International Baccalaureate
Baccalauréat International
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MARIETTA CITY SCHOOLS

Marietta City Schools

2024-2025 District Unit Planner

Grade & Course: 10th Grade Biology	**Topic:** Forces of Microevolution and Patterns of Macroevolution	**Duration:** 4.5 weeks
Teachers: Mariah Sappington, Amber Carr, Ashanti Pilgrim, Rosemary Kamau, Zakayo Ruroro, Ella-Chanel Benton, Jada Vinsang		

Georgia Standards of Excellence:

SB4. Obtain, evaluate, and communicate information to illustrate the organization of interacting systems within single- celled and multi-celled organisms.

a. Construct an argument supported by scientific information to explain patterns in structures and function among clades of organisms, including the origin of eukaryotes by endosymbiosis. Clades should include: archaea, bacteria, eukaryotes, fungi, plants, animals.
b. Analyze and interpret data to develop models (i.e cladograms and phylogenetic trees) based on patterns of common ancestry and the theory of evolution to determine relationships among major groups of organisms.

SB6. Obtain, evaluate, and communicate information to assess the theory of evolution.

a. Construct an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology.
b. Analyze and interpret data to explain patterns in biodiversity that result from speciation.
c. Construct an argument using valid and reliable sources to support the claim that evidence from comparative morphology (analogous vs. homologous structures), embryology, biochemistry (protein sequence) and genetics support the theory that all living organisms are related by way of common descent.
d. Develop and use mathematical models to support explanations of how undirected genetic changes in natural selection and genetic drift have led to changes in populations of organisms.
e. Develop a model to explain the role natural selection plays in causing biological resistance (e.g., pesticides, antibiotic resistance, and influenza vaccines).

Narrative / Background Information

Prior Student Knowledge: (REFLECTION – PRIOR TO TEACHING THE UNIT)

7th Science GSE:

S7L1. Obtain, evaluate, and communicate information to investigate the diversity of living organisms and how they can be compared scientifically

a. Develop and defend a model that categorizes organisms based on common characteristics.
b. Evaluate historical models of how organisms were classified based on physical characteristics and how that led to the six kingdom system (currently archaea, bacteria, protists, fungi, plants, and animals).

S7L5. Obtain, evaluate, and communicate information from multiple sources to explain the theory of evolution of living organisms through inherited characteristics.

a. Use mathematical representations to evaluate explanations of how natural selection leads to changes in specific traits of populations over successive generations.
b. Construct an explanation based on evidence that describes how genetic variation and environmental factors influence the probability of survival and reproduction of a species.
c. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, and extinction of organisms and their relationships to modern organisms.

3rd Science GSE:

S3E2. Obtain, evaluate, and communicate information on how fossils provide evidence of past organisms.

a. Construct an argument from observations of fossils (authentic or reproductions) to communicate how they serve as evidence of past organisms and the environments in which they lived.
b. Develop a model to describe the sequence and conditions required for an organism to become fossilized.

Year-Long Anchoring Phenomena: (LEARNING PROCESS)
Sickle cell is a heritable genetic mutation that evolved in response to interactions in ecosystems.

Unit Phenomena (LEARNING PROCESS)
Antibiotics do not work on viruses and may become less effective on bacteria over time.
Protists have always been a challenging group to classify. An amazing variety of structure & function patterns are found in these aquatic organisms.

MYP Inquiry Statement:
Discerning changes in patterns and using evidence to construct systems with rules and conventions can help to explain how the world works.
Understanding relationships among the organisms based on their forms and patterns that can lead to classification based on identities.

MYP Global Context:
Identities and Relationships

Related Concept: Form

Key Concept: Relationships

Approaches to Learning Skills:

Communication Skills:
- Use and interpret a range of discipline-specific terms

Information literacy Skills:
- Make connections between various sources of information

SEP
- Engage in argument from evidence
- Analyze and interpret data
- Construct explanations
- Develop and use models

Disciplinary Core Ideas: (KNOWLEDGE & SKILLS)

Forces of Microevolution
- mutation
- natural selection
- genetic drift (founder & bottleneck)
- gene flow
- sexual selection

Evidence of Evolution / History of Life
- new understandings of Earth's history/emergence of new species (biogeography)/fossil record
- modern evidence (resistance, moths, etc)
- comparative anatomy & embryology

Speciation / Patterns of Macroevolution
- barriers to gene flow
- mass extinctions / adaptive radiations
- convergent / co / divergent evolution
- gradualism / punctuated equilibrium

Classification & Phylogeny
- comparison of 3 domains
- comparison of 5 kingdoms (no protists)
- cladograms / phylogenetic trees (basic intro)

Crosscutting Concepts: (KNOWLEDGE & SKILLS)
Patterns
Structure & Function
Cause & Effect

MYP Key and Related Concepts:
Change
Form
Patterns
Evidence
Function

Georgia Standards of Excellence

Achievement Level Descriptors and GaDOE Clarification Statements

→ **Unit Disciplinary Core Content:** forces of microevolution and patterns of macroevolution
→**Unit Focus Science & Engineering Practices:** engage in argument from evidence; develop and use models; construct explanations, analyze and interpret data
→ **Unit Focus Crosscutting Concepts:** patterns, cause and effect, structure and function

SB6. Obtain, evaluate, and communicate information to assess the theory of evolution.

