School District of Marshfield Course Syllabus

Course Name: Medical Interventions PS PLTW
Length of Course: Year
Credit: 1 Credit

Program Goal:

The School District of Marshfield K-12 Science Program will prepare and motivate learners to explore, problem solve and collaborate with their classmates to interpret science and explain the world around them. Learners will acquire knowledge and evidence that promotes creative solutions through the evaluation and understanding of scientific theories and evidence. Learners will collect, analyze and reason with scientific data through investigations that ultimately allow for the generation of scientific explanations. Critical thinking skills will elevate natural curiosity, make sense of scientific data and promote scientific literate citizens.

Course Description:

Medical Interventions (MI) 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.

Common Core State Standards for English Language Arts Anchor Standards (AS)
Reading (R)
• AS.R.1 Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text. • AS.R.2 Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas. • AS.R.6 Assess how point of view or purpose shapes the content and style of a text. • AS.R.7 Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words. • AS.R.8 Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence. • AS.R. 9 Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take. • AS.R.10 Read and comprehend complex literary and informational texts independently and proficiently.
Writing (W)

- AS.W.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
- AS.W.2 Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
- AS.W.3 Write narratives to develop real or imagined experiences or events using effective technique, well- chosen details, and well-structured event sequences.
- AS.W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- AS.W.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.
- AS.W.6 Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
- AS.W.7 Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
- AS.W.8 Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
- AS.W.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
- AS.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

Speaking and Listening (SL)

- AS.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- AS.SL.2 Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
- AS.SL.3 Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.
- AS.SL.4 Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
- AS.SL.5 Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
- AS.SL.6 Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.

Language (L)

- AS.L.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
- AS.L.2 Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
- AS.L.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.
- AS.L.5 Demonstrate understanding of word relationships and nuances in word meanings.
- AS.L.6 Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Common Core State Standards for Mathematics

Quantities (Q)

- N.Q.1 Use units as a way to understand problems and to guide the solution of multistep problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- N.Q.2 Define appropriate quantities for the purpose of descriptive modeling.
- N.Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Seeing Structure in Expression (SSE)

- A.SSE.1 Interpret expressions that represent a quantity in terms of its context.

Creating Equations (CED)

- A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

Reasoning with Equations and Inequalities (REI)

- A.REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
- A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Interpreting Functions (IF)

- F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

Interpreting Categorical and Quantitative Data (ID)

- S.ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).
- S.ID.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

- S.ID.6 Represent data on two quantitative variables on a scatter plot and describe how the variables are related.
- S.ID.6c Fit a linear function for a scatter plot that suggests a linear association.
- S.ID.9 Distinguish between correlation and causation.

Making Inferences and Justifying Conclusion (IC)

- S.IC.1 Understand statistics as a process from making inferences about population parameters based on a random sample from that population.
- S.IC.6 Evaluate reports based on data.

Using Probability to Make Decisions (MD)

- S.MD.5 (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.
- S.MD.5.a Find the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fast- food restaurant.
- S.MD.5.b Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, changes of having a minor or major accident.

National Consortium for Health Science Education

Foundation Standard 1: Academic Foundation: Understand human anatomy, physiology, common diseases and disorders, and medical math principles.

Human Anatomy and Physiology 1:1	1.11 Identify basic levels of organization of the human body. a. Chemical b. Cellular c. Tissue d. Organs e. Systems f. Organism 1.13 Analyze basic structures and functions of human body systems (skeletal, muscular, integumentary, cardiovascular, lymphatic, respiratory, nervous, special senses, endocrine, digestive, urinary, and reproductive). a. Skeletal (bone anatomy, axial and appendicular skeletal bones, functions of bones, ligaments, types of joints) b. Muscular (microscopic anatomy of muscle tissue, types of muscle, locations of skeletal muscles, functions of muscles, tendons, directional movements) c. Integumentary (layers, structures and functions of skin) d. Cardiovascular (components of blood, structures and functions of blood components, structures and functions of the cardiovascular system, conduction system of the heart, cardiac cycle) e. Lymphatic (structures and functions of lymphatic

