Learning that works for Washington CTE™

Updated 1.2017

Mt. Baker High School Advanced Animal Biology Template

Course: Advanced Animal Biology		**Total Framework Hours: 124**
CIP Code: 10901	☒**Exploratory** ☐**Preparatory**	**Date Last Modified: 3/10/2021**
Career Cluster:	**Agriculture Food and Natural Resources**	**Cluster Pathway:** **Animal Systems**

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COMPONENTS AND ASSESSMENTS

Performance Assessments:
Classification of Animal Exercise
Practice Lab Write Up – Calorie Calculation Exercise and Energy
Importance of Agriculture Investigations

Leadership Alignment:
Students will think creatively and interact effectively, collaborate with others to complete an animal classification exercise comparing and contrasting different animals and understanding Binomial nomenclature (scientific names)
Students will reason effectively, solve problems, access and evaluate information to complete a practice lab write up on Calorie Calculation of different foods.
Students will analyze media, access and evaluate information to understand the importance of agriculture and trends locally/nationally.

Standards and Competencies

Unit:
Intro to Animal Science Trends and Systems

Industry Standards and/or Competencies	**Total Learning Hours for Unit: 6**

AFNR Standards
· AS.01. Analyze historic and current trends impacting the animal systems industry.
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Aligned Washington State Learning Standards

Arts	
Computer Science	
Educational Technology	
English Language Arts	
Environment & Sustainability	
Financial Education	
Health and Physical Education	
Mathematics	

Science	**HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.** **SEP** - Analyzing and Interpreting Data Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. **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. (HS-LS2-5) Energy and Matter Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-LS1-5), (HS-LS1-6) Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems.(HS-LS1-7),(HS-LS2-4) Energy drives the cycling of matter within and between systems. (HS-LS2-3) **HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.** **HS-LS2-4. Use a mathematical representation to support claims for the cycling of matter and flow of energy among organisms in an ecosystem** **oncepts** **Science and Engineering Practices** **Developing and Using Models** Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds. Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-5),(HS-LS1-7) Develop a model based on evidence to illustrate the relationships between systems or components of a system. (HS-LS2-5) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.
Social Studies	

COMPONENTS AND ASSESSMENTS
Performance Assessments: **SAE Project on AET System** **Identify opportunities in FFA**

List of Opportunities and Misconceptions about FFA

Leadership Alignment:
Students will use and manage information and manage goals and time to understand FFA/SAE.
Students will apply technology effectively by starting and maintaining their SAE project on the AET system. (all students will conduct Agriscience Research project in the late spring).

Standards and Competencies

Unit: FFA/SAE
•SAE.01.0: Students will establish and conduct Supervised Agriculture Experience Projects (SAE).
SAE.01.01.b.Explain the benefits of SAE projects to skill development, leadership and career success.
SAE.01.01.c.Explain the connection between SAE and FFA.
SAE.01.01.d.Explain the five types of SAE. (Entrepreneurship, Placement, Research, Exploratory, Improvement)
SAE.01.01.e.Explore ideas for SAE projects.
SAE.01.01.f. Explain how SAE projects support academic achievement.
SAE.01.01.g Select and establish an SAE project.
SAE.01.01.h.Explain and keep records on established SAE projects.
SAE.01.01.l. Explain the three circle concept for SAE, FFA Leadership, and Classroom/Laboratory in an Agriculture Education program.

Industry Standards and/or Competencies	**Total Learning Hours for Unit: 6**

Aligned Washington State Learning Standards

Arts	
Computer Science	
Educational Technology	
English Language Arts	
Environment & Sustainability	
Financial Education	
Health and Physical Education	
Mathematics	
Science	
Social Studies	

COMPONENTS AND ASSESSMENTS

Performance Assessments:
Silage lab
Dissection of monogastric and ruminant digestive tracts
Ration balancing
Labs on Protein, Starch, Fats, Minerals
Nutrition and Digestion Test

Leadership Alignment:

Students will collaborate with others, use systems thinking, make judgments and decsions, and solve problems by completing labs in animal nutrition and digestive organ dissection.

