CURRICULUM GUIDE

CP (College Prep Biology: Students will utilize science practices to build upon life science concepts introduced over grades 6-8. This course utilizes a three-dimensional approach: incorporating content knowledge, cross cutting concepts and science practices. These practices include asking questions, developing and using models, carrying out investigations, analyzing and interpreting data, using mathematics, constructing explanations, engaging in argumentation and communicating information. Collaboration and discussion are essential components of the course.

Five distinct storylines will serve as a framework for learning. Storylines are coherent sequences of lessons driven by a central, engaging phenomenon that students aim to explain. Each storyline will cover a range of ideas within biology, allowing students to develop a strong understanding of biology in the context of real-life and relatable situations.

Topics covered will include ecology, evolution, organic molecules, inheritance of traits, cell growth and division, energy and photosynthesis, and cell structure and function.

How is this course different from Honors and Core Biology? This course covers the same content as Core Biology, but at a deeper level. *There is an expectation for both productive, collaborative discussion as well as the ability to work independently.*

Quick Links:

1. **Unit 0 - Introduction to Scientific Methodology**
2. **Unit 1 - Storyline 1 - Africa**
3. **Unit 2 - Storyline 2 - Homeostasis (and Cellular Respiration)**
4. **Unit 3 - Storyline 3 - Disease (Cell Division, Gene Expression)**
5. **Unit 4 - Storyline 4 - Melanin (Genetics)**
6. **Unit 5 - Storyline 5 - Penguins (Evolution)**

Whitehall-Coplay School District Course Guide

Course Title: CP Biology **Unit 0 - Scientific Methodology** **Grade/Level: 10**

Textbook(s): Miller-Levine Biology TOC
Digital Software:

Science and Engineering Practices are behaviors that are critical in investigating, modeling and explaining the world, as well as in developing solutions to societal problems.

1. Asking questions (for science) and defining problems (for engineering);
2. Developing and using models;
3. Planning and carrying out investigations;
4. Analyzing and interpreting data;
5. Using mathematics and computational thinking;
6. Constructing explanations (for science) and designing solutions (for engineering);
7. Engaging in argument from evidence; and
8. Obtaining, evaluating and communicating information.

Cross-Cutting Concepts:

1) Patterns
2) Cause and effect
3) Scale, proportion, and quantity
4) Systems and system models

Lesson	Days	Concepts/Topics	Key Terms	Resources	Assessments
1	1	Introduction to Science Practices - Establishing classroom/science norms - Problem Solving Activity	Classroom culture Respect Collaboration	Big paper, markers Items for Problem solving activity	**Formative**: establishment of group norms for collaborative activities and discussions
2	1	Making Observations Developing Hypotheses Creating a model	Hypothesis Model Observations	Fortune telling fish Black canisters Mystery Tubes	**Formative**: evaluation of models, hypotheses and observations
3	1	Making and revising models Providing constructive, meaningful feedback	Models Revision Label and annotations	Supplies for sewer lice activity	**Formative**: evaluation of models, revision of models and feedback
4	1	Experimental Design Analyzing data Creating graphs to represent data	Observation Prediction Hypothesis	Direct Instruction Graphing practice: paper and digital	**Formative:** grade graphing and analysis of data to assess progress and skill development

			Data Average Conclusion Experiment Constants Control Variable Independent variable Dependent variable Line graph Bar graph	Practice identifying the components of an experiment and drawing conclusion	
5	1.5	Experimental Design: design and conduct an experiment to test a hypothesis, collect data, graphically represent, and draw conclusions	Same as above	Oreo Lab and materials	**Formative:** Lab
6	1	Summative assessment			**Summative** Assessment

Whitehall-Coplay School District Course Guide

Course Title: CP Biology | **Unit #1 - Africa Storyline (Lions and Elephants)** | **Grade/Level: 9, 10**

Textbook(s): Miller-Levine Biology

TOC

Digital Software:

STEELS Standards:

3.1.9-12.B - Can develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

3.1.9-12.E - Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

3.1.9-12.F - 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.

3.1.9-12.G - 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.

3.1.9-12.H - Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

3.1.9-12.I - Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

3.1.9-12.J - Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

3.1.9-12.K - Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

3.1.9-12.L - Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

3.1.9-12.O - Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

3.1.9-12.P - Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

3.1.9-12.Q - 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.

3.1.9-12.R - Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

3.1.9-12.T - 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.

