient's symptoms to come up with a diagnosis and treatment.

Lesson 4.3: Transplant

- Research criteria for organ transplantation recipients. Analyze a case and create a short slide presentation that explains the criteria used to determine who should receive a donated organ.
- Analyze blood types and histocompatibility data to determine donor and recipient matches.
- Learn how laparoscopic surgical procedures are done and practice a laparoscopic procedure, using a simulated setup.
- Practice suturing techniques on artificial skin or other media.
- Write career journals for medical professionals involved in surgical procedures.

Lesson 4.4: Building a Better Body

- Create a graphic organizer to compare xenotransplantations and tissue engineering.
- Review all of the medical interventions learned throughout the year. Work in a group to design a superhuman with bionic features or other medical enhancements. Create a poster and presentation to explain how and why the enhancements would be made.

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.

INSTRUCTIONAL MATERIALS (REQUIRED)

Textbook #1 - None

Title:	Edition:
Author:	ISBN:
Publisher:	Publication Date:
Usage: <input type="checkbox"/> Primary Text <input type="checkbox"/> Read in entirety or near	

Textbook #2 - None

Title:	Edition:
Author:	ISBN:
Publisher:	Publication Date:
Usage: <input type="checkbox"/> Primary Text <input type="checkbox"/> Read in entirety or near	

Supplemental Instructional Materials

Please include online, and open source resources if any.

Numerous online resources as specified by PLTW curriculum (varies by lesson).

Estimated costs for classroom materials and supplies (REQUIRED). Please describe in detail.

If more space is needed than what is provided, please attach backup as applicable.

Cost for class set of textbooks: \$0	Description of Additional Costs: Lab supplies per PLTW Inventory List for a Pre-Existing Medical Interventions Course (2021)
Additional costs: \$6837 per 36 students	
Total cost per class set of instructional materials:	\$6837

Key Assignments (REQUIRED):

Please provide a detailed description of the Key Assignments including tests, and quizzes, which should incorporate not only short answers but essay questions also. How do assignments incorporate topics? Include all major assessments that students will be required to complete

- Group presentations
- Case study analysis
- Graphic organizers
- Lab notebooks
- Lab practicum
- Projects
- Lab or case reports
- Lesson quizzes
- Unit exams

Instructional Methods and/or Strategies (REQUIRED). *Please list specific instructional methods.*

- Collaborative groups work
- Hands-on laboratory experiments
- Virtual simulations
- Experimental design
- Modeling
- Role playing
- Graphing
- Direct interactive instruction
- Note taking
- Researching primary sources
- Issue-based inquiry
- Group discussions
- Debate
- Group presentations

Assessment Methods and/or Tools (REQUIRED). *Please list different methods of assessments that will be used.*

This course will assess student progress with both formative and summative assessments.

- Group presentations
- Individual and group projects
- Lab notebooks
- Lab practicum
- Lab or case study reports
- Lesson quizzes
- Unit exams
- Comprehensive End-of-Course Exam (created and administered by PLTW)

COURSE PACING GUIDE AND OBJECTIVES (REQUIRED)

Day(s)	Objective	Standard(s)	Chapter(s)	Reference
14	Lesson 1.1 - The Mystery Infection	N/A	N/A	N/A
9	Lesson 1.2 - Antibiotic Treatment	N/A	N/A	N/A
9	Lesson 1.3 - The Aftermath: Hearing Loss	N/A	N/A	N/A
8	Lesson 1.4 - Vaccination	N/A	N/A	N/A
15	Lesson 2.1 - Genetic Testing & Screening	N/A	N/A	N/A
6	Lesson 2.2 - Our Genetic Future	N/A	N/A	N/A
14	Lesson 3.1 - Detecting Cancer	N/A	N/A	N/A
14	Lesson 3.2 - Reducing Cancer Risk	N/A	N/A	N/A
11	Lesson 3.3 - Treating Cancer	N/A	N/A	N/A
13	Lesson 3.4 - Building a Better Cancer Treatment	N/A	N/A	N/A
17	Lesson 4.1 - Manufacturing Human Proteins	N/A	N/A	N/A
2	Lesson 4.2 - Organ Failure	N/A	N/A	N/A
14	Lesson 4.3 - Transplant	N/A	N/A	N/A
9	Lesson 4.4 - Building a Better Body	N/A	N/A	N/A

C. HONORS COURSES ONLY

Indicate how much this honors course is different from the standard course.