Standards and Competencies

Unit:
Animal Nutrition and Digestion

Industry Standards and/or Competencies	**Total Learning Hours for Unit: 20**

· AS.02. Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.
·AS.03. Design and provide proper animal nutrition to achieve desired outcomes for performance, development, reproduction and/or economic production.

Aligned Washington State Learning Standards

Arts	
Computer Science	
Educational Technology	
English Language Arts	
Environment & Sustainability	
Financial Education	
Health and Physical Education	
Mathematics	
Science	HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. **Science and Engineering Practices** **Developing and Using Models** Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world. ▪ Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2) **Planning and Carrying Out Investigations** Planning and carrying out in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. ▪ Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-LS1-3) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student- generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct 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. (HS-LS1-1) DCI **Structure and Function** ▪ Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

- 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)
- 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)

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. (HS-LS1-2)

Structure and Function

- Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and onnections of components to reveal its function and/or solve a problem. (HS-LS1-1)

HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of

energy.

HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

HS-LS2-4. Use a mathematical representation to support claims for the cycling of matter and flow of energy among organisms in an ecosystem..

Science and Engineering Practices

Developing and Using Models

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

- Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-5),(HS-LS1-7)
- Develop a model based on evidence to illustrate the relationships between systems or components of a system. (HS-LS2-5)
- 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. (HS-LS1-6),(HS-LS2-3)
- Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence. (HS-LS2-3)

Disciplinary Core Ideas

LS1.C: Organization for Matter and Energy Flow in Organisms

- The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5)
- The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. (HS-LS1-6)
- As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (HS-LS1-6),(HS-LS1-7)
- As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another and release energy to the surrounding environment and to maintain body temperature. Cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. (HS-LS1-7)

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

- Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (HS-LS2-3)
- Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter

	reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. (HS-LS2-4) **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. (HS-LS2-5) Energy and Matter ▭ Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-LS1-5), (HS-LS1-6) ▭ Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems.(HS-LS1-7),(HS-LS2-4) ▭ Energy drives the cycling of matter within and between systems. (HS-LS2-3)
Social Studies	

COMPONENTS AND ASSESSMENTS
Performance Assessments: Dissection of heart and lungs Dissection of kidneys External anatomy Kidney function lab Dissection of Fetal Pig Carnivore Cook-off
Leadership Alignment: Students will collaborate with others, use systems thinking, make judgments and decisions, and solve problems by completing labs in anatomy and physiology by dissecting organs and a fetal pig. Students will apply technology effectively, access and evaluate information, use and manage information, collaborate with others, think creatively, and communicate clearly while the compete in the Carnivore Cook-off.
Standards and Competencies
Unit: **Anatomy and Physiology**

Industry Standards and/or Competencies	**Total Learning Hours for Unit: 20**
· AS.06. Classify, evaluate and select animals based on anatomical and physiological characteristics. .	

Aligned Washington State Learning Standards	
Arts	
Computer Science	
Educational Technology	
English Language Arts	
Environment & Sustainability	
Financial Education	

Health and Physical Education	
Mathematics	
Science	**HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.** **HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.** **Science and Engineering Practices** **Developing and Using Models** Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world. ▪ Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2) **Planning and Carrying Out Investigations** Planning and carrying out in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student- generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct 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. (HS-LS1-1) **Disciplinary Core Ideas** **LS1.A: Structure and Function** ▪ Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) ▪ 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) ▪ 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) **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. (HS-LS1-2) **Structure and Function** ▪ Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and onnections of components to reveal its function and/or solve a problem. (HS-LS1-1)
Social Studies	

COMPONENTS AND ASSESSMENTS
Performance Assessments: **Antibiotic Sensitivity Tests** **Gram Staining** **Disease presentation** **Immunology Dice Game** **ELISA test – Bio-Rad**
Leadership Alignment: Students will interact effectively, solve problems, make judgments and decisions and use systems thinking completing the immunology dice game. Students will manage projects, produce results, work, apply technology effectively, and communicate clearly when they present their animal disease presentation

Standards and Competencies

Unit: Animal Health and Welfare

Industry Standards and/or Competencies	**Total Learning Hours for Unit: 12**

· AS.02. Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.
AS.05. Evaluate environmental factors affecting animal performance and implement procedures for enhancing performance and animal health.
· AS.07. Apply principles of effective animal health care.
● AS.08. Analyze environmental factors associated with animal production.