3.1.9-12.U - 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.

Environmental Literacy and Sustainability (3.4): Focuses on the integral relationship between humans and the environment. Key associated strands likely include:

- Agricultural and Environmental Systems and Resources
- Environmental Literacy Skills (Investigating Issues and Evaluating Solutions)

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6) Constructing explanations (for science) and designing solutions (for engineering);
7) Engaging in argument from evidence; and
8) Obtaining, evaluating and communicating information.

Cross-Cutting Concepts:

1) Patterns
2) Cause and effect
3) Scale, proportion, and quantity
4) Systems and system models
5) Energy and matter
6) Structure and function
7) Stability and change

Lesson	Days	Concepts/Topics	Key Terms	Resources	Assessments
1	1	**Introduction of Phenomenon** Practice: making observations, asking questions Benefits of living in a group		Video, questioning forms Venn Diagram	Informal evaluation - formative assessments
2	1	**Energy: all living things need energy** How much energy does an organism need daily? How can lions obtain sufficient energy? Calculations: total energy required, total energy from hunts, net energy	Energy Producer Consumer Carnivore Herbivore Decomposer Omnivore Scavenger Net energy Prey	Handout: Life as a Hunter Calculators Google Slides: notes	Formative: activity

Lesson	Days	Concepts/Topics	Key Terms	Resources	Assessments
			kilocalorie		
3	3 days	**Lulu the Lioness: Determining Parentage, Pride (group) behaviors** Making observations Making predictions Mapping Conducting research: Pride behaviors and dynamics Using genotypes and alleles to determine parentage **Day 1** - Observe female and cub dynamics Examine field notes from researchers Make prediction for parentage of cubs Map lion movements between reserves Start research **Day 2** - Finish research, discuss Notes on karyotypes and alleles Using genotypes to determine parentage **Day 3** - review, create a karyotype Assessment	Pride (lion) Chromosome Gene Allele Karyotype	Video: Female w/Cubs Lulu Data Set 1 Lulu Data Set 2 Lulu Data Set 3 Lulu Data Set 4 Lulu Data Set 5 Parentage Worksheet Research Form Final Analysis Google Slides: notes	Formative: Research Formative: Mapping (Lion Movements) Formative: Parentage WS Summative: Parentage Quiz
4	1	**Using Microsatellite Data to Determine Relationships** Using alleles and microsatellite data to group closely related organisms together Mapping of lion prides Analysis of gene flow between populations	Allele Microsatellite data Gene flow Population	Google Maps/Google Earth Microsatellite data: all populations and individual Map Colored Pencils Analysis/Discussion Sheet Google Slides: notes	Formative: Discussion Questions and Sabi Sands CER
5	1	**Phylogeny and Phylogenetic Trees** Analyze DNA sequences between prides to determine which populations are most closely related. Interpret a phylogenetic tree	Phylogeny Outgroup Sister species Node/branches DNA Mutation	Google Slides: notes Color: DNA sequences Handout: Lion Phylogeny	Formative: Phylogeny WS
7	2-3	**How do consumers obtain energy from their food?** “Energy is acquired through the breakdown of food” Examining energy flow: inputs and outputs(loss) Calculating gain and loss of energy Structure vs. Function: relating physical characteristics of a structure to its function	Energy Digestion Digestive tract Large intestine Small intestine Colon Protein Carbohydrate	Video: Animal diets (NC Zoo) Handout: Energy Handout: Animal Nutrition Lab Individual Assessment Study Guide for exam	Formative: completion of daily work Summative: Individual component