The honors course involves conducting the “optional” laboratory experiments that are part of the PLTW curriculum in order to give students more hands-on, practical experience with using professional laboratory equipment. Students will be required to design experiments and communicate their findings in formal lab reports. Students will also be required to take the comprehensive PLTW End-of-Course exam, which is designed and administered by PLTW.

The final project is lesson 4.4 in which students will apply the medical interventions that they have learned throughout the year to create a “superhuman” that has at least 8 modifications to make a theoretically more superior human. This will be a collaborative group project that will culminate in an oral presentation before the whole class.

D. BACKGROUND INFORMATION

Context for course (optional)

The following outlines the skills and content knowledge students are expected to obtain in the Honors Medical Interventions course. It includes computational and analytical skills as well as technical skills that come from experience with tools, software, lab work, and engineering design. This detailed list of skills and knowledge illustrates the immediate, applicable contributions that MI students can make within a workplace.

Laboratory Skills

- Aseptic technique
- Bacterial plating
- Micropipetting
- DNA extraction
- Restriction enzyme digest
- DNA gel electrophoresis
- Protein gel electrophoresis
- Hydrophobic Interaction Chromatography (HIC)
- Bacterial transformation

Clinical Skills

- Karyotyping
- Quantitative Enzyme-linked Immunosorbent Assay (ELISA) analysis
- Interpretation of audiograms
- Blood typing
- Tissue typing

Equipment and Software Proficiencies

- Productivity software (Google Docs, Sheets, Slides)
- Vernier probes and sensors
- Data Acquisition Software (Vernier Logger Pro)
- Microscope
- Thermal cycler

Scientific Experimentation Skills

- Design and conduct reliable scientific experiments
- Analyze and interpret laboratory data
- Construct graphs (by hand and using graphing software)
- Interpolate and extrapolate data from a graph
- Draw conclusions based on experimental data
- Thoroughly and clearly communicate results and conclusions both orally and in writing

Professional Skills

- Group collaboration
- Planning and organizing
- Time management
- Problem-solving
- Technical writing
- Verbal and written communication
- Decision-making
- Creative thinking

Course Knowledge

Overarching Themes

- Homeostasis
- Biomedical science careers
- Bioethics
- Design process
- Interrelationship between body systems and health/disease
- Current and future medical interventions

Infectious Disease

- Epidemiology
- Bioinformatics/DNA sequence analysis
- Antibiotic mode of action and antibiotic resistance
- Bacterial transduction, transformation, and conjugation
- Physics of sound and anatomy and physiology of the ear
- Hearing loss and audiograms
- Cochlear implant technology
- Vaccine production and mechanism

Innovative Medicine

- Prenatal screenings
- Gene therapy
- Reproductive technology
- Xenotransplantation and tissue engineering

Molecular Biology

- Recombinant DNA technology and genetic engineering
- DNA microarrays
- Restriction Fragment Length Polymorphisms (RFLP) and marker analysis
- Single Nucleotide Polymorphisms (SNPs) and pharmacogenetics
- Biomanufacturing of human proteins

Cancer Genetics, Diagnostics, and Treatment

- Diagnostic imaging
- Histology
- Statistical analysis
- Biofeedback therapy
- Prosthetic limb technology
- Nanomedicine
- Clinical trials

Organ Transplant

- End Stage Renal Disease
- Organ allocation policies and organ transplant
- Laparoscopic surgical techniques
- Antigen/antibody interactions
- Pedigree construction/analysis

History of Course Development (optional)

Although PLTW Medical Interventions met the criteria to be designated as an Honors level course when it was originally brought to PUHSD in 2015, Honors designation was not requested at that time. The purpose of this revision is to ensure that students receive Honors credit for their work in this rigorous project-based learning course. A secondary purpose is to establish prerequisites and corequisites consistent with current student enrollment practices at the school sites. It should be noted that all PLTW Biomedical Science program courses have already been approved at the Honors level by the UC system including Medical Interventions, which is the third of four courses in the biomedical science pathway.