Aligned Washington State Learning Standards

Arts	
Computer Science	
Educational Technology	
English Language Arts	
Environment & Sustainability	
Financial Education	
Health and Physical Education	
Mathematics	
Science	**HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.** **HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.** **Science and Engineering Practices** **Developing and Using Models** Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world. ▪ Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2) **Planning and Carrying Out Investigations** Planning and carrying out in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student- generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct 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. (HS-LS1-1) **Disciplinary Core Ideas** **LS1.A: Structure and Function** ▪ Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) ▪ 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) ▪ 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) **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. (HS-LS1-2) **Structure and Function** ▪ Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and onnections of components to reveal its function and/or solve a problem. (HS-LS1-1)
Social Studies	

COMPONENTS AND ASSESSMENTS
Performance Assessments: **Dissection of female reproductive tract** **Swine Artificial Insemination** **Stages of estrus cycle timeline** **Embryo Transfer assignment**
Leadership Alignment: Students will use systems thinking, solve problems, interact effectively with others, produce results, guide and lead others while completing the reproduction dissection. Students will reason effectively, solve problems, use systems thinking, and make judgments and decisions on swine artificial insemination at the barn.

Standards and Competencies	
Unit: **Reproduction**	
Industry Standards and/or Competencies	**Total Learning Hours for Unit: 9**
· AS.03. Design and provide proper animal nutrition to achieve desired outcomes for performance, development, reproduction and/or economic production. · AS.04. Apply principles of animal reproduction to achieve desired outcomes for performance, development and/or economic production.	

Aligned Washington State Learning Standards	
Arts	
Computer Science	
Educational Technology	
English Language Arts	
Environment & Sustainability	
Financial Education	
Health and Physical Education	
Mathematics	
Science	**HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.** **HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.** **Science and Engineering Practices**

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

- Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2)

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

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

- Construct 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. (HS-LS1-1)

Disciplinary Core Ideas

LS1.A: Structure and Function

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

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. (HS-LS1-2)

Structure and Function

- Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and onnections of components to reveal its function and/or solve a problem. (HS-LS1-1)

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

Science and Engineering Practices

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

- Ask questions that arise from examining models or a theory to clarify relationships. (HS-LS3-1)

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

- Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-4)

Disciplinary Core Ideas

LS1.B: 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)

LS3.B: 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)

	Crosscutting Concepts **Cause and Effect** ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS3-1),(HS-LS3-2) **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. (HS-LS1-4) **Connections to Nature of Science** **Science is a Human Endeavor** ▪ Technological advances have influenced the progress of science and science has influenced advances in technology. (HS-LS3-3) ▪ Science and engineering are influenced by society and society is influenced by science and engineering. (HS-LS3-3)
Social Studies	

COMPONENTS AND ASSESSMENTS	
Performance Assessments: Biotechnology Timeline Research project on impacts of Biotech	
Leadership Alignment: Students will manage goals and time, work independently, be self directed learners, access and evaluate information, use and manage information while they complete their Biotechnology Timeline. Students will analyze media and collaborate with others while they briefly research the impacts of biotechnology on agriculture.	
Standards and Competencies	
Unit: **History and Importance of Biotechnology in Agriculture**	
Industry Standards and/or Competencies	**Total Learning Hours for Unit: 7**
· AS.01. Analyze historic and current trends impacting the animal systems industry. · BS.01. NCAE Standard: Assess factors that have influenced the evolution of biotechnology in agriculture (e.g., historical events, societal trends, ethical and legal implications, etc.).	
Aligned Washington State Learning Standards	
Arts	
Computer Science	
Educational Technology	
English Language Arts	

Environment & Sustainability	
Financial Education	
Health and Physical Education	
Mathematics	
Science	**HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.** **Science is a Human Endeavor** ▪ Technological advances have influenced the progress of science and science has influenced advances in technology. (HS-LS3-3) ▪ Science and engineering are influenced by society and society is influenced by science and engineering. (HS-LS3-3)
Social Studies	