Lesson	Days	Concepts/Topics	Key Terms	Resources	Assessments
		Different foods are made of different molecules **Day 1** - energy flow and comparing energy flow between organisms (calorie vs. mass) Start animal nutrition lab: video, definitions, predictions	Lipid Molar Incisor Canine Trophic level		
		Day 2 - comparison of animal digestive tracts: herbivore vs. carnivore Dentition: structure vs function - different consumers different teeth Dietary requirements: proteins, carbohydrates, lipids			
		Day 3: finish and assess (individual component) Review for midterm			
8	1	**Summative: midpoint assessment**		Summative Assessment	Summative Assessment
9	4	**Organic Molecules: Building Blocks of Life** “How is food used inside living things?” Deep dive into how molecules are digested and used to form new molecules Characteristics of carbohydrates, lipids and proteins **Day 1** Monomers and Polymers Dehydration Synthesis and Hydrolysis Modeling both processes	Monomer Polymer Dehydration synthesis Hydrolysis Chemical reaction Reactant Product	• Google slides - notes • Teacher developed/created review materials • Textbook Chapter(s):	Formative: finished work from stations Summative: individual critical thinking from stations
		Day 2 & 3 - Stations Function of Organic Molecules	Carbohydrate Lipid Proteins Nucleic Acid DNA RNA Enzyme Monosaccharide Fatty acid Amino acid	• Stations for organic molecules • Handouts for stations • Summary table: organic molecule	Formative: Summary/C&C tables Summative Assessment
		Day 4 - Minilab: Testing for organic molecules Students will use qualitative tests to determine which unknown food is for which animal	Benedicts Biuret solutions Iodine/Lugols	Lab supplies: biuret, benedict, lugols, spot plates, test tubes, test tube racks,	Formative: lab summary

Lesson	Days	Concepts/Topics	Key Terms	Resources	Assessments
			Qualitative results	hot plates, droppers Lab handout Dog food Rabbit food	
10	1	**Enzymes** How are reactions able to occur in living things? Basic process of enzymes in hydrolysis and synthesis reactions Enzyme structure Factors affecting enzymes	Enzyme Active site Substrate Product Activation energy Denaturation	Phenomenon slip/enzyme notice/wonder Google slides - notes Enzyme handout Quick lab: Lactose and Lactase Teacher developed review(s)	Formative: lab and classwork Summative: independent assignment
11	2	**Pulling Energy, Digestion and Hydrolysis Together** Use math and models to determine net energy from the digestion and construction of a protein in an organism. Contrast energy from carbohydrates vs proteins. Nitrogen Cycle: How do organisms get the nitrogen they need for proteins?	Digestion Hydrolysis Dehydration synthesis Protein Molecule Atom Nitrogen fixation Denitrification Uptake Assimilation Nitrogen cycle	Activity handout: Digestion of Proteins and Carbohydrates Nitrogen Cycle	Formative: analysis component of activity Formative: nitrogen cycle review
12	1	**Food Webs in the African Ecosystem** Create food chains and food webs Determine energy transfer from one trophic level to the next Relate available energy to number of organisms	Food Chain Food web Producer Consumer Primary consumer Secondary consumer	Activity: Food Webs in Gorongosa National Park	Formative: construction of food web and lab handout
	1	**Summative Assessment - Africa Storyline Lion Storyline**			
Part 2 - Elephant Storyline					
13	1	Introduction of Elephants Population Growth and Limiting Factors Create a line graph of population growth over multiple years using data Use observations and geographical data to	Limiting factors Exponential growth Logistical growth Biotic Abiotic Carrying capacity	Phenomenon Activity: Analyzing Elephant Census Data Direct Instruction: Types of Population Growth	Formative: review of student work, discussion Formative: graded review

Lesson	Days	Concepts/Topics	Key Terms	Resources	Assessments
		determine limiting factors		Limiting Factors	
14	2	How do biologists determine population sizes for nomadic species? Using transect sampling to estimate population sizes Calculating density Estimating population sizes	Transect Census	Video: Elephant Census Activity: The Great Elephant Census	Formative: Analysis of census data
15	1	Effect of Human Activity on an Ecosystem Analyze data to determine factors affecting hunting of elephant populations Determine consequence of selective hunting on rare phenotypes in elephant populations.	Reproduction Selective pressure Ivory Poaching	Phenomenon Activity: Tusklessness in Elephants	Formative: Study work
16	2	Using Biotechnology to Track Poachers	Short Tandem Repeat Gel Electrophoresis PCR	Direct Instruction Guided Practice with STR's Activity: CSI Wildlife	Summative Assessment: Quiz on STR's
17	1	How do organisms divide up an ecosystem to limit competition? Competition and effect of competition Niches and ways to separate niches Value of niche partitioning for biodiversity	Competition Niche Niche Partitioning Coexistence Temporal partitioning Spatial partitioning Biodiversity	Phenomenon Activity: HHMI Niche Partitioning and Species Coexistence (+ handout) Direct instruction Google slides	Formative: student handout
18	3	Transition Lesson: Keystone Species, Seeds and Plant Growth, Cell Division and Photosynthesis Lab: Role of Elephants in the Germination of Seeds - completed over three class periods Day 1 - Locate seeds in samples of elephant dung and soil, plant (on petri dish) Day 2 - Observations Day 3 - Final observations and connections			

