

**MT. DIABLO UNIFIED SCHOOL DISTRICT  
COURSE OF STUDY**

<b>COURSE TITLE:</b>	<b>Honors Medical Interventions</b>
<b>COURSE NUMBER:</b>	<b>(Aeries)</b>
<b>CBEDS NUMBER:</b>	<b>(Aeries)</b>
<b>DEPARTMENT:</b>	<b>CTE/Science</b>
<b>LENGTH OF COURSE:</b>	<b>One Year</b>
<b>CREDITS PER SEMESTER:</b>	<b>5</b>
<b>GRADE LEVEL(S):</b>	<b>11-12</b>
<b>REQUIRED OR ELECTIVE:</b>	<b>Elective</b>

**PREREQUISITES:**

**Required** - Completion with a “C” or better in biology/PBS, chemistry, and HBS.

**Recommended** -

**BOARD OF EDUCATION ADOPTION: (Date of Action Meeting)**

**COURSE DESCRIPTION:** This is the final class of the 3-year series investigating the integration of the body systems, health conditions and related careers. Students investigate a variety of interventions involved in the prevention, diagnosis and treatment of disease as they follow the life of a fictitious family. The course is a “How-To” manual for maintaining overall health and homeostasis in the body. Students explore how to prevent and fight infection; screen and evaluate the code in human DNA; prevent, diagnose and treat cancer; and prevail when the organs of the body begin to fail. Through these scenarios, students are exposed to a range of interventions related to immunology, surgery, genetics, pharmacology, medical devices, and diagnostics.

**COURSE PURPOSE:** Students follow the life of a fictitious family as they investigate how to prevent, diagnose, and treat disease. Students explore how to detect and fight infection; screen and evaluate the code in human DNA; evaluate cancer treatment options; and prevail when the organs of the body begin to fail. Through real-world cases, students are exposed to a range of interventions related to immunology, surgery, genetics, pharmacology, medical devices, and diagnostics.

**COURSE OUTLINE:**

***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 are used to prevent infection.

***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 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 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.

### **LABORATORY ACTIVITIES:**

#### **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 Immunosorbant Assay (ELISA) analysis
- Interpretation of audiograms
- Blood typing
- Tissue typing

### **KEY ASSIGNMENTS:**

#### **Unit 1: How to Fight Infection**

1. In addition to performing research and a virtual lab to identify a pathogen in an outbreak using a lymph fluid sample, students in the honors course will use the ELISA procedure to identify "patient zero".
2. Students in the honors course will present a slideshow detailing one of the four major families of antibiotics and whether their drug is appropriate to treat Meningitis.
3. In addition to researching the effects of meningitis on hearing, performing testing on their own hearing, and building a clay model of the ear, students in the honors course will research the efficacy of cochlear and engage in a formal debate as to whether a meningitis patient should undergo the procedure.

#### **Unit 2: How to Screen What is in Your Genes**

1. In addition to performing research on genetic testing and outcomes, students in the honors course will serve as mock-genetic counselors and formally present various cases to the class.

2. In addition to researching and exploring alternative reproductive choices concerning genetic testing, students in the honors course will formally debate the bioethics of genetics as a medical intervention.

### **Unit 3: How to Conquer Cancer**

1. In addition to researching the different types of cancer, methods for diagnosis and treatments, students in the honors course will research specific cases and formally present a slideshow about the cases and their outcomes.
2. Students in the honors course will build a functional prosthetic arm from everyday materials. The prosthetic will undergo evaluation for function using a dual task (i.e. picking up and flipping a cup AND picking up a ping pong ball from a cup. EMG, grip dynamometry and other physiologic data will be recorded and reported to the class.
3. Students in the honors class will also explore various medical imaging procedures as diagnostic measures for cancer and formally present the information to the class.

### **Unit 4: How to Prevail When Organs Fail**

1. While all students will research and explore diabetes as a disease and the history of its treatment, students in the honors course will perform an experiment in which a genetic trait is transferred from one bacterial cell to another and a culture is grown from the sample cell.
2. While all students will brainstorm and research advances in bionics and nanotechnology, students in the honors course, will create blueprints, write a paper about, and formally present their bionic human detailing eight modifications, their rationale for use and the technology behind them.