COMPONENTS AND ASSESSMENTS	
Performance Assessments: Meiosis/Mitosis Activity – Chromosocks DNA Extraction Lab – Strawberries, DNA necklace Mendelian Genetics – Wisconsin Fast Plants and Prediction of Phenotypes/Genotypes DNA Replication, Transcription, Translation Activity with beads Protein Synthesis Labs and Applications Recombinant DNA Principles Lab	
Leadership Alignment: Students will solve problems, make judgments and decisions, use systems thinking, and reason effectively while they complete their Meiosis and Mitosis Chromosocks activity, DNA extraction, and Mendelian Genetics exercises. Students will solve problems, collaborate with others, guide and lead others, be responsible to others, and interact effectively with others on their DNA extraction, replication/translation activity, and protein synthesis labs.	
Standards and Competencies	
Unit: Basics of Genetics and DNA Science	
Industry Standards and/or Competencies	**Total Learning Hours for Unit: 18**
· BS.02. NCAE Standard: Demonstrate proficiency by safely applying appropriate laboratory skills to complete tasks in a biotechnology research and development environment (e.g., standard operating procedures, record keeping, aseptic technique, equipment maintenance, etc.). .	

Aligned Washington State Learning Standards	
Arts	
Computer Science	
Educational Technology	

English Language Arts	
Environment & Sustainability	
Financial Education	
Health and Physical Education	
Mathematics	
Science	**HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.** **HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.** **Science and Engineering Practices** **Developing and Using Models** Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world. ▪ Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2) **Planning and Carrying Out Investigations** Planning and carrying out in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. ▪ Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-LS1-3) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student- generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct 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. (HS-LS1-1) **Disciplinary Core Ideas** **LS1.A: Structure and Function** ▪ Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) ▪ 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.) ▪ 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) ▪ 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) **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. (HS-LS1-2) **Structure and Function** ▪ Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-LS1-1) **Stability and Change** ▪ Feedback (negative or positive) can stabilize or destabilize a system. (HS-LS1-3) **Connections to Nature of Science** **Scientific Investigations Use a Variety of Methods**

- Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings. (HS-LS1-3)

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Science and Engineering Practices

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

- Ask questions that arise from examining models or a theory to clarify relationships. (HS-LS3-1)

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

- Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-4)

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

- 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. (HS-LS3-3)

Engaging in Argument from Evidence
Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

- Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence. (HS-LS3-2)

Disciplinary Core Ideas

LS1.A: 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. (secondary to HS-LS3-1) (Note: This Disciplinary Core Idea is also addressed by HS-LS1-1.)

LS1.B: 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)

LS3.A: 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)

LS3.B: 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)
- Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed

	depends on both genetic and environmental factors. (HS-LS3-2),(HS-LS3-3) **Crosscutting Concepts** **Cause and Effect** ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS3-1),(HS-LS3-2) **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). (HS- LS3-3) **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. (HS-LS1-4) **Connections to Nature of Science** **Science is a Human Endeavor** ▪ Technological advances have influenced the progress of science and science has influenced advances in technology. (HS- LS3-3) ▪ Science and engineering are influenced by society and society is influenced by science and engineering. (HS-LS3-3)
Social Studies	

COMPONENTS AND ASSESSMENTS

Performance Assessments:
Restriction Enzyme Lab
Electrophoresis Lab- loading gels, micropipetting
PCR Lab – PV92 ALU gene id in individual students
Outbreak DNA Lab – comparison of DNA amongst suspected carriers simulation
pGLO bacterial transformation lab – pGLO plasmid inserted into E.coli to teach transgenic organisms. Bacterial glow in the dark.

Leadership Alignment:
Students will apply technology effectively, access and evaluate information, use and manage information, interact effectively with others as they complete their biotechnology applications laboratory exercises.

Standards and Competencies

Unit: Biotechnology Applications

Industry Standards and/or Competencies	**Total Learning Hours for Unit: 11**

· BS.01. NCAE Standard: Assess factors that have influenced the evolution of biotechnology in agriculture (e.g., historical events, societal trends, ethical and legal implications, etc.).
● BS.02. NCAE Standard: Demonstrate proficiency by safely applying appropriate laboratory skills to complete tasks in a biotechnology research and development environment (e.g., standard operating procedures, record keeping, aseptic technique, equipment maintenance, etc.).
· BS.03. NCAE Standard: Demonstrate the application of biotechnology to solve problems in Agriculture, Food and Natural Resources (AFNR) systems (e.g., bioengineering, food processing, waste management, horticulture, forestry, livestock, crops, etc.).