Lesson	Days	Concepts/Topics	Key Terms	Resources	Assessments
18	1 of 3	Introduction of Lesson, Phenomenon , Lab Part 1 Factors affecting germination of seeds Methods of seed dispersal Experimental design	Gemination Dispersal	Phenomenon Lab: How Elephants Impact their Environment	Formative: completion of warm up and
18	2 of 3	Lab Day 2 Students collect data from seeds Graphing and analysis of data Parts of seeds and germination of seeds	Embryo Radicle Epicotyl Cotyledon	Lab Handout Seed worksheet Dissecting microscopes	Formative: completion of lab
18 19	3 of 3	Lab final day: compare coloration of seedlings light vs. dark Connect cell division to growth of plants/seedlings Compare the rates of cell division between leaves and roots Analyze: why will cells in some parts of a plant divide faster than others?	Cell division Mitosis Nucleus Chromosome DNA	Phenomenon Lab Handout Plant mitosis activity Images: cells from roots and leaves of a plant	Formative: review of mitosis activity
20	1	Photosynthesis: Introduction and Role of Light Create a basic model of photosynthesis using prior knowledge Determine the effect of intensity of light and color of light on the rate of photosynthesis	Photosynthesis Oxygen Carbon dioxide Glucose Chloroplast Chlorophyll Pigment	Phenomenon Modeling activity: need paper Direct Instruction Google slides Virtual Lab: Role of Light in Photosynthesis	Formative: review of student models Formative: review of lab
21	1	Photosynthesis: Plant Structures Role of capillary action, stomata, roots, chloroplasts in plants for photosynthesis Model transpiration from roots, to veins and out stomata	Transpiration Capillary action	Phenomenon: Activity: Exploring role of plant structures in photosynthesis Review	Summative: Analyzing an absorption spectrum Formative: Plant Structure and Review

Lesson	Days	Concepts/Topics	Key Terms	Resources	Assessments
22	1	Photosynthesis: A Detailed Look Conversion of light energy to chemical energy through light dependent and light independent reactions Connect: amount/rate of photosynthesis to available energy in an ecosystem	ATP NADPH (basic) Electrons Thylakoid Stroma Light Dependent reactions Light independent Reactions Calvin Cycle Energy pyramid	Direct Instruction Google slides Activity: Energy Pyramids and photosynthesis	Formative: review of activity for student success and understanding
		Summative Assessment: Photosynthesis and Energy Transfer in Ecosystems			

Whitehall-Coplay School District Course Guide

Course Title: CP Biology **Unit #2 - Homeostasis Storyline** **Grade/Level: 10**

Textbook(s): Miller-Levine Biology Return to TOC

Digital Software:

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2. Developing and using models;
3. Planning and carrying out investigations;
4. Analyzing and interpreting data;
5. Using mathematics and computational thinking;
6. Constructing explanations (for science) and designing solutions (for engineering);
7. Engaging in argument from evidence; and
8. Obtaining, evaluating and communicating information.

Cross-Cutting Concepts:

1) Patterns
2) Cause and effect
3) Scale, proportion, and quantity
4) Systems and system models
5) Energy and matter
6) Structure and function
7) Stability and change

STEEL Standards:

3.1.9-12.A 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.

3.1.9-12.B Can develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

3.1.9-12.C Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

3.1.9-12.G 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.

3.1.9-12.J Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

3.1.9-12.K Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

Lesson	Days	Concepts/Topics	Key Terms	Resources	Assessments
1	1	Cellular Respiration: Introduction Create a model of cellular respiration using prior knowledge Basic process of cellular respiration Relationship: cellular respiration and photosynthesis	Cellular respiration Mitochondria Aerobic ATP ADP Respiration	Phenomenon Modeling Direct Instruction Google slides Activity: Relationship between Cellular Respiration and Photosynthesis	Evaluation of initial models Formative: relationship activity
2	1	Cellular Respiration: Details	Glycolysis Kreb's Cycle Electron Transport Chain Aerobic Anaerobic	Direct Instruction Google slides Case Study: Chicago Cyanide Murders (optional) Organizer	
3	1	Anaerobic - Fermentation Conduct an experiment to determine the effect of sugar on the rate of fermentation Value of fermentation to humans	Anaerobic Fermentation Lactic acid fermentation Alcoholic fermentation	Lab: Barf Bags Direct Instruction Google Slides Instructor Provided review(s)	Formative: Lab Formative: evaluation of student responses
4	2	Homeostasis Analyze data to determine how organisms respond to changes in energy needs and environmental conditions	Homeostasis Negative feedback Positive feedback	Data Jigsaw: Cellular Respiration Data points Direct Instruction Google Slides Video: Feedback	Formative: Data Set Analysis questions
5	1	Using Hierarchical Systems and Specialized Cells to Maintain Homeostasis	Specialized cells Cell Tissue Organ Organ system Organism	Student Research: Organ Systems in the Human Body Organizer: levels of organization within a system Visual: Types of Specialized cells	Formative: evaluation of student work
	1	Summative Assessment - Unit 2			

