Spokane Public Schools
Medical Intervention PLTW Year 3

Course: Medical Intervention		**Total Framework Hours up to: 180 hours**
CIP Code: 510717	☐ **Exploratory** ☒ **Preparatory**	**Date Last Modified: 10/2/15**
Career Cluster: Health Science		**Cluster Pathway: Biotechnology Research and Development**

Unit 1: How to Fight Infection

This unit is divided into four lessons
Total Learning Hours for Unit: 50 hours

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.

Leadership:

- Students will be instructed in how to effectively work in teams. Students will have the opportunity to work in teams and practice team-building throughout this course.
- Students will create, manage and produce projects to submit to the Spokane STEMposium competition.

21st Century Skills:

Creativity and Innovation
Think Creatively
Work Creatively with Others
Implement Innovations

Critical Thinking and Problem Solving
Reason Effectively
Use Systems Thinking
Make Judgments and Decisions
Solve Problems

Communication and Collaboration
Communicate Clearly
Collaborate with Others

Information Literacy
Access and /evaluate Information
Use and Manage Information

Media Literacy
Analyze Media
Create Media Products

Information, Communications and Technology (ICT Literacy)
Apply Technology Effectively

Initiative and Self-Direction
Manage Goals and Time
Work Independently
Be Self-Directed Learners

Social and Cross-Cultural
Interact Effectively with Others
Work Effectively in Diverse Teams

Productivity and Accountability
Manage Projects
Produce Results

Leadership and Responsibility
Guide and Lead Others
Be Responsible to Others

Lesson 1.1 Mystery Infection

Performance Assessments:
DNA Computer Analysis Project
Lab- ELISA
DNA Sequencing of Data for Diagnosis
Portfolio Assignment
Quizzes and tests
Concept mapping

Standards and Competencies

1. Medical Interventions help maintain health and homeostasis in the body.
2. A variety of methods can be used to detect and/or identify infectious agents.

Standards and Benchmarks: (knowledge and skills addressed)

1. Recognize that medical interventions are measures to improve health or alter the course of an illness and can be used to prevent, diagnose, and treat disease.
2. Describe how bioinformatics, the collection, classification, storage, and analysis of biochemical and biological information using computers, can be used to identify disease pathogens.
3. Describe the application of bioinformatics in health and wellness
4. Recognize that diagnostic tests for infectious diseases can provide qualitative results, indicating the presence or absence of disease, as well as quantitative results, indicating the concentration of the infectious agent or of an antibody produced in response to the disease agent.
5. Explain the principles of the Enzyme-linked Immunosorbent Assay (ELISA) test and describe how antibodies can be used to detect disease.

6. Analyze connections between individuals in a disease outbreak.
7. Use publically available molecular databases to search for DNA sequences and identify pathogens.
8. Compare serial dilutions and calculate resultant concentrations.
9. Perform ELISA testing to determine the concentration of infectious bacteria in simulated body fluids and identify infected patients.

Lesson 1.2 Antibiotic Treatment

Performance Assessments:
Exploring the Effects of Antibiotics – Project Lab – Bacterial DNA Transformation
Lab – Antibiotic Resistance
Quizzes and Tests
Concept Mapping
Graphing

Standards and Competencies

1. Antibodies disrupt the pathways that bacteria use to survive.
2. Bacterial cells use multiple pathways to gain resistance to antibiotics.

Standards and Benchmarks: (knowledge and skills addressed)

1. Label the structures of a bacterial cell.
2. Explain the method of action for different classes of antibodies.
3. Describe the pathways through which bacterial cells transfer genes.
4. Explain the importance of taking antibiotics as prescribed.
5. Use proper laboratory techniques to “mate” a streptomycin resistance strain of E. coli with an ampicillin resistant strain of E. coli.
6. Simulate the effects of antibiotics on a bacterial population during an infection.
7. Simulate the effect of a missed dose of antibodies on a bacterial population during an infection.

Lesson 1.3 The Aftermath: Hearing Loss

Performance Assessments:
Create 3- D Model of the human ear
Hearing Assessment Project
Career Project
Presentation
Quizzes and Tests
Portfolio Assignment

Standards and Competencies

1. Problems with one or more structures within the ear cause various types of hearing loss.
2. There are a variety of interventions available to help people with hearing loss.

Standards and Benchmarks: (knowledge and skills addressed)

1. Identify the structures of the ear and describe their function in hearing.
2. Describe the pathway of sound vibrations from the time a sound is generated to the time the brain registers the sound.
3. Recognize that there are bioethical concerns and considerations related to the use of cochlear implant technology.
4. Demonstrate sensorineural versus conductive hearing loss on a model of the ear.

5. Perform several simple tests, such as Rinne Test and the Pure Tone Test, to evaluate hearing.
6. Interpret audiograms to identify different types of hearing loss.
7. Recommend the most appropriate type of intervention for a patient with hearing loss, given the patient's audiogram.

Lesson 1.4 Vaccination

Performance Assessments:
Vaccination Schedule Project
Paper Plasmid Project
Career Project
Concept Mapping
Quizzes and Tests

Standards and Competencies

1. Vaccines are medical interventions that activate the immune system to recognize a disease antigen and produce antibodies necessary to defend the body.
2. Vaccines can be produced in the laboratory by various methods, including recombinant DNA techniques.
3. Epidemiologists are dedicated medical professionals at the heart of the public health field who monitor the health of human populations, search for patterns in the development of both infectious and chronic illnesses, assist in outbreak investigations, and design disease treatment and prevention strategies.

Standards and Benchmarks: (knowledge and skills addressed)

1. Describe how vaccines interact with the human immune system.
2. Recognize that many diseases have been eradicated by large-scale vaccination campaigns.
3. Describe the various laboratory methods that are used to manufacture vaccines.
4. Recognize that plasmids can be employed as an important tool in genetic engineering and can serve as vectors, vehicles for the movement of genetic information.
5. Explain how molecular tools such as ligase and restriction enzymes are used to cut and paste DNA from different sources.
6. Describe how recombinant DNA technology can be used to produce vaccines.
7. Identify the appropriate steps in an outbreak investigation.
8. Assume the role of an epidemiologist to analyze disease data, design an epidemiologic study, and evaluate prevention and therapy for chronic and infectious diseases.

Common Core State Standards for English Language Arts

AS.R.1 - Reading
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 - Reading
Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas. AS.R.7 - Reading
Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

AS.R.7 - Reading
Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

AS.R.8 - Reading
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 - Reading
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 - Reading
Read and comprehend complex literary and informational texts independently and proficiently.

AS.W.1 - Writing
Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

AS.W.2 - Writing
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 - Writing
Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.