	system, movement of lymph fluid) f. Respiratory (structures and functions of respiratory system, physiology of respiration) g. Nervous (structures and functions of nervous tissue and system, organization of nervous system) h. Special senses (structures and functions of eye, ear, nose and tongue; identify senses for sight, hearing, smell, taste, touch) i. Endocrine (endocrine versus exocrine, structures and functions of endocrine system, hormones, regulation of hormones) j. Digestive (structures and functions of gastrointestinal tract, chemical and mechanical digestion, structures and functions of accessory organs) k. Urinary (structures and functions of urinary system, gross and microscopic anatomy, process of urine formation, urine composition, homeostatic balance) l. Reproductive (structures and functions of male and female reproductive systems, formation of gametes, hormone production and effects, menstrual cycle, and conception)
Diseases and Disorders 1:2	1.21 Describe common diseases and disorders of each body system (such as: cancer, diabetes, dementia, stroke, heart disease, tuberculosis, hepatitis, COPD, kidney disease, arthritis, ulcers). a. Etiology b. Pathology c. Diagnosis d. Treatment e. Prevention 1.22 Discuss research related to emerging diseases and disorders (such as: autism, VRSA, PTSD, Listeria, seasonal flu). 1.23 Describe biomedical therapies as they relate to the prevention, pathology, and treatment of disease. a. Gene testing b. Gene therapy c. Human proteomics d. Cloning e. Stem cell research
Medical Mathematics 1:3	1.31 Demonstrate competency in basic math skills and mathematical conversions as they relate to healthcare. a. Metric system (such as: centi, milli, kilo) b. Mathematical (average, ratios, fractions, percentages, addition, subtraction, multiplication, division) c. Conversions (height, weight/mass, length, volume, temperature, household measurements) 1.32 Demonstrate the ability to analyze diagrams, charts, graphs, and tables to interpret healthcare results.

Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.	
Concepts of Effective Communication 2:1	2.11 Model verbal and nonverbal communication. 2.12 Identify common barriers to communication. a. Physical disabilities (aphasia, hearing loss, impaired vision) b. Psychological barriers (attitudes, bias, prejudice, stereotyping) 2.13 Identify the differences between subjective and objective information. 2.15 Practice speaking and active listening skills. 2.16 Modify communication to meet the needs of the patient/client and be appropriate to the situation.
Written Communication Skills 2:3	2.31 Utilize proper elements of written and electronic communication (spelling, grammar, and formatting).
Foundation Standard 4: Employability Skills: Use employability skills to enhance employment opportunities and job satisfaction.	
Employability Skills 4:2	4.21 Apply employability skills in healthcare. a. Chain of command b. Correct grammar c. Decision making d. Flexible e. Initiative f. Integrity g. Loyalty h. Positive attitude i. Professional characteristics j. Prompt and prepared k. Responsibility l. Scope of practice m. Teamwork n. Willing to learn
Career Decision-making 4:3	4.31 Research levels of education, credentialing requirements, and employment trends in health professions. 4.32 Distinguish differences among careers within health science pathways (diagnostic services, therapeutic services, health informatics, support services, or biotechnology research and development).
Foundation Standard 6: Ethics: Understand accepted ethical practices with respect to cultural, social, and ethnic differences within the healthcare environment.	
Ethical Practice 6.1	6.11 Differentiate between ethical and legal issues impacting healthcare 6.12 Identify ethical issues and their implications related to healthcare (such as: organ donation, in vitro fertilization, euthanasia, scope of practice, ethics committee).

Cultural, Social, and Ethnic Diversity 6.2	6.21 Discuss religious and cultural values as they impact healthcare (such as: ethnicity, race, religion, gender).
Foundation Standard 7: Safety Practices: Identify existing and potential hazards to clients, co-workers, and self. Employ safe work practices and follow health and safety policies and procedures to prevent injury and illness.	
Infection Control 7:1	7.11 Explain principles of infection control. a. Chain of infection b. Mode of transmission (direct, indirect, vectors, common vehicle [air, food, water], healthcare associated infections [nosocomial], opportunistic) c. Microorganisms (non-pathogenic, pathogenic, aerobic, anaerobic) d. Classifications (bacteria, protozoa, fungi, viruses, parasites) 7.12 Differentiate methods of controlling the spread and growth of microorganisms. a. Aseptic control (antisepsis, disinfection, sterilization, sterile technique) b. Standard precautions c. Isolation precautions d. Blood borne pathogen precautions e. Vaccinations
Common Safety Hazards 7:4	7.41 Observe all safety standards related to the Occupational Exposure to Hazardous Chemicals Standard (Safety Data Sheets (SDSs)). (www.osha.gov) 7.42 Comply with safety signs, symbols, and labels.
Emergency Procedures and Protocols 7:5	7.51 Practice fire safety in a healthcare setting.
Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.	
Healthcare Teams 8:1	8.11 Evaluate roles and responsibilities of team members. a. Examples of healthcare teams b. Responsibilities of team members c. Benefits of teamwork 8.12 Identify characteristics of effective teams. a. Active participation b. Commitment c. Common goals d. Cultural sensitivity e. Flexibility f. Open to feedback g. Positive attitude h. Reliability i. Trust j. Value individual contributions