- ★ SB6a. construct an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology;
- ★ SB6b. analyze and interpret data to explain patterns in biodiversity that result from speciation;
- ★ SB6c. construct an argument using valid and reliable sources to support the claim that evidence from comparative morphology (analogous vs. homologous structures), embryology, biochemistry (protein sequence) and genetics support the theory that all living organisms are related by way of common descent;
- ★ SB6d. develop and use mathematical models to support explanations of how undirected genetic changes in natural selection and genetic drift have led to changes in populations of organisms *(Clarification statement: Element is intended to focus on basic statistical and graphic analysis. Hardy Weinberg would be an optional application to address this element.)*;
- ★ SB6e. develop a model to explain the role of natural selection in causing biological resistance (e.g., pesticides, antibiotic resistance, influenza vaccines).

SB4. Obtain, evaluate, and communicate information to illustrate the organization of interacting systems within single- celled and multi-celled organisms.

c. Construct an argument supported by scientific information to explain patterns in structures and function among clades of organisms, including the origin of eukaryotes by endosymbiosis. Clades should include: archaea, bacteria, eukaryotes, fungi, plants, animals.

d. Analyze and interpret data to develop models (i.e cladograms and phylogenetic trees) based on patterns of common ancestry and the theory of evolution to determine relationships among major groups of organisms.

The beginning learner can…	**The developing learner can…**	**The proficient learner can…**	**The distinguished learner can…**
identify patterns in structures and function among clades of organisms; recognize that patterns of common ancestry and the theory of evolution can be used to determine relationships among major groups of organisms; identify characteristics of viruses; recognize that new understandings of Earth's history have influenced our understanding of biology.	explain patterns in structures and function among clades of organisms, including the origin of eukaryotes by endosymbiosis; analyze and interpret simple data related to patterns of common ancestry and the theory of evolution to determine relationships among major groups of organisms; describe the characteristics of viruses and organisms; identify an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology.	**construct an argument supported by scientific information** to explain patterns in structures and function among clades of organisms, including the origin of eukaryotes by endosymbiosis; **analyze and interpret data** to **develop models** (i.e., cladograms, phylogenetic trees) based on patterns of common ancestry and the theory of evolution to determine relationships among major groups of organisms; **construct an argument supported by empirical evidence** to compare and contrast the characteristics of viruses and organisms; **construct an explanation** of how new understandings of Earth's history, the emergence	**refine an argument supported by scientific information** to explain patterns in structures and function among clades of organisms, including the origin of eukaryotes by endosymbiosis; **use data to evaluate models** based on patterns of common ancestry and the theory of evolution to determine relationships among major groups of organisms; **refine an argument supported by empirical evidence** to compare and contrast the characteristics of viruses and organisms; **compare explanations** of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology.

		of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology.	

