# Year 1, Unit 11 HL Topic 10 Genetics and Evolution

Science
IB Biology, HL
Third Marking Period
3 Weeks
Published

#### **Unit Overview**

Students will learn the advanced principles of genetics, which include inheritance patterns and gene expression. Students will learn about gene segregation and processes which can affect the inheritance of traints.

#### **STAGE 1- DESIRED RESULTS**

10.1 Making careful observations—careful observation and record keeping turned up anomalous data that Mendel's law of independent assortment could not account for. Thomas Hunt Morgan developed the notion of linked genes to account for the anomalies.

10.2 Looking for patterns, trends and discrepancies—Mendel used observations of the natural world to find and explain patterns and trends. Since then, scientists have looked for discrepancies and asked questions based on further observations to show exceptions to the rules. For example, Morgan discovered non-Mendelian ratios in his experiments with *Drosophila*.

10.3 Looking for patterns, trends and discrepancies—patterns of chromosome number in some genera can be explained by speciation due to polyploidy.

#### **Standards**

# 2020 New Jersey Student Learning Standards- Science

# **Science and Engineering Practices**

- Analyzing and Interpreting Data
- Asking Questions and Defining Problems
- Developing and Using Models

• Using Mathematics and Computational Thinking

## **Cross Cutting Concepts**

- Cause and Effect
- Influence of Engineering, Technology, and Science on Society and the Natural World
- Interdependence of Science, Engineering, and Technology
- Patterns
- Structure and Functions

## **Disciplinary Core Ideas**

#### **Life Sciences**

- LS1A: Structure and Functions
- LS1D: Information Processing
- LS3A: Inheritance of Traits
- LS3B: Variation of traits
- LS4B: Natural Selection

#### **Essential Questions**

10.1 How does meiosis leads to independent assortment of chromosomes and unique composition of alleles in daughter cells?

10.2 How are genes that may be linked or unlinked and are inherited accordingly?

10.3 How do gene pools change over time?

## **Enduring Understanding**

Students will have an understanding of the importance of inherited traits. Students will also appreciate the process for how traits are segregated and how they are inherited from parent to offspring.

## Students will know...

10.1

- Chromosomes replicate in interphase before meiosis.
- Crossing over is the exchange of DNA material between non-sister homologous chromatids.
- Crossing over produces new combinations of alleles on the chromosomes of the haploid cells.
- Chiasmata formation between non-sister chromatids can result in an exchange of alleles.
- Homologous chromosomes separate in meiosis I.
- Sister chromatids separate in meiosis II.
- Independent assortment of genes is due to the random orientation of pairs of homologous chromosomes in meiosis I.

10.2

- Gene loci are said to be linked if on the same chromosome.
- Unlinked genes segregate independently as a result of meiosis.
- Variation can be discrete or continuous.
- The phenotypes of polygenic characteristics tend to show continuous variation.
- Chi-squared tests are used to determine whether the difference between an observed and expected frequency distribution is statistically significant.

10.3

- A gene pool consists of all the genes and their different alleles, present in an interbreeding population.
- Evolution requires that allele frequencies change with time in populations.
- Reproductive isolation of populations can be temporal, behavioural or geographic.
- Speciation due to divergence of isolated populations can be gradual.
- Speciation can occur abruptly.

## Students will be able to...

10.2

- Analyze Morgan's discovery of non-Mendelian ratios in Drosophila.
- Explain the completion and analysis of Punnett squares for dihybrid traits.
- Critique polygenic traits such as human height may also be influenced by environmental factors.

## 10.3

- Identifying examples of directional, stabilizing and disruptive selection.
- Prove the speciation in the genus *Allium* by polyploidy.

#### **Formative Assessment**

- Debriefing
- Hand Signals
- Misconception Check
- Observation
- Questions & Answers
- Quiz

## **Authentic Assessments**

10.1

• Skill: Drawing diagrams to show chiasmata formed by crossing over.

10.2

- Skill: Calculation of the predicted genotypic and phenotypic ratio of offspring of dihybrid crosses involving unlinked autosomal genes.
- Skill: Identification of recombinants in crosses involving two linked genes.
- Skill: Use of a chi-squared test on data from dihybrid crosses.

10.3

• Skill: Comparison of allele frequencies of geographically isolated populations.

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 for the implementation of the IB Biology curriculum

10.1

• Diagrams of chiasmata should show sister chromatids still closely aligned, except at the point where crossing over occurred and a chiasma was formed.

## 10.2

• Alleles are usually shown side by side in dihybrid crosses, for example, TtBb. In representing crosses involving linkage, it is more common to show them as vertical pairs, for example:

<u>T B</u>

- tb
- This format will be used in examination papers, or students will be given sufficient information to allow them to deduce which alleles are linked.

10.3

• Punctuated equilibrium implies long periods without appreciable change and short periods of rapid evolution.

# **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 singlesubject 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

# **Differentiation Strategies**

#### **High Preparation**

- Group Investigations
- Guided Reading
- Independent Research / Project
- Varying Graphic Organizers

## **Low Preparation**

- Varied Supplemental Materials
- Work Alone / Together

See Appendix

# **Vertical Integration- Discipline Mapping**

Previous courses

6<sup>th</sup> grade – Diversity of life

7<sup>th</sup> grade – Populations and Ecosystems

8<sup>th</sup> grade –Human Systems Interactions and Heredity and Adaptations

9<sup>th</sup> grade – Honors Biology

10<sup>th</sup> 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.