Team Member Participation 8:2	8.21 Recognize methods for building positive team relationships (such as: mentorships and teambuilding). 8.22 Analyze attributes and attitudes of an effective leader. a. Characteristics (interpersonal skills, focused on results, positive) b. Types (autocratic, democratic, laissez faire) c. Roles (sets vision, leads change, manages accountability) 8.23 Apply effective techniques for managing team conflict (negotiation, assertive communication, gather the facts, clear expectations, mediation).
Foundation Standard 9: Health Maintenance Practices: Differentiate between wellness and disease. Promote disease prevention and model healthy behaviors.	
Healthy Behaviors 9:1	9.11 Promote behaviors of health and wellness (such as: nutrition, weight control, exercise, sleep habits). 9.12 Describe strategies for prevention of disease. a. Routine physical exams b. Medical, dental, and mental health screenings c. Community health education outreach programs d. Immunizations e. Stress management f. Avoid risky behaviors
Foundation Standard 10: Technical Skills: Apply and demonstrate technical skills and knowledge common to health career specialties.	
Technical Skills 10:1	10.11 Apply procedures for measuring and recording vital signs including the normal ranges (temperature, pulse, respirations, blood pressure, pain).
Foundation Standard 11: Information Technology in Healthcare: Apply information technology practices common across health professions.	
Basic Computer Skills 11:3	11.31 Apply basic computer concepts and terminology necessary to use computers and other mobile devices. 11.32 Demonstrate basic computer troubleshooting procedures (such as: restart, check power supply, refresh browser, check settings). 11.33 Demonstrate use of file organization and information storage. 11.34 Identify uses of basic word processing, spreadsheet, and database applications. 11.35 Evaluate validity of web-based resources.

Next Generation Science Standards (NGSS)

From Molecules to Organisms: Structures and Processes

- HS.LS1.1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
- HS.LS1.2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Heredity: Inheritance and Variation of Traits

- HS.LS3.1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
- HS.LS3.2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Biological Evolution: Unity and Diversity

- HS.LS4.2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
- HS.LS4.4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
- HS.LS4.5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Motion and Stability: Forces and Interactions

- HS.PS2.6 Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Waves and Their Applications in Technologies for Information Transfer

- HS.PS4.1 Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

Engineering Design

- HS.ETS1.2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HS.ETS1.3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Engineering Design - Defining and Delimiting Engineering Problems

- DCI - ETS1.A Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (secondary to HS-PS2-3)

From Molecules to Organisms: Structures and Processes - Structure and Function

- DCI - LS1.A Systems of specialized cells within organisms help them perform the essential functions of life. (HS- LS1-1)
- DCI - LS1.A All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1), (Note: This Disciplinary Core Idea is also addressed by HS-LS3-1.)
- DCI - LS1.A Feedback mechanisms maintain a living system’s internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3)

- DCI - LS1.B In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)

Heredity: Inheritance and Variation of Traits - Inheritance of Traits

- DCI - LS3.A Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA . All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)
- DCI - LS3.B In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2)

Biological Evolution: Unity and Diversity - Evidence of Common Ancestry and Diversity

- DCI - LS4.A Genetic information provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. (HS-LS4-1)
- DCI - LS4.B Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. (HS-LS4-2) (HS-LS4-3)
- DCI - LS4.B The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (HS-LS4-3)
- DCI - LS4.C Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in the environment. (HS-LS4-2)
- DCI - LS4.C Adaptation also means that the distribution of traits in a population can change when conditions change. (HS-LS4-3)
- DCI - LS4.C Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline – and sometimes the extinction- of some species. (HS-LS4-5), (HS-LS4-6)