Lesson	Days	Concepts/Topics	Key Terms	Resources	Assessments
NOTES		Unit needs revised to include rest of storyline for breadth Keystone species in the Pacific Northwest Investigation of effect of environment on cells			

Whitehall-Coplay School District Course Guide

Course Title: CP Biology **Unit #3 - Disease Storyline** **Grade/Level: 10**
Textbook(s): Miller-Levine Biology
Digital Software:

Return to TOC

Key Standards for Unit:

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2. Developing and using models;
3. Planning and carrying out investigations;
4. Analyzing and interpreting data;
5. Using mathematics and computational thinking;
6. Constructing explanations (for science) and designing solutions (for engineering);
7. Engaging in argument from evidence; and
8. Obtaining, evaluating and communicating information.

Cross-Cutting Concepts:

1) Patterns
2) Cause and effect
3) Scale, proportion, and quantity
4) Systems and system models
5) Energy and matter
6) Structure and function
7) Stability and change

STEEL Standards

3.1.9-12.A 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.
3.1.9-12.B Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
3.1.9-12.D Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
3.1.9-12.C Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
3.1.9-12.P Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
3.1.9-12.Q 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.
3.1.9-12.R Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Lesson	Days	Concepts/Topics	Key Terms	Resources	Assessments
1	2 days	**How are cancer cells different from normal cells?**			
	1	**Phenomenon**: Teenager with Melanoma **Data JigSaw**: Explore data in form of graphs and diagrams to develop a set of characteristics contrasting normal cells and cancer cells **Poster**: Summary of learning	Cancer Melanoma Cell division Density Chromosomes Lymph nodes Tumor	Phenomenon video Data Sets Paper for posters Exit Ticket Google Slides	**Formative**: ● Poster of Cancer Cell Characteristics ● Exit ticket
	2	**Phenomenon**: UV Light and Melanoma **Activity** - Observing Normal and Cancer Cell Division: Compare/Contrast **Data Activity**: Explore how division differs between normal cells and cancer, role of cell division in healing.	DNA Mitosis Apoptosis	Phenomenon video Data Sets Google Slides	**Formative**: Summary of data sets
2	2 days	**How do cells divide for growth and repair?**			
	3	**Quiz** - Characteristics of Cancer cells **Phenomenon:** cells going through mitosis **Direct Instruction**: cell division and chromosomes **Activity**: Structure of DNA and Chromosomes **Activity**: Create a sequential, logical model of cells dividing	Chromosome Chromatid Centromere DNA Nucleotide Histone Mitosis	Phenomenon video Google slides DNA/Chromosome visual Model: sequence of mitosis (digital or paper)	**Summative**: Characteristics of Cancer cells
	4	**Activity:** Mitosis Flip book organizer Close Read: Mitosis and Visual Direct Instruction	Interphase M-Phase Cell Cycle G1 S Phase G2 Prophase Metaphase Anaphase Telophase Cytokinesis	Materials for flip book: Paper, glue sticks, scissors Colored pencils for diagram Google slides Flip book assignment Close Read	**Formative**: Close Read and Visual
3	1	**How do cells know when to divide and to stop dividing?**			