AS.W.4 - Writing
Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

AS.W.6 - Writing
Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

AS.W.7 - Writing
Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

AS.W.8 - Writing
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 - Writing
Draw evidence from literary or informational texts to support analysis, reflection, and research.

AS.W.10 - Writing
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.

AS.SL.1 - Speaking and Listening

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 - Speaking and Listening
Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

AS.SL.4 - Speaking and Listening
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.6 - Speaking and Listening
Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.

AS.L.1 - Language
Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

AS.L.2 - Language
Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

AS.L.4 - Language
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 - Language
Demonstrate understanding of word relationships and nuances in word meanings.

AS.L.6 - Language
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

N.Q .2 - Quantities
Define appropriate quantities for the purpose of descriptive modeling.

N.Q .3 - Quantities
Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

A.CED.1 - Creating Equations
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.

A.REI.3 - Reasoning with Equations and Inequalities
Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

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

S.ID.1 - Interpreting Categorical and Quantitative Data
Represent data with plots on the real number line (dot plots, histograms, and box plots).

S.ID.6 - Interpreting Categorical and Quantitative Data
Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

S.ID.6.c - Interpreting Categorical and Quantitative Data
Fit a linear function for a scatter plot that suggests a linear association.

S.IC.6 - Making Inferences and Justifying Conclusions
Evaluate reports based on data.

National Health Science

1.11 Foundation Standard 1: Academic Foundation: Understand human anatomy, physiology, common diseases and disorders, and medical math principles.
Identify basic levels of organization of the human body
a. Chemical
b. Cellular
c. Tissue
d. Organs
e. Systems
f. Organism

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

1.21 Foundation: Standard 1: Academic Foundation: Understand human anatomy, physiology, common diseases and disorders, and medical math principles.
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 Foundation: Standard 1: Academic Foundation: Understand human anatomy, physiology, common diseases and disorders, and medical math principles.
Discuss research related to emerging diseases and disorders (such as: autism, VRSA, PTSD, Listeria, seasonal flu).

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

1.31 Foundation: Standard 1: Academic Foundation: Understand human anatomy, physiology, common diseases and disorders, and medical math principles.
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 Foundation: Standard 1: Academic Foundation: Understand human anatomy, physiology, common diseases and disorders, and medical math principles.
Demonstrate the ability to analyze diagrams, charts, graphs, and tables to interpret healthcare results.

2.11 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Model verbal and nonverbal communication.

2.12 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Identify common barriers to communication.
a. Physical disabilities (aphasia, hearing loss, impaired vision)
b. Psychological barriers (attitudes, bias, prejudice, stereotyping)

2.13 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Identify the differences between subjective and objective information.

2.15 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Practice speaking and active listening skills.

2.16 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Modify communication to meet the needs of the patient/client and be appropriate to the situation.

2.31 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Utilize proper elements of written and electronic communication (spelling, grammar, and formatting).

4.21 Foundation Standard 4: Employability Skills: Utilize employability skills to enhance employment opportunities and job satisfaction
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

4.31 Foundation Standard 4: Employability Skills: Utilize employability skills to enhance employment opportunities and job satisfaction
Research levels of education, credentialing requirements, and employment trends in health professions.

4.32 Foundation Standard 4: Employability Skills: Utilize employability skills to enhance employment opportunities and job satisfaction
Distinguish differences among careers within health science pathways (diagnostic services, therapeutic services, health informatics, support services, or biotechnology research and development).

6.11 Foundation Standard 6: Ethics: Understand accepted ethical practices with respect to cultural, social, and ethnic differences within the healthcare environment.
Differentiate between ethical and legal issues impacting healthcare.

6.21 Foundation Standard 6: Ethics: Understand accepted ethical practices with respect to cultural, social, and ethnic differences within the healthcare environment.
Discuss religious and cultural values as they impact healthcare (such as: ethnicity, race, religion, gender).

7.11 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.
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 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.
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

7.41 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.
Observe all safety standards related to the Occupational Exposure to Hazardous Chemicals Standard (Safety Data Sheets (SDSs)). (www.osha.gov)

7.42 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.
Comply with safety signs, symbols, and labels.

7.51 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.
Practice fire safety in a healthcare setting.

8.11 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
Evaluate roles and responsibilities of team members.
a. Examples of healthcare teams
b. Responsibilities of team members
c. Benefits of teamwork

8.12 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
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

8.21 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
Recognize methods for building positive team relationships (such as: mentorships and teambuilding).

8.22 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
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 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
Apply effective techniques for managing team conflict (negotiation, assertive communication, gather the facts, clear expectations, mediation).

9.11 Foundation Standard 9: Health Maintenance Practices: Differentiate between wellness and disease. Promote disease prevention and model healthy behaviors.
Promote behaviors of health and wellness (such as: nutrition, weight control, exercise, sleep habits).

9.12 Foundation Standard 9: Health Maintenance Practices: Differentiate between wellness and disease. Promote disease prevention and model healthy behaviors.

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

11.31 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions. Apply basic computer concepts and terminology necessary to use computers and other mobile devices.

11.32 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions.
Demonstrate basic computer troubleshooting procedures (such as: restart, check power supply, refresh browser, check settings).

11.33 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions.
Demonstrate use of file organization and information storage.

11.34 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions.
Identify uses of basic word processing, spreadsheet, and database applications.

11.35 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions.
Evaluate validity of web-based resources.

Next Generation Science Standards

HS.PS4.1 - Waves and Their Applications in Technologies for Information Transfer
Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

HS.LS1.1 - From Molecules to Organisms: Structures and Processes
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 - From Molecules to Organisms: Structures and Processes
Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS.LS4.2 - Biological Evolution: Unity and Diversity

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 - Biological Evolution: Unity and Diversity
Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS.LS4.5 - Biological Evolution: Unity and Diversity
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.

DCI - PS3.A - Energy - Definitions of Energy
At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HSPS3-2), (HS-PS3-3)

DCI - PS3.A - Energy - Definitions of Energy
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 the 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)

DCI - PS3.B - Energy - Conservation of Energy and Energy Transfer
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)

DCI - PS4.A - Waves and Their Applications in Technologies for Information Transfer - Wave Properties
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 - 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)

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

DCI - 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)

DCI - 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)

DCI - LS4.B - Biological Evolution: Unity and Diversity - Natural Selection
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 - Biological Evolution: Unity and Diversity - Natural Selection
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 - Biological Evolution: Unity and Diversity - Adaptation
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 that environment. (HS-LS4-2)

DCI - LS4.C - Biological Evolution: Unity and Diversity - Adaptation
Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (HS-LS4-3), (HS-LS4-4)

DCI - LS4.C - Biological Evolution: Unity and Diversity - Adaptation
Adaptation also means that the distribution of traits in a population can change when conditions change. (HS-LS4-3)

DCI - LS4.C - Biological Evolution: Unity and Diversity - Adaptation
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)

Science and Engineering Practice - Asking questions and defining problems
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.

