



Medical Interventions Syllabus – 2023-24

Course Description

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 a 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.

Course Content

Unit One – How to Fight Infection

Sue Smith is a college freshman who is presenting symptoms of an unknown infectious disease, which you will need to identify. Sue survives the infection but is left with hearing impairment. Through this case, you 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.

Unit Two – How to Screen What Is In Your Genes

Mr. and Mrs. Smith – Sue Smith's parents - are very excited because they just found 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, you 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 Three – How to Conquer Cancer

Mike Smith – Sue's brother - is diagnosed with osteosarcoma, a type of bone cancer that often affects teenagers. Mike's treatments put him into remission; in order to remove all of the cancerous tissue, he had to have most of his arm amputated and he needs a prosthesis. Through this case, you 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 Four – How to Prevail When Organs Fail

Mrs. Diana Jones, the 40-year-old sister of Mrs. Smith, has been struggling with Type 1 Diabetes Mellitus 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, and now Diana is experiencing some strange symptoms. Through this case, students will explore protein production, blood sugar regulation, dialysis, organ donation and transplantation, non-invasive surgery techniques, as well as creation of a bionic human.

Course Goals

Students will:

- think critically and problem solve
- write scientifically and analyze scientific writing
- master technology skills including internet, presentation & spreadsheet software, and other computer programs • master relevant lab skills using proper lab equipment
- use proper medical terminology
- gain a deeper understanding of the Biomedical Sciences field including content and career aspects.

Required Course Materials

- Three ring binder with tabbed dividers
- Pen/Pencil

Course Policies

Attendance / Absences / Makeup Work

Regardless of the reason for an absence, you will be allowed 2 days to complete your missing work. You will be expected to check google classroom for assignments and any work you missed during your absence.

Assignments due the day of an absence are due the day you return to class or will be given a late grade.

Take responsibility for your work - it is up to YOU to get your make up work - not for me to give it to you.

Classroom Rules / Expectations

You are expected to arrive each day on time, prepared and ready for learning, to act responsibly and contribute to an orderly, creative and positive learning environment, and to follow the behavior guidelines outlined in the school handbook.

BE RESPECTFUL

BE RESPONSIBLE

BE PREPARED

Assignment Policy

Most class assignments will be submitted online using the course google classroom. Other assignments may be handwritten or printed in order to submit. Late work will receive only partial credit, and you are expected to keep up-to-date on your work and be aware of all due dates. Cheating will not be tolerated and will result in a zero on that assignment (for both the copier and anyone who allows the other to copy). Same goes for ChatGPT.

I am available most days after school. If you need help, we can set up a google meet. Let me know that you need help and we'll make it work!

Grading Policy & Distribution

- Unit / Lesson Tests/ Labs: 70%
- Quizzes/Assignments: 25%
- Homework: 5%

A= 90-100

B = 80-89

C = 70-79

D = 65-69

F = 64 & below

Attendance Failure = 40

Congratulations on making it to the 3rd and final course in the Health Sciences Pathway! Let's have a fantastic senior year!

9.3 – Career & Technical Education (CTE)

Content Area: 21st Century Life and Careers

CONTENT AREA:	9.3 CAREER AND TECHNICAL EDUCATION
HEALTH SCIENCE CAREER CLUSTER*	
Number	Standard Statement
<i>At the end of Grade 12, Career and Technical Education Program completers will be able to:</i>	
CAREER CLUSTER*:	HEALTH SCIENCE (HL)
9.3.HL.1	Determine academic subject matter, in addition to high school graduation requirements, necessary for pursuing a health science career.
9.3.HL.2	Explain the healthcare workers' role within their department, their organization and the overall healthcare system.
9.3.HL.3	Identify existing and potential hazards to clients, coworkers, visitors and self in the healthcare workplace.
9.3.HL.4	Evaluate the roles and responsibilities of individual members as part of the healthcare team and explain their role in promoting the delivery of quality health care.
9.3.HL.5	Analyze the legal and ethical responsibilities, limitations and implications of actions within the healthcare workplace.
9.3.HL.6	Evaluate accepted ethical practices with respect to cultural, social and ethnic differences within the healthcare workplace.
PATHWAY:	BIOTECHNOLOGY RESEARCH & DEVELOPMENT (HL-BRD)
9.3.HL-BRD.1	Summarize the goals of biotechnology research and development within legal and ethical protocols.
9.3.HL-BRD.2	Apply the fundamentals of biochemistry, cell biology, genetics, mathematical concepts, microbiology, molecular biology, organic chemistry and statistics to conduct effective biotechnology research and development of products.
9.3.HL-BRD.3	Demonstrate basic knowledge of recombinant DNA, genetic engineering, bioprocessing, monoclonal antibody production, nanotechnology, bioinformatics, genomics, proteomics and transcriptomics to conduct biotechnology research and development.
9.3.HL-BRD.4	Demonstrate the principles of solution preparation, sterile techniques, contamination control, and measurement and calibration of instruments used in biotechnology research.
9.3.HL-BRD.5	Determine processes for product design and production and how that work contributes to an understanding of the biotechnology product development process.
9.3.HL-BRD.6	Summarize and explain the larger ethical, moral and legal issues related to biotechnology research, product development and use in society.