Aligned Washington State Learning Standards	
Arts	
Computer Science	
Educational Technology	
English Language Arts	
Environment & Sustainability	
Financial Education	
Health and Physical Education	
Mathematics	Interpreting Categorical and Quantitative Data (S-ID) ● Summarize, represent, and interpret data on a single count or measurement variable ● Summarize, represent, and interpret data on two categorical and quantitative variables ● Interpret linear models Making Inferences and Justifying Conclusions (S-IC) ● Understand and evaluate random processes underlying statistical experiments ● Make inferences and justify conclusions from sample surveys, experiments and observational studies Conditional Probability and the Rules of Probability (S-CP) ● Understand independence and conditional probability and use them to interpret data ● Use the rules of probability to compute probabilities of compound events in a uniform probability model Using Probability to Make Decisions (S-MD) ● Calculate expected values and use them to solve problems Use probability to evaluate outcomes of decisions
Science	HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. **Analyzing and Interpreting Data** Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. ▪ 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. (HS-LS4-3) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct 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. (HS-LS4-2),(HS-LS4-4) **Engaging in Argument from Evidence** Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current or historical episodes in science.

- Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS4-5)

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

- Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-LS4-1)

Connections to Nature of Science

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science

Disciplinary Core Ideas

LS4.A: Evidence of Common Ancestry and Diversity

- Genetic information, like the fossil record, 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)

LS4.B: 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)
- The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (HS-LS4-3)

LS4.C: 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)
- 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)
- Adaptation also means that the distribution of traits in a population can change when conditions change. (HS-LS4-3)
- 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)
- Species become extinct because they can no longer survive and reproduce in their altered environment.

Crosscutting Concepts

Patterns

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS- LS4-1),(HS-LS4-3)

Cause and Effect

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS- LS4-2),(HS-LS4-4),(HS-LS4-5)

HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Science and Engineering Practices

Asking Questions and Defining Problems

	▪ Ask questions that arise from examining models or a theory to clarify relationships. (HS-LS3-1) **Developing and Using Models** ▪ Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-4) **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. (HS-LS3-3) **Engaging in Argument from Evidence** ▪ Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence. (HS-LS3-2) **Disciplinary Core Ideas** **LS1.A: 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. (secondary to HS-LS3-1) **LS1.B: 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) **LS3.A: 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) **LS3.B: 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) ▪ Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. (HS-LS3-2),(HS-LS3-3) **Crosscutting Concepts** **Cause and Effect** ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS3-1),(HS-LS3-2) **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). (HS- LS3-3) **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. (HS-LS1-4) **Connections to Nature of Science** **Science is a Human Endeavor** ▪ Technological advances have influenced the progress of science and science has influenced advances in technology. (HS- LS3-3) ▪ Science and engineering are influenced by society and society is influenced by science and engineering. (HS-LS3-3)
Social Studies	
COMPONENTS AND ASSESSMENTS	

Performance Assessments:
Conduct Agriscience Research Project – Examples: PCR test to identify GMO Food, Parasite analysis, Antibiotic Resistance, Extracting Bacterial DNA. Genetic Survey project with statistics.
Review of Literature
Project Write-Up and Presentation

- **Leadership Alignment:**
- Students will think creatively, implement innovations, use systems thinking, solve problems, collaborate with others, access and evaluate information, use and manage information while they produce their Agriscience Research Project.
- Students will manage goals and time, work independently or in diverse teams and be self-directed learners while they complete their Agriscience Research Project.

Standards and Competencies

Unit: Agriscience Research Project

Industry Standards and/or Competencies	**Total Learning Hours for Unit: 14**

· BS.02. NCAE Standard: Demonstrate proficiency by safely applying appropriate laboratory skills to complete tasks in a biotechnology research and development environment (e.g., standard operating procedures, record keeping, aseptic technique, equipment maintenance, etc.).
• BS.03. NCAE Standard: Demonstrate the application of biotechnology to solve problems in Agriculture, Food and Natural Resources (AFNR) systems (e.g., bioengineering, food processing, waste management, horticulture, forestry, livestock, crops, etc.).