Student-Friendly Learning Targets

I can recognize that new understandings of Earth's history have influenced our understanding of biology.
I can construct an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology.
I can identify an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology.
I can name the scientists that contributed ideas used to develop the theory of evolution and state what idea each contributed.
I can identify patterns in biodiversity that result in speciation.
I can define the terms biodiversity and speciation.
I can recognize that individuals are selected, but populations evolve.
I can communicate major patterns of macroevolution, such as fossil record extinction, adaptive radiations, convergent and coevolution, and punctuated equilibrium.
I can analyze and interpret data to explain patterns in biodiversity that result from speciation.
I can define and explain the connection between terms natural selection, fitness, adaptation, and evolution.
I can differentiate between sexual selection and natural selection.
I can explain the details of the mechanisms of reproductive isolation and speciation.
I can analyze and interpret data for patterns in the fossil record that document the existence, diversity, and extinction of organisms and their relationships to modern organisms.
I can recognize that evidence from comparative morphology, embryology, biochemistry, and genetics support the theory that all living organisms are related by way of common descent
I can analyze and interpret data for patterns in the fossil record that document the existence, diversity, and extinction of organisms and their relationships to modern organisms
I can construct an argument using valid and reliable sources to support the claim that evidence from comparative morphology, embryology, biochemistry and genetics support the theory that all living organisms are related by way of common descent
I can construct an explanation using evidence of how external features and adaptations of animals allow them to survive in their habitat.
I can identify I can recognize that undirected genetic changes in natural selection and genetic an explanation using evidence of how external features and adaptations of animals allow them to survive in their habitat
I can contrast Lamark and Darwin's ideas on the mechanisms of evolution.
I can explain how the interaction of the environment and a phenotype determines the fitness of the phenotype.
I can identify mathematical models that can be used to support explanations of how undirected genetic changes in natural selection and genetic drift have led to changes in populations of organisms
I can recognize that undirected genetic changes in natural selection and genetic drift have led to changes in populations of organisms
I can explain the effect of genetic drift on small populations, using bottleneck effect and founder effect as examples populations
I can analyze and interpret data to explain patterns in biodiversity that result from speciation.
I can determine the role of natural selection in causing biological resistance
I can describe modern examples of microevolution such as peppered moths, antibiotic resistance, rapidly evolving influenza virus, and pesticide resistance.
I can identify a model that can be used to explain the role of natural selection in causing biological resistance.
I can develop a model to explain the role of natural selection in causing biological resistance
I can explain the concept of heterozygous advantage using sickle cell trait as an illustrative example
I can identify patterns in structures and function among archaea, bacteria, eukaryotes, fungi, plants, animals (*i.e., I can state the defining characteristics of organisms placed that would be classified within each of these groups*)
I can explain patterns in structures and function among archaea, bacteria, eukaryotes, fungi, plants, animals (*i.e., I can explain (compare, contrast, differentiate, etc.) the defining characteristics of organisms placed that would be classified within each of these groups*)
I can construct an argument supported by scientific information to explain patterns in structures and function among clades of organisms (*i.e., I can articulate, using scientific thinking and evidence, that our current model of classification is correct*)
I can explain the origin of eukaryotes by endosymbiosis
I can construct an argument supported by scientific evidence to explain the origin of eukaryotes by endosymbiosis

I can recognize that patterns of common ancestry and the theory of evolution can be used to determine relationships among major groups of organisms
I can analyze and interpret simple data related to patterns of common ancestry and the theory of evolution to determine relationships among major groups of organisms (*i.e. simple genome sequences or data tables of similar traits*)
I can analyze and interpret data to develop models (i.e., cladograms, phylogenetic trees) based on patterns of common ancestry and the theory of evolution to determine relationships among major groups of organisms (*i.e., I can interpret, use, and create a simple phylogenetic tree*)
I can use data to evaluate models based on patterns of common ancestry and the theory of evolution to determine relationships among major groups of organisms (*i.e., I can use data to refine a cladogram or phylogenetic tree*)
I can identify characteristics of viruses
I can describe the characteristics of viruses and organisms
I can construct an argument supported by empirical evidence to compare and contrast the characteristics of viruses and organisms
I can refine an argument supported by empirical evidence to compare and contrast the characteristics of viruses and organisms

Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)
All bacteria are harmful. Students should understand that the majority of bacterial species are beneficial. Many species play an essential role in nutrient cycling and some are involved in food production processes.
Many students have the misconception that evolution means that "man came from monkeys." Although evidence suggests that they share a common ancestor, students should understand that the evolutionary pathway of man is still a major research topic among scientists.
Evolution happens quickly. Students should understand that evolution generally occurs over long periods of time.
Darwin was the only evolutionary theorist. Students should understand that many scientists have contributed to our understanding of the current theory of evolution.
Populations change because all individuals in that population change. Students should understand that populations change as a result of natural selection as organisms that are more favorably suited for their environment reproduce at higher rates.

Preconceptions: Students should have a basic understanding of the differences between prokaryotic and eukaryotic cells, as well as the basic functions of the organelles. Students should have a general understanding of how organisms are classified into 6 kingdoms, and how taxonomy and classification have changed over time. Students should understand the general idea of homeostasis.

Key Vocabulary: (KNOWLEDGE & SKILLS)
Evolution, Antibiotics, Pesticides, Natural Selection, Fitness, Adaptation, Genetic Drift (founder/bottleneck), Sexual Selection, Gene Flow, Speciation, Biodiversity, Eukaryotic, Prokaryotic, Autotroph, Heterotroph, Multicellular, Peptidoglycan, Cellulose, Endosymbiosis, Endosymbiotic Theory, Domain, Kingdom, Phylum, Class, Order, Family, Genus, Species, Clade, Phylogeny, Phylogenetic Tree, Cladogram, Ancestor, Taxonomy, Adaptive Radiation, Convergent Evolution, Coevolution, Divergent Evolution, Speciation, Gradualism, Punctuated Equilibrium, Reproductive Isolation, Comparative Morphology, Comparative Embryology, Heterozygous Advantage, Biological Resistance

Inquiry Statements:

Factual:

- What are the 3 domains and 6 kingdoms of life?
- What are the characteristics of life?
- What is a cladogram?
- How can a phylogenetic tree be used to identify living and extinct organisms?
- How do scientists determine the age of fossils?
- What are three pieces of evidence that support the endosymbiosis theory?
- What is speciation?
- What conditions must be present for natural selection to occur?
- What are the key features of living organisms?
- How can we classify the living organism based on their characteristics?
- How has life on Earth changed over time?