Science and Engineering Practice - Asking questions and defining problems
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.

Science and Engineering Practice - Developing and Using Models
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.

Science and Engineering Practice - Developing and Using Models
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.

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

Science and Engineering Practice - Analyzing and Interpreting 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.

Science and Engineering Practice - Analyzing and Interpreting Data
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.

Science and Engineering Practice - Using Mathematics and Computational Thinking
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.)

Science and Engineering Practice - Using Mathematics and Computational Thinking
Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system.

Science and Engineering Practice - Constructing Explanations and Designing Solutions
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.

Science and Engineering Practice - Constructing Explanations and Designing Solutions
Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions
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.

Science and Engineering Practice - Constructing Explanations and Designing Solutions
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.

Science and Engineering Practice - Engaging in Argument from Evidence
Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence
Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from 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.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information
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.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information
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.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information
Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information
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).

Crosscutting Concepts - Patterns
Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction
Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction
Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - 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).

Crosscutting Concepts - Systems and System Models
A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Systems and System Models
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.

Crosscutting Concepts - Systems and System Models
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.

Crosscutting Concepts - Energy and Matter: Flows, Cycles, and Conservation
Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems.

Crosscutting Concepts - Structure and Function
The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function
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.

Crosscutting Concepts - Stability and Change
Much of science deals with constructing explanations of how things change and how they remain stable.

Unit 2: How To Screen What Is In Your Genes

This unit is divided into two lessons
Total Learning Hours for Unit: 30 hours

Students are introduced to Mr. and Mrs. Smith, the head of the Smith family. Mr. and Mrs. Smith are very excited because they just found out they are expecting a new baby. Because the couple is in their early 40's, 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.

Leadership:

- Students will brainstorm and work in teams to analyze, discuss, and debate personal and community health-related issues.
- Students will create, manage and produce projects to submit to the Spokane STEMposium competition.

21st Century Skills:

Creativity and Innovation
Think Creatively
Work Creatively with Others

Critical Thinking and Problem Solving
Reason Effectively
Use Systems Thinking
Make Judgments and Decisions
Solve Problems

Communication and Collaboration
Communicate Clearly
Collaborate with Others

Information Literacy
Access and /evaluate Information
Use and Manage Information

Media Literacy
Analyze Media

Flexibility and Adaptability
Adapt to Change
Be Flexible

Initiative and Self-Direction
Manage Goals and Time
Work Independently
Be Self-Directed Learners

Social and Cross-Cultural
Interact Effectively with Others
Work Effectively in Diverse Teams

Lesson 2.1 Genetic Testing and Screening

Performance Assessments:
Career Project
Molecular Biology of DNA
Amplification by PCR – Lab
Using a Single Nucleotide Polymorphism (SNP) to Predict Bitter Tasting Ability – LAB
Quizzes and Tests
Observations

Standards and Competencies

1. Genetic testing is the use of molecular methods to determine if someone has a genetic disorder, will develop one, or is a carrier of a genetic illness and involves sampling a person's DNA and examining the chromosomes or genes for abnormalities.
2. Genetic counseling can help a family understand the risks of having a child with a genetic disorder, the medical facts about an already diagnosed condition, and other information necessary for a person or a couple to make decisions suitable to their cultural, religious, and moral beliefs.
3. Proper prenatal care and monitoring of the fetus are vital to maternal and child health during a pregnancy.

Standards and Benchmarks: (knowledge and skills addressed)

1. Recognize that the polymerase chain reaction (PCR) is a laboratory procedure that produces multiple copies of a specific DNA sequence.
2. Explain how single base pair changes called single nucleotide polymorphisms (SNPs) can be identified through genetic testing and often correlate to specific diseases or traits.
3. Describe proper prenatal care and the medical interventions that function to monitor a pregnancy.
4. Compare the process of amniocentesis and chorionic villus sampling.
5. Analyze a genetic counseling case file and provide feedback regarding potential genetic outcomes.
6. Use laboratory techniques such as DNA extraction, PCR, and restriction analysis to identify single base pair differences in DNA.
7. Analyze genetic testing results to predict phenotype.
8. Analyze a karyotype.

Lesson 2.2 Our Genetic Future

Performance Assessments:
Concept Mapping
Computerized Assessment
Essay prompts
Discussion
Quizzes and tests

Standards and Competencies

1. Gene therapy is a type of disease treatment in which faulty genes are replaced by functional copies.
2. Advances in reproductive technology open many moral, ethical, and scientific debates.

Standards and Benchmarks: (knowledge and skills addressed)

1. Explain how gene therapy can treat a genetic disorder.
2. Recognize that various vectors, including viruses, can be used to transfer DNA into human cells.
3. Explain how both sperm sorting and embryo selection by preimplantation genetic diagnosis (PDG) provide parents the option to select the gender of a child.
4. Outline the process of reproductive cloning.
5. Debate the safety and overall effectiveness of gene therapy.

6. Defend an argument governing future gene therapy research.

Common Core State Standards for English Language Arts

AS.R.1 - Reading
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 - Reading
Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas. AS.R.7 - Reading
Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

AS.R.7 - Reading
Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

AS.R.8 - Reading
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 - Reading
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 - Reading
Read and comprehend complex literary and informational texts independently and proficiently.

AS.W.1 - Writing
Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

AS.W.2 - Writing
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 - Writing
Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.

AS.W.4 - Writing
Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

AS.W.5 - Writing
Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.

AS.W.6 - Writing
Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

AS.W.7 - Writing
Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

AS.W.8 - Writing
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 - Writing
Draw evidence from literary or informational texts to support analysis, reflection, and research.

AS.W.10 - Writing
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.

AS.SL.1 - Speaking and Listening
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 - Speaking and Listening
Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

AS.SL.3 - Speaking and Listening
Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

AS.SL.4 - Speaking and Listening
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 - Speaking and Listening
Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

AS.SL.6 - Speaking and Listening
Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.

AS.L.1 - Language
Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

AS.L.2 - Language
Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

AS.L.4 - Language
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.

Common Core State Standards for Mathematics

S.IC.6 - Making Inferences and Justifying Conclusions
Evaluate reports based on data.

S.MD.5 - Using Probability to Make Decisions
(+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.

S.MD.5.a - Using Probability to Make Decisions
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 - Using Probability to Make Decisions
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, chances of having a minor or a major accident.