Aligned Washington State Learning Standards

Arts	
Computer Science	
Educational Technology	
English Language Arts	
Environment & Sustainability	
Financial Education	
Health and Physical Education	
Mathematics	Interpreting Categorical and Quantitative Data (S-ID) ● Summarize, represent, and interpret data on a single count or measurement variable ● Summarize, represent, and interpret data on two categorical and quantitative variables ● Interpret linear models Making Inferences and Justifying Conclusions (S-IC) ● Understand and evaluate random processes underlying statistical experiments ● Make inferences and justify conclusions from sample surveys, experiments and observational studies Conditional Probability and the Rules of Probability (S-CP) ● Understand independence and conditional probability and use them to interpret data ● Use the rules of probability to compute probabilities of compound events in a uniform probability model Using Probability to Make Decisions (S-MD) ● Calculate expected values and use them to solve problems

	Use probability to evaluate outcomes of decisions
Science	HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. **Planning and Carrying Out Investigations** Planning and carrying out in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. ▪ Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-LS1-3) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student- generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct 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. (HS-LS1-1) **Disciplinary Core Ideas** **LS1.A: Structure and Function** ▪ Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) ▪ 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.) ▪ 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) ▪ 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) **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. (HS-LS1-2) **Structure and Function** ▪ Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-LS1-1) **Stability and Change** ▪ Feedback (negative or positive) can stabilize or destabilize a system. (HS- LS1-3)
Social Studies	

COMPONENTS AND ASSESSMENTS

Performance Assessments:
Harvest of Fear DVD Reaction Paper
Research and Present Bioethics Issue

Leadership Alignment:
Students will analyze media, communicate clearly and collaborate with others while they debate Issues and Ethics surrounding biotechnology including Genetically Modified Foods, Animal/Human Health, and pharmaceuticals.

Standards and Competencies

Unit: Issues and Ethics

Industry Standards and/or Competencies	**Total Learning Hours for Unit: 5**

· BS.01. NCAE Standard: Assess factors that have influenced the evolution of biotechnology in agriculture (e.g., historical events, societal trends, ethical and legal implications, etc.).
· AS.01. Analyze historic and current trends impacting the animal systems industry.
● AS.08. Analyze environmental factors associated with animal production.

Aligned Washington State Learning Standards

Arts	
Computer Science	
Educational Technology	
English Language Arts	
Environment & Sustainability	
Financial Education	
Health and Physical Education	
Mathematics	
Science	**HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.** **HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.** **Science and Engineering Practices** **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct 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. (HS-LS4-2),(HS-LS4-4) **Engaging in Argument from Evidence** ▪ Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS4-5) **Obtaining, Evaluating, and Communicating Information** ▪ Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-LS4-1) **Disciplinary Core Ideas** **LS4.A: Evidence of Common Ancestry and Diversity** ▪ Genetic information, like the fossil record, 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) **LS4.C: 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)

	▪ 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) ▪ 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) **Crosscutting Concepts** **Patterns** ▪ Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS- LS4-1),(HS-LS4-3) **Cause and Effect** ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS- LS4-2),(HS-LS4-4),(HS-LS4-5) **----------** **Connections to Nature of Science** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** ▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (HS-LS4-1),(HS-LS4-4)
Social Studies	

The 21st Century Skills should be taught and assessed throughout the course.This table should be included at the end of this document.

21st Century Skills		
Check those that students will demonstrate in this course:		
LEARNING & INNOVATION **Creativity and Innovation** ☒Think Creatively ☐Work Creatively with Others ☒Implement Innovations **Critical Thinking and Problem Solving** ☒Reason Effectively ☒**U**se Systems Thinking ☒Make Judgments and Decisions ☒Solve Problems **Communication and Collaboration** ☐Communicate Clearly ☒Collaborate with Others	**INFORMATION, MEDIA & TECHNOLOGY SKILLS** **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	**LIFE & CAREER SKILLS** **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