International Baccalaureate
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MARIETTA CITY SCHOOLS

MYP/3D Science Unit Planner
Marietta City Schools

Grade & Course: 10th Grade Biology	**Topic: Mendelian and Non Mendelian Genetics:** Patterns of Heredity	**Duration:** 5.5 weeks
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Georgia Standards of Excellence:

SB1. Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells.

b. Develop and use models to explain the role of cellular reproduction (including binary fission, mitosis, and meiosis) in maintaining genetic continuity.

SB2. Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells.

b. Construct an argument based on evidence to support the claim that inheritable genetic variations may result from: new genetic combinations through meiosis (crossing over, nondisjunction); non-lethal errors occurring during replication (insertions, deletions, substitutions); and/or heritable mutations caused by environmental factors (radiation, chemicals, and viruses).

SB3. Obtain, evaluate, and communicate information to analyze how biological traits are passed on to successive generations.

a. Use Mendel's laws (segregation and independent assortment) to ask questions that explain the role of meiosis in reproductive variability.

b. Use mathematical models to predict and explain patterns of inheritance. (Clarification statement: Students should be able to use Punnett squares (monohybrid and dihybrid crosses) and/or rules of probability, to analyze the following inheritance patterns: dominance, codominance, incomplete dominance.)

c. Construct an argument to support a claim about the relative advantages and disadvantages of sexual and asexual reproduction.

Narrative / Background Information

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

S7L3. Obtain, evaluate, and communicate information to explain how organisms reproduce either sexually or asexually and transfer genetic information to determine the traits of their offspring.

a. Construct an explanation supported with scientific evidence of the role of genes and chromosomes in the process of inheriting a specific trait.

b. Develop and use a model to describe how asexual reproduction can result in offspring with identical genetic information while sexual reproduction results in genetic variation. (Clarification statement: Models could include, but are not limited to, the use of monohybrid Punnett squares to demonstrate the heritability of genes and the resulting genetic variation, identification of heterozygous and homozygous, and comparison of genotype vs. phenotype.)

c. Ask questions to gather and synthesize information about the ways humans influence the inheritance of desired traits in organisms through selective breeding. (Clarification statement: The element specifically addresses artificial selection and the ways in which it is fundamentally different from natural selection.)

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)

Non-identical twin siblings do not look like each other or their parents.

MYP Inquiry Statement:

Models help people visualize and predict the **relationship** within **patterns** that shape **human identity.**

MYP Global Context:

Scientific and Technological Innovation

Approaches to Learning Skills: ***

COMMUNICATION: Communication Skills
SOCIAL: Collaboration Skills

Disciplinary Core Ideas: (KNOWLEDGE & SKILLS)

- Genetic continuity (meiosis)
- Sexual reproduction (meiosis)
- Heritable variation (events in meiosis and sexual reproduction) - crossing over, independent assortment, fertilization
- Karyotypes analysis
- Inheritance of Genes & Alleles
- Punnett squares
- Mendelian Patterns of Inheritance
- Mendel's Laws
- Non-Mendelian Patterns of Inheritance
- Pedigree analysis

Crosscutting Concepts: * (KNOWLEDGE & SKILLS)**

Stability & Change

System & System Models

Cause & Effect

Patterns

Scale, Proportion, & Quantity

MYP Key and Related Concepts: **
Select one Key Concept:
Relationships (key concept)

Evidence, Models, & Patterns (related concepts)

Identities & Relationships (global context)

[GADOE Achievement Level Descriptors for Biology]
[GADOE Inspire Notes for Biology]

Disciplinary Core Content: Mendelian and non-Mendelian patterns of inheritance
Focus Science & Engineering Practices: developing and using models; engaging in argument from evidence, asking questions, constructing explanations, using mathematics and computational thinking
Focus Crosscutting Concepts: stability and change, systems and system modes, patterns, cause and effect, scale, proportion, and quantity

Refer to the Georgia Standards of Excellence outlined on page 1 of the unit planner.