National Health Science

1.11 Foundation Standard 1: Academic Foundation: Understand human anatomy, physiology, common diseases and disorders, and medical math principles.
Identify basic levels of organization of the human body
a. Chemical
b. Cellular
c. Tissue
d. Organs
e. Systems
f. Organism

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

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

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

1.32 Foundation: Standard 1: Academic Foundation: Understand human anatomy, physiology, common diseases and disorders, and medical math principles.
Demonstrate the ability to analyze diagrams, charts, graphs, and tables to interpret healthcare results.

2.11 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Model verbal and nonverbal communication.

2.13 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Identify the differences between subjective and objective information.

2.15 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Practice speaking and active listening skills.

2.16 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Modify communication to meet the needs of the patient/client and be appropriate to the situation.

2.31 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Utilize proper elements of written and electronic communication (spelling, grammar, and formatting).

4.21 Foundation Standard 4: Employability Skills: Utilize employability skills to enhance employment opportunities and job satisfaction
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

4.31 Foundation Standard 4: Employability Skills: Utilize employability skills to enhance employment opportunities and job satisfaction
Research levels of education, credentialing requirements, and employment trends in health professions.

4.32 Foundation Standard 4: Employability Skills: Utilize employability skills to enhance employment opportunities and job satisfaction
Distinguish differences among careers within health science pathways (diagnostic services, therapeutic services, health informatics, support services, or biotechnology research and development).

6.12 Foundation Standard 6: Ethics: Understand accepted ethical practices with respect to cultural, social, and ethnic differences within the healthcare environment.
Identify ethical issues and their implications related to healthcare (such as: organ donation, in vitro fertilization, euthanasia, scope of practice, ethics committee).

7.41 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.
Observe all safety standards related to the Occupational Exposure to Hazardous Chemicals Standard (Safety Data Sheets (SDSs)). (www.osha.gov)

7.42 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.
Comply with safety signs, symbols, and labels.

8.11 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
Evaluate roles and responsibilities of team members.
a. Examples of healthcare teams
b. Responsibilities of team members
c. Benefits of teamwork

8.12 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
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

8.21 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
Recognize methods for building positive team relationships (such as: mentorships and teambuilding).

8.22 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
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 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
Apply effective techniques for managing team conflict (negotiation, assertive communication, gather the facts, clear expectations, mediation).

11.31 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across

health professions. Apply basic computer concepts and terminology necessary to use computers and other mobile devices.

11.32 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions.
Demonstrate basic computer troubleshooting procedures (such as: restart, check power supply, refresh browser, check settings).

11.33 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions.
Demonstrate use of file organization and information storage.

11.34 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions.
Identify uses of basic word processing, spreadsheet, and database applications.

11.35 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions.
Evaluate validity of web-based resources.

Next Generation Science Standards

HS.LS1.1 - From Molecules to Organisms: Structures and Processes
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 - From Molecules to Organisms: Structures and Processes
Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS.LS3.1 - Heredity: Inheritance and Variation of Traits
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 - Heredity: Inheritance and Variation of Traits
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.

DCI - 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)

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

DCI - 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)

DCI - LS3.B - Heredity: Inheritance and Variation of Traits - Variation of Traits
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)

Science and Engineering Practice - Asking questions and defining problems
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.

Science and Engineering Practice - Asking questions and defining problems
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.

Science and Engineering Practice - Analyzing and Interpreting 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.

Science and Engineering Practice - Constructing Explanations and Designing Solutions
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.

Science and Engineering Practice - Constructing Explanations and Designing Solutions
Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

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.

Science and Engineering Practice - Constructing Explanations and Designing Solutions
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.

Science and Engineering Practice - Engaging in Argument from Evidence
Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence
Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from 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.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information
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.

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Crosscutting Concepts - Stability and Change
Much of science deals with constructing explanations of how things change and how they remain stable.

Unit 3: How To Conquer Cancer

This unit is divided into four lessons
Total Learning Hours for Unit: 50 hours

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 in 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, 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.

Leadership:

- Students will use appropriate technology to research, analyze, and report information.
- Students will create, manage and produce projects to submit to the Spokane STEMposium competition.

21st Century Skills:

Creativity and Innovation
Think Creatively
Work Creatively with Others
Implement Innovations

Critical Thinking and Problem Solving
Reason Effectively
Use Systems Thinking

Make Judgments and Decisions
Solve Problems

Communication and Collaboration
Communicate Clearly
Collaborate with Others

Information Literacy
Access and /evaluate Information
Use and Manage Information

Media Literacy
Analyze Media
Create Media Products

Information, Communications and Technology (ICT Literacy)
Apply Technology Effectively

Flexibility and Adaptability
Adapt to Change
Be Flexible

Initiative and Self-Direction
Manage Goals and Time
Work Independently
Be Self-Directed Learners

Social and Cross-Cultural
Interact Effectively with Others
Work Effectively in Diverse Teams

Productivity and Accountability
Manage Projects
Produce Results

Leadership and Responsibility
Guide and Lead Others
Be Responsible to Others

Lesson 3.1 Detecting Cancer

Performance Assessments:
Career Project – Imaging and Radiology
Lab- Microarray Wet Lab
Portfolio Assignment
Concept mapping
Quizzes and Tests
Demonstrations and Observations

Portfolio Assignment

Standards and Competencies

1. Cancer is a term used for more than 100 different diseases in which cell regulation genes are mutated causing the cells to reproduce out of control.
2. X-rays, CT scans, and MRI scans are used to create pictures of the inside of the body to diagnose and treat many disorders.
3. Scientists use DNA microarray technology to determine the differences in gene expression between different tissue samples.

Standards and Benchmarks: (knowledge and skills addressed)

1. Recognize that there are many different types of cancer, each with specific risk factors, manifestations in the body, and treatment options.
2. Describe the different uses for X-rays, CT scans, and MRIs as well as how each technology works.
3. Describe the differences in the appearance of normal cells and cancer cells.
4. Recognize that DNA microarrays measure the amount of mRNA for genes that is present in a cell sample.
5. Use a microscope to compare normal cells and cancer cells.
6. Perform a simulated DNA microarray to analyze gene expression patterns.
7. Calculate the correlation coefficient for gene expression patterns between different individuals.

