# Unit 5 Evolution and Biodiversity

Content Area: **Science**
Course(s): **IB Biology, SL**
Time Period: **Third Marking Period**
Length: **3 weeks**
Status: **Published**

## Unit Overview

Students will learn about the principles of Natural Selection. Students will apply those principles to create modern cladograms to deduce evolutionary relationships.

## STAGE 1- DESIRED RESULTS

5.1 Looking for patterns, trends and discrepancies—there are common features in the bone structure of vertebrate limbs despite their varied use.

5.2 Use theories to explain natural phenomena—the theory of evolution by natural selection can explain the development of antibiotic resistance in bacteria.

5.3 Cooperation and collaboration between groups of scientists—scientists use the binomial system to identify a species rather than the many different local names.

5.4 Falsification of theories with one theory being superseded by another—plant families have been reclassified as a result of evidence from cladistics.

## Standards

### 2020 New Jersey Student Learning Standards- Science

## Science and Engineering Practices

- Analyzing and Interpreting Data
- Asking Questions and Defining Problems
- Constructing Explanations and Designing Solutions
- Developing and Using Models
- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information
- Planning and Carrying Out Information

- Using Mathematics and Computational Thinking

## Cross Cutting Concepts

- Cause and Effect
- Energy and Matter
- Influence of Engineering, Technology, and Science on Society and the Natural World
- Interdependence of Science, Engineering, and Technology
- Patterns
- Scale, Proportion, and Quantity
- Stability and Change
- Structure and Functions
- Systems and System Models

## Disciplinary Core Ideas

## Life Sciences

- LS1C: Organization for Matter and Energy Flow in Organisms
- LS3B: Variation of traits
- LS4A: Evidence of Common Ancestry and Diversity
- LS4B: Natural Selection
- LS4C: Adaptation
- LS4D: Biodiversity and Humans

## Engineering. Technology. and Applications of Science

- ETS1B: Developing Possible Solutioins

## Essential Questions

5.1 What is the evidence for the evolution of life on Earth?

5.2 How has the diversity of life evolved and how does it continue to evolve by natural selection?

5.3 How are species named and classified using an internationally agreed system?

5.4 How can you explain the ancestry of groups of species by comparing their base or amino acid sequences?

## Enduring Understanding

Students will have a lasting appreciation for the processes which have occured, and are currently taking place, which allow the evolution of current species. Students will also have an understanding of the work that scientists do to help compare species using modern technology to show lineages of related species.

## Students will know...

5.1

- Evolution occurs when heritable characteristics of a species change.
- The fossil record provides evidence for evolution.
- Selective breeding of domesticated animals shows that artificial selection can cause evolution.
- Evolution of homologous structures by adaptive radiation explains similarities in structure when there are differences in function.
- Populations of a species can gradually diverge into separate species by evolution.
- Continuous variation across the geographical range of related populations matches the concept of gradual divergence.

5.2

- Natural selection can only occur if there is variation among members of the same species.
- Mutation, meiosis and sexual reproduction cause variation between individuals in a species.
- Adaptations are characteristics that make an individual suited to its environment and way of life.
- Species tend to produce more offspring than the environment can support.
- Individuals that are better adapted tend to survive and produce more offspring while the less well adapted tend to die or produce fewer offspring.
- Individuals that reproduce pass on characteristics to their offspring.
- Natural selection increases the frequency of characteristics that make individuals better adapted and decreases the frequency of other characteristics leading to changes within the species.

5.3

- The binomial system of names for species is universal among biologists and has been agreed and developed at a series of congresses.
- When species are discovered they are given scientific names using the binomial system.
- Taxonomists classify species using a hierarchy of taxa.
- All organisms are classified into three domains.
- The principal taxa for classifying eukaryotes are kingdom, phylum, class, order, family, genus and species.
- In a natural classification, the genus and accompanying higher taxa consist of all the species that have

evolved from one common ancestral species.
- Taxonomists sometimes reclassify groups of species when new evidence shows that a previous taxon contains species that have evolved from different ancestral species.
- Natural classifications help in identification of species and allow the prediction of characteristics shared by species within a group.

5.4

- A clade is a group of organisms that have evolved from a common ancestor.
- Evidence for which species are part of a clade can be obtained from the base sequences of a gene or the corresponding amino acid sequence of a protein.
- Sequence differences accumulate gradually so there is a positive correlation between the number of differences between two species and the time since they diverged from a common ancestor.
- Traits can be analogous or homologous.
- Cladograms are tree diagrams that show the most probable sequence of divergence in clades.
- Evidence from cladistics has shown that classifications of some groups based on structure did not correspond with the evolutionary origins of a group or species.

## Students will be able to...

5.1

- Analyze the development of melanistic insects in polluted areas.
- Compare the pentadactyl limb of mammals, birds, amphibians and reptiles with different methods of locomotion.

5.2

- Compare the changes in beaks of finches on Daphne Major.
- Explain the evolution of antibiotic resistance in bacteria.

5.3

- Explain the classification of one plant and one animal species from domain to species level.
- Analyze the features of bryophyta, filicinophyta, coniferophyta and angiospermophyta.
- Analyze the features of porifera, cnidaria, platyhelmintha, annelida, mollusca, arthropoda and chordata.
- Analyze thefeatures of birds, mammals, amphibians, reptiles and fish.

