Medical Intervention
14257

Rationale Statement: In the Medical Interventions course, students will 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 and will reinforce concepts learned in the previous two courses, as well as 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 scientific thinking and engineering design play in the development of interventions of the future.

Suggested grade level: Grades 11 or 12

Topics covered:
How to fight infection: virology, microbiology, audiology, epidemiology
How to screen what is in your genes: molecular genetics, prenatal screening, gene therapy, bioethics
How to conquer cancer: oncology, biostatistics, prosthetics, nanotechnology
How to prevail when organs fail: genetic engineering, organ transplantation, biomanufacturing

Indicator #1: How to fight infection	
Webb's Leveling	Standard and Examples
Recall	**MI 1.1** List medical interventions to create a classroom display.
Recall	**MI 1.2** Group common medical interventions into categories.
Recall	**MI 1.3** Draw and label a diagram of a bacterial cell.
Recall	**MI 1.4** Research the method of action for different classes of antibiotics.
Recall	**MI 1.5** Trace the pathway of sound.

Recall	**MI 1.6** Match up audiograms with their corresponding patients with hearing loss.
Skill/Concept	**MI 1.7** Maintain case notes of an outbreak investigation.
Skill/Concept	**MI 1.8** Create a graphic organizer displaying connections between individuals in a disease outbreak.
Skill/Concept	**MI 1.9** Use publically available molecular databases to search for DNA sequences and identify pathogens.
Skill/Concept	**MI 1.10** Compute serial dilutions and calculate resultant concentrations.
Skill/Concept	**MI 1.11** Use proper laboratory techniques to “mate” a streptomycin resistant strain of *E. coli* with an ampicillin resistant strain of *E. coli*.
Skill/Concept	**MI 1.12** Perform several simple hearing tests.
Strategic Thinking	**MI 1.13** Build a model or draw a diagram that illustrates how ELISA can be used to detect disease.
Strategic Thinking	**MI 1.14** Perform ELISA testing to determine the concentration of infectious bacteria in simulated body fluids and identify infected patients.
Strategic Thinking	**MI 1.15** Write a report summarizing the multi-step process followed to investigate an outbreak of bacterial meningitis.
Strategic Thinking	**MI 1.16** Create a 3-D model of the structures of the ear.
Strategic Thinking	**MI 1.17** Give a short presentation to describe the type of hearing loss experienced by a patient.
Strategic Thinking	**MI 1.18** Demonstrate hearing loss on the model of the ear.
Strategic Thinking	**MI 1.19** Recommend the most appropriate type of intervention for a patient with hearing loss.
Strategic Thinking	**MI 1.20** Interview people from different generations about their vaccination history and organize findings in a graphic organizer.
Strategic Thinking	**MI 1.21** Engineer a paper plasmid to include the genetic code necessary to produce a vaccine.
Extended Thinking	**MI 1.22** Design and construct a 3-D model that demonstrates one of the pathways through which bacterial cells transfer genes.
Extended Thinking	**MI 1.23** Use a model to simulate the effects of antibiotics on the population of bacteria during an infection.
Extended Thinking	**MI 1.24** Write a letter from the opposing perspectives of an adult deaf person expressing his or her reasons for choosing to get a cochlear implant versus an adult deaf person expressing his or her reasons for choosing not to get a

	cochlear implant.
Extended Thinking	**MI 1.25** Assume the role of an epidemiologist and complete four tasks to showcase their skills as a professional.

Indicator #2: How to screen what is in your genes	
Webb's Leveling	Standard and Examples
Skill/Concept	**MI 2.1** Amplify a segment of DNA in the laboratory using PCR.
Skill/Concept	**MI 2.2** Use laboratory techniques such as DNA extraction, PCR, and restriction analysis to identify single base pair differences in DNA.
Skill/Concept	**MI 2.3** Create a Venn diagram to compare the process of amniocentesis and chorionic villus sampling.
Skill/Concept	**MI 2.4** Analyze prenatal screening results.
Skill/Concept	**MI 2.5** Construct a graphic organizer comparing and contrasting potential gene therapy vectors.
Strategic Thinking	**MI 2.6** Test their ability to taste the chemical PTC and relate this trait to laboratory genetic testing results.
Strategic Thinking	**MI 2.7** Write a diary entry that describes proper prenatal care and the medical interventions that function to monitor a pregnancy.
Strategic Thinking	**MI 2.8** Read and summarize current news articles debating the overall safety and value of gene therapy as a treatment option for genetic disorders.
Strategic Thinking	**MI 2.9** Complete a survey of their personal feelings regarding reproductive options of the future.
Extended Thinking	**MI 2.10** Analyze a genetic counseling case file and provide written and oral feedback to a patient or family.
Extended Thinking	**MI 2.11** Write a policy statement governing future gene therapy research.

Indicator #3: How to conquer cancer	
Webb's Leveling	Standard and Examples
Recall	**MI 3.1** Display information about cancer case studies on graphic organizers.
Recall	**MI 3.2** Create a concept map that describes the different uses for various diagnostic imaging technologies.
Skill/Concept	**MI 3.3** Compare normal cells and cancer cells.
Skill/Concept	**MI 3.4** Perform a simulated DNA microarray to analyze the gene expression patterns of two patients.