Lesson 3.2 Reducing Cancer Risk

Performance Assessments:

Skin Cancer Prevention Lab
Career Project
Portfolio Assignment
Quizzes and Tests
Observation
Concept Mapping
Graphing

Standards and Competencies

1. Behavioral, biological, environmental, and genetic risk factors increase the chance that a person will develop cancer.
2. The risk for developing many cancers can be reduced with life-style changes.
3. Molecular diagnostic tests, such as marker analysis, can be used to detect inherited genetic mutations associated with certain cancers and can be used to predict risk for developing those cancers.
4. Viruses insert their DNA or RNA into a host cell, causing the host cell's genes to mutate which can sometimes cause the cell to become cancerous.
5. Routine cancer screenings can prevent certain types of cancer or can increase the chance that cancer is detached to treatment is more effective.

Standards and Benchmarks: (knowledge and skills addressed)

1. Describe the potential risk factor for different types of cancer as well as the way to reduce the risk.
2. Recognize that all external variables in an experiment need to be controlled.
3. Recognize that viruses can insert their DNA or RNA into a host cell, causing the host cell's genes to mutate which can sometimes cause the cell to become cancerous.
4. List and describe the routine cancer screenings a person should have performed throughout his or her life.
5. Design a controlled experiment.
6. Graph and analyze experimental data.
7. Perform marker analysis to determine the presence of a genetic mutation associated with breast cancer.

Lesson 3.3 Treating Cancer

Performance Assessments:
Career Project
Biofeedback Project
Prosthetic Arm Project
Observations
Quizzes and Tests
Project Assessment

Standards and Competencies

1. Various methods are used to treat cancer.
2. Various biomedical science disciplines and professionals help patients cope with cancer or the side effects of cancer treatment.
3. Experiments are designed to find answers to testable questions.

Standards and Benchmarks: (knowledge and skills addressed)

1. Recognize that chemotherapy and radiation therapy are cancer treatments that work to destroy cancer cells by stopping or slowing their growth; both treatments can cause negative side effects to the patient.
2. Describe how specific chemotherapy drugs interact with and destroy cancer cells.
3. Recognize that biofeedback therapy is a technique in which patients are trained to improve their health or manage pain by learning to control certain internal bodily processes that normally occur involuntarily, such as heart rate, respiration rate, and skin temperature.
4. Recognize that artificial limbs are built to allow patients who have suffered from the loss of a limb to regain lost function.
5. Describe how myoelectric prosthetic limbs work.
6. Recognize that physical and occupational therapists work to help patients with disabilities or patients recovering from surgery or injury to restore function, improve mobility, relieve pain, and improve the ability to perform the tasks necessary to lead an independent and productive life.
7. Design a controlled experiment to test the effect of relaxation techniques on their heart rate, respiration rate, and skin temperature.
8. Design and create a simple functioning model of an arm.
9. Design and present a comprehensive rehabilitation plan, given a specific case.

Lesson 3.4 Building a Better Cancer Treatment

Performance Assessments:
Nanotechnology Project
Quizzes and Tests
Observations
Project Assessments
Peer Review

Standards and Competencies

1. The field of pharmacogenetics investigates how genetic variations correlate with responses to specific medication and strives to develop medical treatments tailored to the individual.
2. Nanotechnology is a field of science that can be applied to health and medicine.
3. Clinical trials are biomedical or health-related research studies that investigate how a new medicine or treatment works in human beings.

Standards and Benchmarks: (knowledge and skills addressed)

1. Recognize that all drugs do not act the same way for all individuals.
2. Explain how single nucleotide polymorphism (SNP) profiles may factor in to the decision to prescribe a specific medication.
3. Recognize that nanomedicine shows great promise, particularly for cancer research, in the hope that medical interventions can be developed at the cellular and molecular scale to diagnose and treat disease.
4. Describe the size of the nanoscale.
5. Recognize that clinical trials are regulated by strict guidelines that ensure data collected is valid and human subjects are treated ethically.

6. Explain why controlled, randomized, double-blind studies are considered the gold standard for clinical trials.
7. Complete an alignment to arrange DNA sequences side-by-side to locate any base pair differences between different individuals.
8. Use patients' SNP profiles to predict how they will respond to particular medicines.
9. Develop and present a clinical trial proposal for nanotechnology-based cancer treatment.

Common Core State Standards for English Language Arts

AS.R.1 - Reading
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 - Reading
Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas. AS.R.7 - Reading
Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

AS.R.7 - Reading
Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

AS.R.8 - Reading
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 - Reading
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 - Reading
Read and comprehend complex literary and informational texts independently and proficiently.

AS.W.1 - Writing
Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

AS.W.2 - Writing
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 - Writing
Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.

AS.W.4 - Writing
Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

AS.W.5 - Writing
Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.

AS.W.6 - Writing
Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

AS.W.7 - Writing
Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

AS.W.8 - Writing
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 - Writing
Draw evidence from literary or informational texts to support analysis, reflection, and research.

AS.W.10 - Writing
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.

AS.SL.1 - Speaking and Listening
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 - Speaking and Listening
Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

AS.SL.4 - Speaking and Listening
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 - Speaking and Listening
Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

AS.L.1 - Language
Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

AS.L.2 - Language
Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

AS.L.4 - Language
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 - Language
Demonstrate understanding of word relationships and nuances in word meanings.

AS.L.6 - Language
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

N.Q .1 - Quantities
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 - Quantities
Define appropriate quantities for the purpose of descriptive modeling.

N.Q .3 - Quantities
Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

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

A.REI.3 - Reasoning with Equations and Inequalities
Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

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

S.ID.2 - Interpreting Categorical and Quantitative Data
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 - Interpreting Categorical and Quantitative Data
Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

S.ID.9 - Interpreting Categorical and Quantitative Data

Distinguish between correlation and causation.

S.IC.1 - Making Inferences and Justifying Conclusions
Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

S.IC.6 - Making Inferences and Justifying Conclusions
Evaluate reports based on data.

National Health Science

1.11 Foundation Standard 1: Academic Foundation: Understand human anatomy, physiology, common diseases and disorders, and medical math principles.
Identify basic levels of organization of the human body
a. Chemical
b. Cellular
c. Tissue
d. Organs
e. Systems
f. Organism

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

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

principles.
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 Foundation: Standard 1: Academic Foundation: Understand human anatomy, physiology, common diseases and disorders, and medical math principles.
Discuss research related to emerging diseases and disorders (such as: autism, VRSA, PTSD, Listeria, seasonal flu).

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

1.31 Foundation: Standard 1: Academic Foundation: Understand human anatomy, physiology, common diseases and disorders, and medical math principles.
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 Foundation: Standard 1: Academic Foundation: Understand human anatomy, physiology, common diseases and disorders, and medical math principles.
Demonstrate the ability to analyze diagrams, charts, graphs, and tables to interpret healthcare results.

2.11 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Model verbal and nonverbal communication.