Energy: Definitions of Energy

- DCI - PS3.A At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS-PS3-2), (HS-PS3-3)
- DCI - PS3.A These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated

with the motion of particles and energy associated with configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space (HS-PS3-2)	
Energy: Conservation of Energy and Energy Transfer	
• DCI - PS3.B Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1), (HS-PS3-4)	
Waves and Their Applications in Technologies for Information Transfer	
• DCI - PS4.A The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. (HS-PS4-1) • DCI - PS4.B When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy (heat). Shorter wavelength electromagnetic radiation (ultraviolet, X-rays, gamma rays) can ionize atoms and case damage to living cells (HS-PS4-4) • DCI - PS4.C Multiple technologies based on the understanding of waves and their interactions with matter are part of everyday experiences in the modern world (e.g., medical imaging, communications, scanners) and in scientific research. They are essential tools for producing, transmitting, and capturing signals and for storing and interpreting the information contained in them. (HS-PS4-5)	
Asking questions and defining problems	
Science and Engineering Practices	• Ask questions o - that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information. o - that arise from examining models or a theory, to clarify and/or seek additional information and relationships. o - to determine relationships, including quantitative relationships, between independent and dependent variables. o - to clarify and refine a model, an explanation, or an engineering problem. • Evaluate a question to determine if it is testable and relevant. • Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design. • Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations.
Developing and Using Models	
Science and Engineering Practices	• Design a test of a model to ascertain its reliability. • Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system. • Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations. • Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.
Planning and Carrying Out Investigations	

Science and Engineering Practices	• Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled. • Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. • Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts. • Select appropriate tools to collect, record, analyze, and evaluate data. Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.
Analyzing and Interpreting Data	
Science and Engineering Practices	• Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. • Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
Using Mathematics and Computational Thinking	
Science and Engineering Practices	• Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system. • Apply techniques of algebra and functions to represent and solve scientific and engineering problems. • Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m^3, acre-feet, etc.)
Constructing Explanations and Designing Solutions	
Science and Engineering Practices	• Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables. • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. • Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. • Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

	• Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
Engaging in Argument from Evidence	
Science and Engineering Practices	• Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments. • Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence. • Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.
Obtaining, Evaluating, and Communicating Information	
Science and Engineering Practices	• Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. • Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem. • Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source. • Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible.
Patterns	
Crosscutting Concepts	• Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.
Energy and Matter: Flows, Cycles, and Conservation	
Crosscutting Concepts	• Energy cannot be created or destroyed- only moves between one place and another place, between objects and/or fields, or between systems.
Scale, Proportion, and Quantity	
Crosscutting Concepts	• Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth).
Systems and System Models	
Crosscutting Concepts	• A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. • Systems can be designed to do specific tasks. • Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. • Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models.
Structure and Function	

Crosscutting Concepts	• The way an object is shaped or structured determines many of its properties and functions. • The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.
Stability and Change	
Crosscutting Concepts	• Much of science deals with constructing explanations of how things change and how they remain stable. • Feedback (negative or positive) can stabilize or destabilize a system.

Key Vocabulary:			
Medical Intervention	cancer	vaccination	Physical Therapy
Occupational Therapy	clinical trial	Antibiotic Resistance	antigen
oncogene	DNA Microarray	Bioinformatics	Epidemiology
Bacterial Transformation Conjugation	Bacterial Transformation Transduction	Diagnostic Imaging	cochlear implant
gene therapy	double blind study	chemotherapy	genetic testing
FDA	cohort study	herd immunity	genetic counseling
ELISA	antibody	marker analysis	enzyme
gel electrophoresis	nanotechnology	genetic engineering	single blind study
pathogen	outbreak	genetic marker	PCR
plasmid	risk factor	radiology	recombinant DNA
vector	serial dilution	virology	

Topics/Content Outline- Units and Themes:

Unit 1: How to Fight Infection

- 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's in your Genes

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

Unit 3: How to Conquer Cancer

- 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

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

Primary Resource(s):
Project Lead The Way Medical Interventions Program