5.4

- Design cladograms including humans and other primates.
- Explain the reclassification of the figwort family using evidence from cladistics.

## STAGE 2- EVIDENCE OF LEARNING

### Formative Assessment

- Exit Card / Ticket
- Inside-Outside Circle Discussion (Fishbowl)
- Observation
- Questions & Answers
- Quiz
- Web or Concept Map

### Authentic Assessments

5.3

- Skill: Construction of dichotomous keys for use in identifying specimens.

5.4

Skill: Analysis of cladograms to deduce evolutionary relationships.

Laboratories will be used for assessment

Quizzes will be given.

### Benchmark Assessments

Chapter tests will be given.

## STAGE 3- LEARNING PLAN

### Instructional Map

Helpful guidance to implement the IB Biology curriculum

5.2

- Students should be clear that characteristics acquired during the lifetime of an individual are not heritable. The term Lamarckism is not required.

5.3

- Archaea, eubacteria and eukaryote should be used for the three domains.
- Members of these domains should be referred to as archaeans, bacteria and eukaryotes.
- Students should know which plant phyla have vascular tissue, but other internal details are not required.
- Recognition features expected for the selected animal phyla are those that are most useful in distinguishing the groups from each other and full descriptions of the characteristics of each phylum are not needed.
- Viruses are not classified as living organisms.

## Modification/Differentiation of Instruction

Differentiation Strategies for Special Education Students

- Remove unnecessary material, words, etc., that can distract from the content
- Use of off-grade level materials
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Time allowed
- Level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in “chunks”
- Varied texts and supplementary materials
- Use technology, if available and appropriate
- Varied homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language.
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Ability to work at their own pace
- Present ideas using auditory, visual, kinesthetic, & tactile means
- Provide graphic organizers and/or highlighted materials

- Strategy and flexible groups based on formative assessment
- Differentiated checklists and rubrics, if available and appropriate

Differentiation Strategies for Gifted and Talented Students

- Increase the level of complexity
- Decrease scaffolding
- Variety of finished products
- Allow for greater independence
- Learning stations, interest groups
- Varied texts and supplementary materials
- Use of technology
- Flexibility in assignments
- Varied questioning strategies
- Encourage research
- Strategy and flexible groups based on formative assessment or student choice
- Acceleration within a unit of study
- Exposure to more advanced or complex concepts, abstractions, and materials
- Encourage students to move through content areas at their own pace
- After mastery of a unit, provide students with more advanced learning activities, not more of the same activity
- Present information using a thematic, broad-based, and integrative content, rather than just single-subject areas

Differentiated Strategies for ELL Students

- Remove unnecessary materials, words, etc., that can distract from the content
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Gradually increase the level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in “chunks”
- Varied texts and supplementary materials, including visuals
- Use technology, if available and appropriate
- Differentiate homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language.
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary

- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Allow students to work at their own pace
- Presenting ideas through auditory, visual, kinesthetic, & tactile means
- Role play
- Provide graphic organizers, highlighted materials
- Strategy and flexible groups based on formative assessment

Differentiation Strategies for At Risk Students

- Remove unnecessary materials, words, etc., that can distract from the content
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Gradually increase the level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in "chunks"
- Varied texts and supplementary materials
- Use technology, if available and appropriate
- Differentiate homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Presenting ideas through auditory, visual, kinesthetic, & tactile means
- Provide graphic organizers and/or highlighted materials
- Strategy and flexible groups based on formative assessment

**504 Plans**

Students can qualify for 504 plans if they have physical or mental impairments that affect or limit any of their abilities to:

- walk, breathe, eat, or sleep
- communicate, see, hear, or speak
- read, concentrate, think, or learn
- stand, bend, lift, or work

Examples of accommodations in 504 plans include:

- preferential seating
- extended time on tests and assignments
- reduced homework or classwork
- verbal, visual, or technology aids
- modified textbooks or audio-video materials
- behavior management support
- adjusted class schedules or grading
- verbal testing
- excused lateness, absence, or missed classwork
- pre-approved nurse's office visits and accompaniment to visits
- occupational or physical therapy

## Modification Strategies

- Cooperative Grouping
- Oral Directions
- Preferential Seating

## Differentiation Strategies

## High Preparation

- Alternative Assessments
- Group Investigations
- Independent Research / Project
- Multiple Texts

## Low Preparation

- Flexible Grouping
- Jigsaw

- Work Alone / Together

## Horizontal Intergration- Interdisciplinary Connections

See Appendix

## Vertical Integration- Discipline Mapping

Previous courses

6th grade – Diversity of life

7th grade – Populations and Ecosystems

8th grade – Human Systems Interactions and Heredity and Adaptations

9th grade – Honors Biology

10th grade – Honors Chemistry

Possible next courses

Honors Physics

Anatomy & Physiology

IB Physics

Zoology

Forensics

## Additional Materials

Videos used through McGraw Hill, Crash Course and Howard Hughes Medical Institute.

Current Research articles supplied through Newsela.