2.12 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Identify common barriers to communication.
a. Physical disabilities (aphasia, hearing loss, impaired vision)
b. Psychological barriers (attitudes, bias, prejudice, stereotyping)

2.13 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Identify the differences between subjective and objective information.

2.15 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Practice speaking and active listening skills.

2.16 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Modify communication to meet the needs of the patient/client and be appropriate to the situation.

2.31 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Utilize proper elements of written and electronic communication (spelling, grammar, and formatting).

4.21 Foundation Standard 4: Employability Skills: Utilize employability skills to enhance employment opportunities and job satisfaction
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

4.31 Foundation Standard 4: Employability Skills: Utilize employability skills to enhance employment opportunities and job satisfaction
Research levels of education, credentialing requirements, and employment trends in health professions.

4.32 Foundation Standard 4: Employability Skills: Utilize employability skills to enhance employment opportunities and job satisfaction
Distinguish differences among careers within health science pathways (diagnostic services, therapeutic services, health informatics, support services, or biotechnology research and development).

6.12 Foundation Standard 6: Ethics: Understand accepted ethical practices with respect to cultural, social, and ethnic differences within the healthcare environment.
Identify ethical issues and their implications related to healthcare (such as: organ donation, in vitro fertilization, euthanasia, scope of practice, ethics committee).

7.11 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.
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 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.
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

7.22 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.
Demonstrate principles of body mechanics.

7.41 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.
Observe all safety standards related to the Occupational Exposure to Hazardous Chemicals Standard (Safety Data Sheets (SDSs)). (www.osha.gov)

7.42 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.
Comply with safety signs, symbols, and labels.

8.11 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
Evaluate roles and responsibilities of team members.
a. Examples of healthcare teams
b. Responsibilities of team members
c. Benefits of teamwork

8.12 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
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

8.21 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
Recognize methods for building positive team relationships (such as: mentorships and teambuilding).

8.22 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
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 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
Apply effective techniques for managing team conflict (negotiation, assertive communication, gather the facts, clear expectations, mediation).

9.11 Foundation Standard 9: Health Maintenance Practices: Differentiate between wellness and disease. Promote disease prevention and model healthy behaviors.
Promote behaviors of health and wellness (such as: nutrition, weight control, exercise, sleep habits).

9.12 Foundation Standard 9: Health Maintenance Practices: Differentiate between wellness and disease. Promote disease prevention and model healthy behaviors.
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

10.11 *Foundation Standard 10: Technical Skills: Apply technical skills required for all career specialties and demonstrate skills and knowledge as appropriate.
Apply procedures for measuring and recording vital signs including the normal ranges (temperature, pulse, respirations, blood pressure, pain).

11.31 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions. Apply basic computer concepts and terminology necessary to use computers and other mobile devices.

11.32 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions.
Demonstrate basic computer troubleshooting procedures (such as: restart, check power supply, refresh browser, check settings).

11.33 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions.
Demonstrate use of file organization and information storage.

11.34 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions.
Identify uses of basic word processing, spreadsheet, and database applications.

11.35 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions.
Evaluate validity of web-based resources.

Next Generation Science Standards

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

HS.LS1.1 - From Molecules to Organisms: Structures and Processes
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 - From Molecules to Organisms: Structures and Processes
Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS.LS3.1 - Heredity: Inheritance and Variation of Traits
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 - Heredity: Inheritance and Variation of Traits
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.

HS.ETS1.2 - Engineering Design
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 - Engineering Design

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.

DCI - ETS1.A - Engineering Design - Defining and Delimiting Engineering Problems
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)

DCI - PS4.B - Waves and Their Applications in Technologies for Information Transfer - Electromagnetic Radiation
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 cause damage to living cells. (HS-PS4-4)

DCI - PS4.C - Waves and Their Applications in Technologies for Information Transfer - Information Technologies and Instrumentation
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)

DCI - 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)

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

DCI - LS1.B - From Molecules to Organisms: Structures and Processes - Growth and Development of Organisms
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)

DCI - 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)

DCI - LS3.B - Heredity: Inheritance and Variation of Traits - Variation of Traits
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)

DCI - LS4.C - Biological Evolution: Unity and Diversity - Adaptation
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)

Science and Engineering Practice - Asking questions and defining problems
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.

Science and Engineering Practice - Asking questions and defining problems
Evaluate a question to determine if it is testable and relevant.

Science and Engineering Practice - Asking questions and defining problems
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.

Science and Engineering Practice - Asking questions and defining problems
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.

Science and Engineering Practice - Asking questions and defining problems
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.

Science and Engineering Practice - Developing and Using Models
Design a test of a model to ascertain its reliability.

Science and Engineering Practice - Developing and Using Models
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.

Science and Engineering Practice - Developing and Using Models
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.

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

Science and Engineering Practice - Planning and Carrying Out Investigations
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.

Science and Engineering Practice - Planning and Carrying Out Investigations
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.

Science and Engineering Practice - Planning and Carrying Out Investigations
Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.

Science and Engineering Practice - Planning and Carrying Out Investigations
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.

Science and Engineering Practice - Analyzing and Interpreting 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.

Science and Engineering Practice - Analyzing and Interpreting Data
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.

Science and Engineering Practice - Constructing Explanations and Designing Solutions
Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.

Science and Engineering Practice - Constructing Explanations and Designing Solutions
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.

Science and Engineering Practice - Constructing Explanations and Designing Solutions
Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions
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.

Science and Engineering Practice - Constructing Explanations and Designing Solutions
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.

Science and Engineering Practice - Engaging in Argument from Evidence
Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence
Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from 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.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information
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.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information
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.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information
Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information
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).

Crosscutting Concepts - Patterns
Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction
Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction
Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - 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).

Crosscutting Concepts - Systems and System Models
A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Systems and System Models
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.

Crosscutting Concepts - Systems and System Models
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.

Crosscutting Concepts - Structure and Function
The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function
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.

Crosscutting Concepts - Stability and Change
Much of science deals with constructing explanations of how things change and how they remain stable.

Unit 4: How To Prevail When Organs Fail

This unit is divided into four lessons
Total Learning Hours for Unit: 50 hours

Students are introduced to Mrs. Jones, the forty-four-year-old sister of Mrs. Smith. Mrs. Jones 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. 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, non-invasive surgery techniques, as well as creation of a bionic human.

Leadership:

- Students will use appropriate communication skills in group situations. Students will have the opportunity to present information to a group.
- Students will create, manage and produce projects to submit to the Spokane STEMposium competition.