### **INSTRUCTIONAL METHODS and/or STRATEGIES:**

- Project Based Learning
- Guided Inquiry projects
- Modeling
- Direct instruction (minimal)

### **ASSESSMENTS INCLUDING METHODS and/or TOOLS**

- Project-based learning (Graded by rubric)
  - Cumulative unit presentations
  - Medical Innovations for real life medical phenomenon
- Unit exams
- End of Course Exam

### **INSTRUCTIONAL MATERIALS:**

- Course laptops to allow for research and exploration of biomedical concepts
- Inspiration concept mapping tool
- Google Classroom/Edmodo
- PLTW Curriculum
- Equipment and Software Proficiencies
  - Microsoft Office (Excel, Word, PowerPoint)
  - Vernier probes and sensors
  - Data acquisition Software (Vernier Logger Pro)
  - Microscope
  - Thermal Cycler

## For Honors Distinction:

### CORRESPONDING NON-HONORS COURSE: Medical Interventions

#### DIFFERENCES in HONORS/NON-HONORS COURSES:

##### *Unit 1:*

- a. All students will perform research and a virtual lab to identify a pathogen in an outbreak using a lymph fluid sample. Once the pathogen is positively identified as *Nisseria Meningitis*, **HONORS** students will use the ELISA procedure to identify “patient zero”.
- b. All students will research antibiotics and immune responses. **HONORS** students will formally present a slide show detailing of the four major families of antibiotics and whether their drug is appropriate to treat Meningitis.
- c. All students will perform testing of their own hearing and will build a clay model of the ear.
- d. All students will explore medical interventions available for sensorineural and conductive hearing loss.
- e. **HONORS** students will research the efficacy of cochlear implants and formally debate whether a meningitis patient should undergo the procedure.

##### *Unit 2:*

- a. All students will be required to perform research on genetic testing and outcomes and explore bioethical issues with GATTACA as a reference. **HONORS** students will serve as mock-genetic counselors and formally present various cases to the class.
- b. All students will research and explore alternative reproductive choices concerning genetic testing. **HONORS** students will formally debate the bioethics of genetics of medical intervention.

##### *Unit 3:*

- a. All students will research the types of cancers, methods for diagnosis and treatments. **HONORS** students will research and formally present a slideshow detailing various cases and their outcomes.
- b. All students will be exposed to information regarding the course of treatment for Mike Smith (the case study) **HONORS** students will have to build a functional prosthetic arm from everyday materials. The prosthesis will undergo evaluation for function using a dual task (i.e. picking up and flipping a cup AND picking up a ping pong ball from a cup). EMG grip dynamometry and other physiologic data will be recorded and reported to the class.
- c. **HONORS** students will also explore various medical imaging procedures as diagnostic measures for cancer and formally present the information to the class.

##### *Unit 4:*

- a. All students will research and explore diabetes as a disease and the history of its treatment. **HONORS** students will perform an experiment in which a genetic trait is transferred from on bacterial cell to another and a culture is grown from the sample cell.
- b. All students will also perform a mock-laparoscopic surgery and suturing project.
- c. All students will brainstorm and research advances in bionics and nanotechnology. **HONORS** students will create blueprints, write a paper about and formally present their bionic human detailing eight modifications, their rationale for use and the technology behind them.

**For CTE/Pathway/PLTW Distinction:**

**This course is designed with an industry partner and to be scheduled in a course sequence as follows.**

**Industry Partner: PLTW**

**Sequence of Courses: Principles of Biomedical Science (Year One)**

**Human Body Systems (Year Two)**

**Medical Interventions (Year Three)**

**Committee Members:**

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|-------------------------|------------------------------|
| <b>1. Dylan Bland</b>   | <b>4. Heather Fontanilla</b> |
| <b>2. Marcus Thomas</b> | <b>5. David Saucedo</b>      |
| <b>3. Al Douex</b>      | <b>6.</b>                    |