9.3 – Career & Technical Education (CTE)

Content Area: 21st Century Life and Careers

CONTENT AREA:	9.3 CAREER AND TECHNICAL EDUCATION
HEALTH SCIENCE CAREER CLUSTER*	
Number	Standard Statement
PATHWAY:	DIAGNOSTIC SERVICES (HL-DIA)
9.3.HL-DIA.1	Communicate key diagnostic information to healthcare workers and patients in an accurate and timely manner.
9.3.HL-DIA.2	Assess and report patient's/client's health status in order to monitor and document patient progress.
9.3.HL-DIA.3	Demonstrate the principles of body mechanics for positioning, transferring and transporting of patients/clients, and perform them without injury to the patient/client or self.
9.3.HL-DIA.4	Explain procedures and goals to the patient/client accurately and effectively, using strategies to respond to questions and concerns.
9.3.HL-DIA.5	Select, demonstrate and interpret diagnostic procedures.
PATHWAY:	HEALTH INFORMATICS (HL-HI)
9.3.HL-HI.1	Communicate health information accurately and within legal and regulatory guidelines, upholding the strictest standards of confidentiality.
9.3.HL-HI.2	Describe the content and diverse uses of health information.
9.3.HL-HI.3	Demonstrate the use of systems used to capture, retrieve and maintain confidential health information from internal and external sources.
PATHWAY:	SUPPORT SERVICES (HL-SUP)
9.3.HL-SUP.1	Describe, differentiate and safely perform the responsibilities of healthcare support services roles.
9.3.HL-SUP.2	Demonstrate work practices that maintain a clean and healthy healthcare facility to reduce or eliminate pathogenic organisms.
9.3.HL-SUP.3	Follow established internal and external guidelines in order to provide high-quality, effective support services in the healthcare facility.
9.3.HL-SUP.4	Maximize available resources for proper care and use of healthcare equipment and materials.
9.3.HL-SUP.5	Implement healthcare facility standards in order to maintain high-quality healthcare facilities.

PATHWAY:	THERAPEUTIC SERVICES HL-THR
9.3.HL-THR.1	Utilize communication strategies to answer patient/client questions and concerns on planned procedures and goals.

**9.3 – Career & Technical Education (CTE)
Content Area: 21st Century Life and Careers**

CONTENT AREA:	9.3 CAREER AND TECHNICAL EDUCATION
HEALTH SCIENCE CAREER CLUSTER*	
Number	Standard Statement
9.3.HL-THR.2	Communicate patient/client information among healthcare team members to facilitate a team approach to patient care.
9.3.HL-THR.3	Utilize processes for assessing, monitoring and reporting patient's/clients' health status to the treatment team within protocol and scope of practice.
9.3.HL-THR.4	Evaluate patient/client needs, strengths and problems in order to determine if treatment goals are being met.

Next Generation Science Standards

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.

Unit 1 Unit 2 Unit 3 Unit 4

HS.LS1.3

Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Unit 1 Unit 2 Unit 3 Unit 4

HS.LS1.6

Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

Unit 1 Unit 2 Unit 3 Unit 4

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.

Unit 1 Unit 2 Unit 3 Unit 4

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.

Unit 1 Unit 2 Unit 3 Unit 4

HS.LS3.3

Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Unit 1 Unit 2 Unit 3 Unit 4

Disciplinary core ideas

LS1.A From Molecules to Organisms: Structures and Processes - Structure and Function

• Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

Unit 1 Unit 2 Unit 3 Unit 4

Next Generation Science Standards

- 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.)

Unit 1 Unit 2 Unit 3 Unit 4

- Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

Unit 1 Unit 2 Unit 3 Unit 4

- 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)

Unit 1 Unit 2 Unit 3 Unit 4

LS3.A Heredity: Inheritance and Variation of Traits - Inheritance of Traits

- 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)

Unit 1 Unit 2 Unit 3 Unit 4

LS4.A Biological Evolution: Unity and Diversity - Evidence of Common Ancestry and Diversity

- 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)

Unit 1 Unit 2 Unit 3 Unit 4

Next Generation Science Standards

Science and Engineering Practice

Practice 1 - Asking questions and defining problems in 9-12 builds on K-8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Ask questions

- that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.
- that arise from examining models or a theory, to clarify and/or seek additional information and relationships.
- to determine relationships, including quantitative relationships, between independent and dependent variables.
- to clarify and refine a model, an explanation, or an engineering problem.