21st Century Skills:

Creativity and Innovation
Think Creatively
Work Creatively with Others

Critical Thinking and Problem Solving
Reason Effectively
Use Systems Thinking
Make Judgments and Decisions
Solve Problems

Communication and Collaboration
Communicate Clearly
Collaborate with Others

Information Literacy
Access and /evaluate Information
Use and Manage Information

Media Literacy
Analyze Media
Create Media Products

Information, Communications and Technology (ICT Literacy)
Apply Technology Effectively

Flexibility and Adaptability
Adapt to Change
Be Flexible

Initiative and Self-Direction
Manage Goals and Time
Work Independently
Be Self-Directed Learners

Social and Cross-Cultural
Interact Effectively with Others
Work Effectively in Diverse Teams

Productivity and Accountability
Manage Projects
Produce Results

Leadership and Responsibility

Guide and Lead Others
Be Responsible to Others

Lesson 4.1 Manufacturing Human Proteins

Performance Assessments:
Lab- pGLO Bacterial Transformation
Lab- Protein Purification
Protein Electrophoresis
Prompts
Computerized assessment
Quizzes and Tests
Observation
Performance Assessment
Career Project

Standards and Competencies

1. The methods used to diagnose and treat diabetes have changed dramatically over the last 200 years, including the use and production of insulin.
2. Recombinant DNA technology allows scientists to custom-design bacteria that can produce a variety of important protein products, including insulin.
3. Amino acid interactions affect the structure and function of proteins.
4. Proteins in a mixture can be separated by various laboratory techniques.
5. Numerous biomedical professionals assist with the production, distribution, and marketing of a new pharmaceutical or bioengineered product.

Standards and Benchmarks: (knowledge and skills addressed)

1. Describe the evolution of the methods used to diagnose and treat diabetes from the 1800s through today.
2. Explain how plasmids, rings of DNA containing genes of interest, can be inserted into bacteria cells via the process of bacterial transformation.
3. Outline the process of bacterial transformation.
4. Recognize that chromatography is a technique used to separate components of a mixture and can be used to separate proteins based on the properties of their side chains
5. Recognize that electrophoresis can be used to separate proteins in a mixture and determine the purity of a sample.
6. Outline the steps required to produce a protein in the laboratory and describe the role of biomedical professionals along this processing path.
7. Insert plasmid DNA into bacterial cells in the laboratory and observe how this genetic information relates to new traits of the bacteria.
8. Calculate transformation efficiency to determine the success of a laboratory experiment.
9. Demonstrate how amino acids interact using a protein model.
10. Isolate a protein based on its chemical properties using column chromatography.
11. Analyze results of a bacterial transformation and a protein purification laboratory.
12. Set up and run protein gel electrophoresis to test the purity of a protein sample.
13. Graph electrophoresis results to determine the molecular weight of an unknown protein

Lesson 4.2 Organ Failure

Performance Assessments:
Prompts
Computerized Assessment
Quizzes and Tests

Identify and design treatment options for ESRD

Standards and Competencies

1. When the kidneys are not functioning properly, they will not filter adequately. Harmful waste products such as urea, creatinine, and blood urea nitrogen build up in the blood stream, which causes the body to make fewer red blood cells due to the lack of the hormone erythropoietin.
2. Dialysis is an artificial process that removes waste products and excess water from the blood when the kidney can no longer function.

Standards and Benchmarks: (knowledge and skills addressed)

1. Recognize that end stage renal failure is diagnosed when a patient loses 85 to 90 percent of his/her normal kidney function.
2. Explain how dialysis machines work to remove wastes from the blood and adjust fluid and electrolyte imbalances.
3. Analyze patient symptoms and laboratory results to diagnose a patient and make treatment recommendations.
4. Analyze the pros and cons of hemodialysis, peritoneal dialysis, and kidney transplant for a patient with end stage renal disease.

Lesson 4.3 Transplant

Performance Assessments:

Quizzes and Tests
Presentations
Career Project
Prompts
Computerized Assessment
Demonstrations of Laparoscopic surgery skills through simulation
Perform a virtual transplant

Standards and Competencies

1. Deciding who receives donated organs is not always a clear-cut issue and involves many difficult decisions guided by federal policies.
2. In organ transplantation, the organ donor and recipient need to have compatible blood and tissue types.
3. Organ transplant surgery is a complex procedure involving various surgical techniques and a variety of biomedical science professionals.

Standards and Benchmarks: (knowledge and skills addressed)

1. Recognize that the surgical techniques involved in a live donor kidney transplant require skill, dexterity, and eye-hand coordination.
2. Recognize that there are many similarities and differences between a heart transplant and a kidney transplant.
3. Use federal policy guidelines to defend who should receive a donated organ in a given situation.
4. Use blood typing and HLA typing results to determine to match an organ donor with a compatible recipient.
5. Perform simulated laparoscopic and general surgical techniques.

Lesson 4.4 Building a Better Body

Performance Assessments:

Super Human Project
Prompts
Computerized Assessment
Project Assessment
Presentations on replacement and/or enhancements to the human body
Career Project
Reflection paper

Standards and Competencies

1. A variety of tissues and organs can be transplanted from one person to another.
2. Scientific research is investigating the possibility of replacing damaged organs and tissues using xenotransplantation and tissue engineering
3. Advancing medical knowledge and technology will enable scientists to enhance the human body.
4. Scientists need to make sure that what they present is accurate and is communicated in a way that keeps interest and focus.

Standards and Benchmarks: (knowledge and skills addressed)

1. Identify which tissues and organs can be transplanted from one person to another.
2. Describe how xenotransplantation or tissue engineering work, as well as their potential risks, benefits, challenges, and ethical or moral concerns.
3. Defend arguments as to whether or not further research for xenotransplantation and tissue engineering should be banned.
4. Evaluate the effectiveness of different body parts and functions and design enhancements and/or replacements to make the human body more efficient.

Common Core State Standards for English Language Arts

AS.R.1 - Reading
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.6 - Reading
Assess how point of view or purpose shapes the content and style of a text.

AS.R.7 - Reading
Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

AS.R.8 - Reading
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 - Reading
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 - Reading
Read and comprehend complex literary and informational texts independently and proficiently.

AS.W.1 - Writing
Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

AS.W.2 - Writing
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 - Writing
Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.

AS.W.4 - Writing
Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

AS.W.5 - Writing
Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.

AS.W.6 - Writing
Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

AS.W.7 - Writing
Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

AS.W.8 - Writing
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 - Writing
Draw evidence from literary or informational texts to support analysis, reflection, and research.

AS.W.10 - Writing
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.

AS.SL.1 - Speaking and Listening
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 - Speaking and Listening
Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

AS.SL.4 - Speaking and Listening
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 - Speaking and Listening
Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

AS.L.1 - Language
Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

AS.L.2 - Language
Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

AS.L.4 - Language
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.6 - Language
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

N.Q .1 - Quantities
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 - Quantities
Define appropriate quantities for the purpose of descriptive modeling.