Skill/Concept	**MI 3.5** Read an article about a potential risk factor that interests them and share it with the class.
Skill/Concept	**MI 3.6** Create a timeline of cancer screenings they should do throughout their life using Inspiration® software.
Skill/Concept	**MI 3.7** Create an outline of an article about myoelectric prosthetic limbs.
Skill/Concept	**MI 3.8** Complete an alignment to arrange DNA sequences side-by-side to locate any base pair differences between different individuals.
Skill/Concept	**MI 3.9** Determine how many cuts are necessary to cut a 10 cm x 1 cm strip of paper in half before the paper is approximately ten nanometers long.
Skill/Concept	**MI 3.10** Summarize an article pertaining to the application of nanotechnology in medicine.
Strategic Thinking	**MI 3.11** Use statistical analysis to determine the similarity between gene expression patterns of three patients.
Strategic Thinking	**MI 3.12** Complete a skin cancer risk questionnaire and evaluate which risks are in their control.
Strategic Thinking	**MI 3.13** Perform marker analysis to determine the presence of a genetic mutation associated with breast cancer.
Strategic Thinking	**MI 3.14** Create a mock interview with a virologist either working to develop a new vaccine or drug for a virus associated with cancer.
Strategic Thinking	**MI 3.15** Write journal entries or a blog describing the experiences of teenagers undergoing cancer treatments.
Strategic Thinking	**MI 3.16** Design and create a simple model of an arm that is able to pick-up an empty Styrofoam cup.
Strategic Thinking	**MI 3.17** Complete a laboratory investigation using data acquisition software and probes to explore biofeedback therapy.
Strategic Thinking	**MI 3.18** Use patients' SNP profiles to predict how they will respond to particular medicines.
Extended Thinking	**MI 3.19** Use proper laboratory techniques to design and conduct an experiment to test the effectiveness of various sunscreens or types of cloth against UV light using UV sensitive yeast cells.
Extended Thinking	**MI 3.20** Design an experiment to test the effect of relaxation techniques on their heart rate, respiration rate, and skin temperature.
Extended Thinking	**MI 3.21** Design and present a comprehensive rehabilitation plan for an assigned patient.
Extended	**MI 3.22** Research and present cases of human abuse that

Thinking	lead to the regulations governing clinical trials.
Extended Thinking	**MI 3.23** Develop and present a clinical trial proposal to test the safety and efficacy of a nanotechnology-based cancer treatment for an assigned patient.

Indicator #4: How to prevail when organs fail	
Webb's Leveling	Standard and Examples
Recall	**MI 4.1** Create a timeline using Inspiration software chronicling the methods used to diagnose and treat diabetes from the 1800's through today.
Recall	**MI 4.2** Create an evidence board to document the symptoms of a patient.
Recall	**MI 4.3** Describe what diagnostic tests need to be run to determine the cause of a patient's mystery symptoms.
Recall	**MI 4.4** Research the interventions available for patients with ESRD.
Recall	**MI 4.5** View a laparoscopic nephrectomy and outline the general steps of the surgical procedure.
Recall	**MI 4.6** Research a technology being investigated to provide replacement tissues or organs for patients needing a transplant.
Recall	**MI 4.7** Display information about xenotransplantation or tissue engineering using graphic organizers.
Skill/Concept	**MI 4.8** Insert plasmid DNA into bacterial cells in the laboratory and observe how this genetic information relates to new traits of the bacteria.
Skill/Concept	**MI 4.9** Produce a flow chart or graphic organizer that outlines the entire process of protein production and purification.
Skill/Concept	**MI 4.10** Perform general laparoscopic surgical techniques.
Skill/Concept	**MI 4.11** Perform a simulated portion of a kidney transplant surgery.
Skill/Concept	**MI 4.12** Complete a Venn diagram to compare and contrast kidney and heart transplants.
Strategic Thinking	**MI 4.13** Calculate transformation efficiency to determine the success of a laboratory experiment.
Strategic Thinking	**MI 4.14** Create a 3-D model of a protein that demonstrates how amino acids interact.
Strategic Thinking	**MI 4.15** Isolate a protein based on its chemical properties using column chromatography.
Strategic	**MI 4.16** Set up and run protein gel electrophoresis to test the

Thinking	purity of a protein sample.
Strategic Thinking	**MI 4.17** Graph electrophoresis results to determine the molecular weight of an unknown protein.
Strategic Thinking	**MI 4.18** Write a cover letter for a biomedical professional looking for a job in the field of protein production or biomanufacturing.
Strategic Thinking	**MI 4.19** Write a one-page description of which treatment they would recommend for a patient with ESRD.
Strategic Thinking	**MI 4.20** Use the information gathered from blood typing tests and HLA typing to determine which of Diana's relatives is the most appropriate match to be her kidney donor.
Strategic Thinking	**MI 4.21** Design a heart transplant procedure.
Strategic Thinking	**MI 4.22** Design the blueprints for eight replacements and/or enhancements to the human body to create a "super" human.
Strategic Thinking	**MI 4.23** Review and write a reflection on all of the medical interventions encountered throughout the course.
Strategic Thinking	**MI 4.24** Write a reflection on their career aspirations.
Extended Thinking	**MI 4.25** Prepare a computer presentation that details who should receive a donated organ in a given situation.
Extended Thinking	**MI 4.26** Formulate and write arguments from the perspective of different stakeholders as to whether or not further research for xenotransplantation and tissue engineering should be banned.
Extended Thinking	**MI 4.27** Create and present computer presentations that outline the replacements and/or enhancements to create their "super" human.