Unit 1 Unit 2 Unit 3 Unit 4

- Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.

Unit 1 Unit 2 Unit 3 Unit 4

Practice 2 Developing and Using Models

Modeling in 9-12 builds on K-8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- 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.

Unit 1 Unit 2 Unit 3 Unit 4

- 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.

Unit 1 Unit 2 Unit 3 Unit 4

- Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Unit 1 Unit 2 Unit 3 Unit 4

Next Generation Science Standards

Practice 3 Planning and Carrying Out Investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- 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.

Unit 1 Unit 2 Unit 3 Unit 4

- Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.

Unit 1 Unit 2 Unit 3 Unit 4

- 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.

Unit 1 Unit 2 Unit 3 Unit 4

Practice 4 Analyzing and Interpreting Data

Analyzing data in 9-12 builds on K-8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- 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.

Unit 1 Unit 2 Unit 3 Unit 4

- 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.

Unit 1 Unit 2 Unit 3 Unit 4

- Evaluate the impact of new data on a working explanation and/or model of a proposed process or system.

Unit 1 Unit 2 Unit 3 Unit 4

Practice 5 Using Mathematics and Computational Thinking

Mathematical and computational thinking in 9- 12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.

Unit 1 Unit 2 Unit 3 Unit 4

Next Generation Science Standards

- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.

Unit 1 Unit 2 Unit 3 Unit 4

- 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/m³, acre-feet, etc.)

Unit 1 Unit 2 Unit 3 Unit 4

Practice 6 Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9-12 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.

Unit 1 Unit 2 Unit 3 Unit 4

- 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.

Unit 1 Unit 2 Unit 3 Unit 4

- 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.

Unit 1 Unit 2 Unit 3 Unit 4

- 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.

Unit 1 Unit 2 Unit 3 Unit 4

Practice 7 Engaging in Argument from Evidence

- Compare and evaluate competing arguments or design solutions in light of currently accepted explanations, new evidence, limitations (e.g., trade-offs), constraints, and ethical issues.

Unit 1 Unit 2 Unit 3 Unit 4

- Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Unit 1 Unit 2 Unit 3 Unit 4

- Respectfully provide and/or receive critiques on scientific arguments by probing reasoning and evidence, challenging ideas and conclusions, responding thoughtfully to diverse perspectives, and determining additional information required to resolve contradictions.

Unit 1 Unit 2 Unit 3 Unit 4

Next Generation Science Standards

- Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Unit 1 Unit 2 Unit 3 Unit 4

- 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.

Unit 1 Unit 2 Unit 3 Unit 4

- Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and/or logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations).

Unit 1 Unit 2 Unit 3 Unit 4

Practice 8 Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in 9-12 builds on K-8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.

- 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.

Unit 1 Unit 2 Unit 3 Unit 4

- 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.

Unit 1 Unit 2 Unit 3 Unit 4

- Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Unit 1 Unit 2 Unit 3 Unit 4

- 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. Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Unit 1 Unit 2 Unit 3 Unit 4

Crosscutting Concepts

Patterns

- Patterns of performance of designed systems can be analyzed and interpreted to reengineer and improve the system.

Unit 1 Unit 2 Unit 3 Unit 4

Next Generation Science Standards

Cause and Effect: Mechanism and Prediction

- Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

Unit 1 Unit 2 Unit 3 Unit 4

- Systems can be designed to cause a desired effect.

Unit 1 Unit 2 Unit 3 Unit 4

- Changes in systems may have various causes that may not have equal effects.

Unit 1 Unit 2 Unit 3 Unit 4

Scale, Proportion, and Quantity

- 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).

Unit 1 Unit 2 Unit 3 Unit 4

Systems and System Models

- Systems can be designed to do specific tasks.

Unit 1 Unit 2 Unit 3 Unit 4

Stability and Change

- Feedback (negative or positive) can stabilize or destabilize a system.

Unit 1 Unit 2 Unit 3 Unit 4



Medical Interventions

Dr. Valerie Daniluk
PLTW Biomedical Science Teacher
Lakewood High School

Students...

I have read and understand all information contained in this syllabus. I will adhere to all procedures, policies, rules, and regulations of the class, the school, and the school system. I will be an active and productive member of class and will do my best to ensure that I am making the best decisions and doing all that I can to help myself and my classmates succeed.

Student name (print): _____

Student name (sign): _____

Parents / Guardians...

I have read and understand all information contained in this syllabus. I will be an active member of my child's education and do all that I can to help him/her succeed.

Parent / Guardian Name(s) (print): _____

Parent / Guardian Name(s) (sign): _____

Phone number(s): _____

E-mail address: _____

Feel free to add any comments or additional information on the back of this paper.