Conceptual:

- How do clades of organisms show relatedness through common ancestry? How are models used to trace

evolutionary relationships among organisms?

- How can students support arguments with evidence to classify organisms based on patterns in structure and function in closely related organisms?
- How can data be analyzed to determine evolutionary relationships among organisms?
- Are viruses classified as living or non living?
- What is the importance of biodiversity in an ecosystem? How does genetic diversity occur in a population? What factors cause change in the allele frequency of a population? How does speciation occur?
- How does our classification system help us to understand species and their evolutionary history?
- How do scientists determine what is classified as living vs. non living?

Debatable:

- It has been said that Evolution is just a theory. Is this statement inaccurate, if so, how?
- Do you think that the current six kingdom classification system would change in the future? Explain your answer.
- How can we use what we know about life on Earth in order to find evidence of life on other planets?

MYP Objectives: Knowing & Understanding; Processing & Evaluating			
Assessments: Formative & Summative			
• Common Formative Assessment • MYP Essay • Common Summative Assessment			
Unit Objectives			
Learning Activities and Experiences	**Inquire & Obtain (LEARNING PROCESS)**	**Evaluate (LEARNING PROCESS)**	**Communicate (LEARNING PROCESS)**
Week 1: Forces of Microevolution: Topic 1: - mutation - natural selection - genetic drift (founder & bottleneck) - gene flow - sexual selection	Common Openers & Closers for Evolution Unit Principles of Evolution PPT (Honors) Natural Selection PPT (Honors) Evolution (Darwin) PPT Evolution with Natural Selection PPT Article: Accumulating Glitches: Exploring the Grandeur of Evolution Nearpod: Selection Types in Evolution	Natural Selection Exploration Tuskless Elephant Case Study Natural Selection Case Studies Activity Battle of the Bird Beaks: Adaptations Lab (Honors); Battle of the Bird Beaks: Adaptations Lab (On-Level) Adaptations Activity: Which One Doesn't Belong and Why? Gummy Bear Island Evolution Game and Gummy Bear Island Task Cards Founder Effect Simulation Bottleneck Effect Simulation	Unit 2 Study Guide
Week 2: Evidence of Evolution & History of Life: Topic 2:	Principles of Evolution PPT (Honors) Evidence of Evolution PPT History of Life on Earth PPT	Oxygen Revolution Interactive NOVA Evolution Lab & Video Quizzes Deep Time: Earth's History WebQuest	Common Formative Assessment (Topics 1 & 2)

- new understandings of Earth's history; emergence of new species (biogeography), fossil record - modern evidence of evolution (moths, resistance, etc) - comparative anatomy & embryology	Article: The Heterozygote Advantage Examples of Disease-Causing Genes That Give Humans an Edge	Evolution & Biological Resistance Evidence of Evolution C-E-R Endosymbiotic Theory Comic Strip or Sales Pitch Activity	
Week 3: Speciation & Patterns of Macroevolution Topic 3: - barriers to gene flow - mass extinctions / adaptive radiations - convergent / co / divergent evolution - gradualism / punctuated equilibrium	Principles of Evolution PPT (Honors) Patterns of Macroevolution PPT Speciation PPT	Speciation Activity Adapting to the Environment and Speciation Close Read Reproductive Isolation Data Nuggets Activity	
Week 4: Classification & Phylogeny Topic 4: - comparison of 3 domains - comparison of 5 kingdoms (no protists) - cladograms / phylogenetic trees	Classification & Phylogeny: Exploring the Tree of Life PPT (Honors) Taxonomy PPT Phylogeny PPT	Classification & Phylogeny Exploration Cladogram Lab Cladogram Practice Classification Review: Interpreting Graphics	Classification MYP Prompt Classification C-E-R Practice
Week 4.5 Common Summative Assessment & Remediation			Common Summative Assessment Remediation on CSA
Resources (hyperlink to model lessons and/or resources): All resources are available on Schoology.			

Reflection: Considering the planning, process and impact of the inquiry

Prior to Teaching	During Teaching	After Teaching
Students generally have significant misconceptions or misunderstandings regarding the theory of evolution.		