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

A.REI.1 - Reasoning with Equations and Inequalities
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 - Reasoning with Equations and Inequalities
Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

S.IC.6 - Making Inferences and Justifying Conclusions
Evaluate reports based on data.

National Health Science

1.11 Foundation Standard 1: Academic Foundation: Understand human anatomy, physiology, common diseases and disorders, and medical math principles.
Identify basic levels of organization of the human body
a. Chemical
b. Cellular
c. Tissue
d. Organs
e. Systems
f. Organism

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

1.21 Foundation: Standard 1: Academic Foundation: Understand human anatomy, physiology, common diseases and disorders, and medical math principles.
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 Foundation: Standard 1: Academic Foundation: Understand human anatomy, physiology, common diseases and disorders, and medical math principles.
Discuss research related to emerging diseases and disorders (such as: autism, VRSA, PTSD, Listeria, seasonal flu).

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

1.32 Foundation: Standard 1: Academic Foundation: Understand human anatomy, physiology, common diseases and disorders, and medical math principles.
Demonstrate the ability to analyze diagrams, charts, graphs, and tables to interpret healthcare results.

2.11 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Model verbal and nonverbal communication.

2.13 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Identify the differences between subjective and objective information.

2.15 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Practice speaking and active listening skills.

2.16 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Modify communication to meet the needs of the patient/client and be appropriate to the situation.

2.31 Foundation Standard 2: Communications: Demonstrate methods of delivering and obtaining information, while communicating effectively.
Utilize proper elements of written and electronic communication (spelling, grammar, and formatting).

4.21 Foundation Standard 4: Employability Skills: Utilize employability skills to enhance employment opportunities and job satisfaction
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

4.31 Foundation Standard 4: Employability Skills: Utilize employability skills to enhance employment opportunities and job satisfaction
Research levels of education, credentialing requirements, and employment trends in health professions.

4.32 Foundation Standard 4: Employability Skills: Utilize employability skills to enhance employment opportunities and job satisfaction
Distinguish differences among careers within health science pathways (diagnostic services, therapeutic services, health informatics, support services, or biotechnology research and development).

6.12 Foundation Standard 6: Ethics: Understand accepted ethical practices with respect to cultural, social, and ethnic differences within the healthcare environment.
Identify ethical issues and their implications related to healthcare (such as: organ donation, in vitro fertilization, euthanasia, scope of practice, ethics committee).

7.11 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.
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 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.
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

7.41 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.
Observe all safety standards related to the Occupational Exposure to Hazardous Chemicals Standard (Safety Data Sheets (SDSs)). (www.osha.gov)

7.42 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.
Comply with safety signs, symbols, and labels.

8.11 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
Evaluate roles and responsibilities of team members.
a. Examples of healthcare teams
b. Responsibilities of team members
c. Benefits of teamwork

8.12 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
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

8.21 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
Recognize methods for building positive team relationships (such as: mentorships and teambuilding).

8.22 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
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 Foundation Standard 8: Teamwork: Identify roles and responsibilities of individual members as part of the healthcare team.
Apply effective techniques for managing team conflict (negotiation, assertive communication, gather the facts, clear expectations, mediation).

11.31 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions. Apply basic computer concepts and terminology necessary to use computers and other mobile devices.

11.32 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions.
Demonstrate basic computer troubleshooting procedures (such as: restart, check power supply, refresh browser, check settings).

11.33 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions.
Demonstrate use of file organization and information storage.

11.34 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions.
Identify uses of basic word processing, spreadsheet, and database applications.

11.35 Foundation Standard 11: Information Technology Applications: Utilize and understand information technology applications common across health professions.
Evaluate validity of web-based resources.

Next Generation Science Standards

HS.LS1.1 - From Molecules to Organisms: Structures and Processes
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 - From Molecules to Organisms: Structures and Processes
Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS.LS3.1 - Heredity: Inheritance and Variation of Traits
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.ETS1.2 - Engineering Design
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 - Engineering Design
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.

DCI - ETS1.A - Engineering Design - Defining and Delimiting Engineering Problems
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)

DCI - 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)

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

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

Science and Engineering Practice - Asking questions and defining problems
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.

Science and Engineering Practice - Asking questions and defining problems
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.

Science and Engineering Practice - Asking questions and defining problems
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.

Science and Engineering Practice - Developing and Using Models
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.

Science and Engineering Practice - Developing and Using Models

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.

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

Science and Engineering Practice - Analyzing and Interpreting 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.

Science and Engineering Practice - Analyzing and Interpreting Data
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.

Science and Engineering Practice - Constructing Explanations and Designing Solutions
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.

Science and Engineering Practice - Constructing Explanations and Designing Solutions
Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions
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.

Science and Engineering Practice - Constructing Explanations and Designing Solutions
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.

Science and Engineering Practice - Engaging in Argument from Evidence
Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence
Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from 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.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information
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.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information
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.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information
Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information
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).

Crosscutting Concepts - Patterns
Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction
Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction
Systems can be designed to cause a desired effect.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction
Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - 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).

Crosscutting Concepts - Systems and System Models
A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Systems and System Models

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.

Crosscutting Concepts - Systems and System Models
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.

Crosscutting Concepts - Structure and Function
The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function
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.

Crosscutting Concepts - Stability and Change
Much of science deals with constructing explanations of how things change and how they remain stable.

Crosscutting Concepts - Stability and Change
Feedback (negative or positive) can stabilize or destabilize a system.

21st Century Skills

LEARNING & INNOVATION

Creativity and Innovation
X Think Creatively
X Work Creatively with Others
X Implement Innovations

Critical Thinking and Problem Solving
X Reason Effectively
X Use Systems Thinking
X Make Judgments and Decisions
X Solve Problems

Communication and Collaboration
X Communicate Clearly
X Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS

Information Literacy
X Access and /evaluate Information
X Use and Manage Information

Media Literacy
X Analyze Media
X Create Media Products

Information, Communications and Technology (ICT Literacy)
X Apply Technology Effectively

LIFE & CAREER SKILLS

Flexibility and Adaptability
X Adapt to Change
X Be Flexible

Initiative and Self-Direction
X Manage Goals and Time
X Work Independently
X Be Self-Directed Learners

Social and Cross-Cultural
X Interact Effectively with Others
X Work Effectively in Diverse Teams

Productivity and Accountability
X Manage Projects
X Produce Results

Leadership and Responsibility
X Guide and Lead Others
X Be Responsible to Others