Lesson	Days	Concepts/Topics	Key Terms	Resources	Assessments
	5	**Quiz:** Major events of the Cell Cycle **Phenomenon:** Cell Division and Differentiation in Villi of Small Intestine **Activity**: The Cell Cycle and Cancer **Direct Instruction**: Regulating the cell cycle	Cyclins Checkpoints Proto-oncogenes Oncogenes Tumor suppressor genes p53 apoptosis Differentiation Mutation CDK	Phenomenon video Website: The Cell Cycle and Cancer Google slides	**Summative**: Major events of cell cycle and cell division
	1	**Connecting Progress So Far: What is wrong with cancer cells that cause them to behave differently?**			
	6	**Direct Instruction:** Types of Cell Death **Activity:** Cell Cycle and Checkpoints **Science Circle:** why do cancer cells behave differently?	Necrosis Apoptosis Autophagy	Google slides Activity Review	**Formative:** Participation in science circle Review of checkpoints
	1	**How does the structure of DNA allow it to be replicated without errors?**			
4	7	**DNA Replication** Phenomenon video: DNA Replication Direct Instruction: DNA Replication	Semiconservative replication template/template strand DNA DNA replication	Phenomenon video Handout: Graphing Data Google slides Review	**Formative:** Student review
	8	**Summative Assessment**			
	1	**How does the information in DNA result in a protein?**			
5	9	**Protein Synthesis** **Phenomenon:** How does a firefly's tail make light **Direct Instruction:** Protein Synthesis **Activity**: Modeling Transcription and Translation	RNA mRNA tRNA rRNA Ribosome Transcription Translation Amino acid Codon anticodon	Phenomenon video Google slides Student practice handout Website: Learn Genetics Review	**Formative:** teacher observations of embedded skills during direct instruction Formative: student completion of practice assignment

Lesson	Days	Concepts/Topics	Key Terms	Resources	Assessments
	10	**Activity: Make a Monster** (or similar) students select genes for different traits and then transcribe and translate to produce the functional proteins and phenotypes		Activity: Make a Monster	**Summative -** monster and supporting materials
	1	**How can changes in DNA cause cancer (changes in phenotypes)?**			
6	11	**Mutations** **Phenomenon**: Sickle Cell Anemia **Activity**: Exploring Mutations (create mutations, observe protein, analyze result) P53 Mutations Science Discussion: connect to storyline Positive Mutations - Rock Pocket Mice	Mutation Silent mutation Nonsense mutation Missense mutation	Phenomenon video Direct instruction Google slides Student activity Website P53 handout Video for rock pocket mice mutations	**Formative:** completion of student activity **Formative**: group discussion
		How do cells divide to produce eggs and sperm which have fewer chromosomes?			
7	12	**Meiosis** **Phenomenon:** Visual of Mitosis and Meiosis	Meiosis Haploid Diploid Crossing Over Homologous chromosomes Asexual reproduction Sexual reproduction Variation Fertilization Zygote	Phenomenon Image Direct instruction Google slides Student Activity Chromosome models	**Formative:** Demonstration of meiosis and crossing over using models
8	1	**Stem Cells**	Stem Cells Differentiation	Phenomenon Direct Instruction Google slides Stem Cell Website Handout	**Formative**

Lesson	Days	Concepts/Topics	Key Terms	Resources	Assessments
				Video	
9	1	**Summative Assessment**			

Whitehall-Coplay School District Course Guide

Course Title: CP Biology **Unit #4 - Melanin** **Grade/Level: 10**
Textbook(s): Miller-Levine Biology
Return to TOC
Digital Software:

Key Standards for Unit:

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3. Planning and carrying out investigations;
4. Analyzing and interpreting data;
5. Using mathematics and computational thinking;
6. Constructing explanations (for science) and designing solutions (for engineering);
7. Engaging in argument from evidence; and
8. Obtaining, evaluating and communicating information.

Cross-Cutting Concepts:

1) Patterns
2) Cause and effect
3) Scale, proportion, and quantity
4) Systems and system models
5) Energy and matter
6) Structure and function
7) Stability and change

STEEL Standards:

3.1.9-12.A 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.
3.1.9-12.F 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.
3.1.9-12.P Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
3.1.9-12.Q 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.
3.1.9-12.R Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. (This directly relates to the lessons involving allele frequency calculations, such as those using the Hardy-Weinberg principle).
3.1.9-12.S Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
3.1.9-12.T 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.
3.1.9-12.U 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.
3.1.9-12.V Create or revise a simulation to test a solution to mitigate the adverse impacts of human activity on biodiversity.
3.1.9-12.W Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
3.1.9-12.X 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.

Lesson	Days	Concepts/Topics	Key Terms	Resources	Assessments
		How do traits vary among individuals?			
1	1	Pedigrees demonstrate inheritance of traits	Pedigree Dominant Recessive Trait Genotype Phenotype Heterozygous Homozygous Segregation Independent Assortment	Phenomenon video Handouts Direct instruction Google slides	**Formative assessment:** The reasoning students write should contain specific evidence that explains that parents with normal phenotypes can have a child with a different phenotype.
		How are traits passed from generation to generation?			
2	1	Pedigrees demonstrate inheritance of traits Punnett Squares can be used to predict genetic recombination of parental traits in offspring.	Punnett square probability	Phenomenon video Jigsaw Narrative Paper for full pedigree Punnet Square handout	**Formative Assessment:** Evaluation of pedigrees and Punnett Squares Summative: quiz on pedigree and Punnett squares
		How do different alleles reflect different DNA sequences?			
3	1	Karyotypes and Chromosomal disorders	Karyotype Non-disjunction Trisomy Monosomy Gamete Zygote	Phenomenon Karyotype analysis and preparation and disorders Exploration: Chromosomal	**Formative:** evaluation of student product and discussion

Lesson	Days	Concepts/Topics	Key Terms	Resources	Assessments
			Aneuploidy Polyploidy	mutations	
4	1	Genotype to phenotype Different alleles have different DNA sequences which correspond to differing protein products. Different genes can affect the same phenotype.	Albinism Allele RNA DNA Transcription Translation Protein Mutation Genotype Phenotype Melanin	Lab: Albinism	**Formative:** evaluation of student product and discussion
		How do so many different phenotypes arise?			
5	2	Polygenenic Traits: some phenotypes are the product of multiple genes	Polygeneic Melanin UV Dihybrid	Biology of Skin Coloration Evolution and Skin Coloration	**Formative:** evaluation of student product
6	2	Natural Selection and Mutations affect phenotypes	Natural selection Selection Variation Adaptation Competition Differential survival	Lab: Color variation over time in Rock Pocket Mice	**Formative:** evaluation of student product
7	1	Other types of Inheritance	Codominance Incomplete dominance Multiple alleles	Practice sets	**Formative:** evaluation of student product
		Summative Assessment: Unit			

Whitehall-Coplay School District Course Guide

Course Title: CP Biology | **Unit #5 Penguin Storyline** | **Grade/Level: 10**

Textbook(s): Miller-Levine Biology

Return to TOC

Digital Software:

Key Standards for Unit:

Science and Engineering Practices are behaviors that are critical in investigating, modeling and explaining the world, as well as in developing solutions to societal problems.

1. Asking questions (for science) and defining problems (for engineering);
2. Developing and using models;
3. Planning and carrying out investigations;
4. Analyzing and interpreting data;
5. Using mathematics and computational thinking;
6. Constructing explanations (for science) and designing solutions (for engineering);
7. Engaging in argument from evidence; and
8. Obtaining, evaluating and communicating information.

Cross-Cutting Concepts:

1) Patterns
2) Cause and effect
3) Scale, proportion, and quantity
4) Systems and system models
5) Energy and matter
6) Structure and function
7) Stability and change

STEEL Standards:

3.1.9-12.N Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
3.1.9-12.O Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.
3.1.9-12.P Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
3.1.9-12.Q 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.

3.1.9-12.R Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
3.1.9-12.S Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
3.1.9-12.T 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.

Lesson	Days	Concepts/Topics	Key Terms	Resources: Activities, Materials, Digital & Print Resources	Assessments
1	2	Introduce storyline - Penguins Phylogeny of Penguins	Phylogenetic tree Species Population Node Branch Common ancestor	Phenomenon Phylogeny of Penguins	Formative: evaluation of student product
2	2	Using DNA to determine common ancestry Use DNA and Amino Acid sequences to create a phylogenetic tree	DNA Restriction enzyme Gel electrophoresis DNA fingerprint	Species identification activity	Formative: evaluation of student product
3	2	Isolation and Speciation	Reproductive isolation Behavioral isolation Geographic isolation Temporal isolation Speciation	Penguin isolation activity Isolation beak activity	Formative: evaluation of student product
4	2	Human impacts on natural populations	Endangered species Human impacts HIPPO Habitat loss Invasive species Pollution overconsumption	Endangered species activity	Formative: evaluation of student product
5	1	Evidence for Evolution	Homologous structures Analogous structures Vestigial structures Biogeography	Stations: evidence for evolution (modified)	Formative: evaluation of student product
		Summative Evaluation - Unit			