Beginning *Students performing in the beginning range are able to consistently…*	**Developing** *Students performing in the developing range are able to consistently…*	**Proficient** *Students performing in the proficient range are able to consistently…*	**Distinguished** *Students performing at the distinguished range are able to consistently…*
As a ***beginning learner***, I can… • recognize the role of cellular reproduction (meiosis) in maintaining genetic continuity; • recognize that genetic variations may result from new genetic combinations through meiosis; • recognize examples of Mendel's laws; • identify general patterns of inheritance; • communicate that there are advantages and disadvantages of sexual and asexual	As a ***developing learner***, I can… • recognize models used to explain the role of cellular reproduction (meiosis I and II) in maintaining genetic continuity; • provide examples of inheritable genetic variations that may result from new genetic combinations through meiosis; • describe Mendel's laws and recognize how they can be used to explain the role of meiosis in reproductive variability; • determine how models	As a ***proficient learner***, I can… • develop and use models to explain the role of cellular reproduction (meiosis) in maintaining genetic continuity; • construct an argument based on evidence to support the claim that inheritable genetic variations may result from new genetic combinations through meiosis (crossing over, nondisjunction); • use Mendel's laws (segregation and independent assortment)	As a ***distinguished learner***, I can… • refine models to explain the role of cellular reproduction (meiosis) in maintaining genetic continuity; • analyze an argument based on evidence to support the claim that inheritable genetic variations may result from new genetic combinations through meiosis; • use Mendel's laws to answer questions and solve problems related to the role of meiosis in reproductive variability; • analyze mathematical models used to predict and

reproduction;	can be used to explain patterns of inheritance; • describe the advantages and disadvantages of sexual and asexual reproduction;	to ask questions that explain the role of meiosis in reproductive variability; • use mathematical models to predict and explain patterns of inheritance; • construct an argument to support a claim about the relative advantages and disadvantages of sexual and asexual reproduction;	explain patterns of inheritance; • refine an argument to support a claim about the relative advantages and disadvantages of sexual and asexual reproduction;

Student-Friendly Learning Targets:

1. I can appropriately use key terms such as chromosome, chromatid, recombinant chromosome, gamete, sex cell, somatic cell, meiosis, crossing over, hereditary, diploid, haploid, fertilization, nondisjunction, monosomy, trisomy.
2. I can compare and contrast mitosis and meiosis.
3. I can develop and use models to explain the role of cellular reproduction (meiosis) in maintaining genetic continuity.
4. I can explain how events in meiosis, including crossing over and nondisjunction, may increase genetic variation.
5. I can use evidence to support an argument about how events in meiosis, including crossing over and nondisjunction, can increase genetic variation.
6. I can differentiate between Meiosis I and Meiosis II.
7. I can appropriately use key terms such as monohybrid, dihybrid, hybrid, heterozygous, homozygous, carrier, phenotype, genotype, ratio, zygote, recombination (fertilization), homologous, allele, gene, Punnett square, genetic cross, segregation, assortment, F1, F2, parental generation, pedigree analysis, karyotype, dominant (example HH), recessive (example Hh), codominant (example HC), incomplete dominance (example HH' or HB).
8. I can state Mendel's law of segregation.
9. I can identify models and diagrams that demonstrate my understanding of Mendel's law of segregation.
10. I can use Mendel's law of segregation to ask questions that explain the role of meiosis in reproductive variability.
11. I can state Mendel's law of independent assortment.
12. I can identify models and diagrams that demonstrate my understanding of Mendel's law independent assortment.
13. I can use Mendel's law of independent assortment to ask questions that explain the role of meiosis in reproductive variability.
14. I can use Mendel's laws of segregation and independent assortment to ask questions regarding the relationship between meiosis and genetic variation.
15. I can create and use mono and dihybrid Punnett square as a mathematical model to predict and explain patterns of Mendelian inheritance.
16. I can define and give examples of Non-Mendelian inheritance patterns (codominance and incomplete dominance).
17. I can create and use a monohybrid Punnett square mathematical model to predict and explain patterns of Non-Mendelian inheritance (codominance and incomplete dominance).
18. I can interpret a Punnett square demonstrating basic sex linkage (i.e., color blindness in humans or hemophilia in humans).
19. I can interpret the outcome of Punnett squares in terms of ratios, percentages, and probabilities.
20. I can interpret and use a karyotype as a possible model to predict patterns of inheritance (monosomy, trisomy, etc.).
21. I can interpret and use a pedigree as a model to predict patterns of inheritance.

Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)

Students may think that Mendel's Law of dominance is the only pattern of inheritance, and they may not understand that 50% of an offspring's DNA comes from mom and the other 50% from dad, even if you look more like one parent over the other.
Mutations can be genetic or environmental- students often don't know that there are environmental causes of DNA mutations, which in turn can cause diseases such as cancer.
There is more than one form of asexual reproduction- binary fission is not the only way to asexually reproduce. Sexual reproduction can be internal or external, and many organisms can perform both sexual and asexual reproduction. There are many unique and interesting methods of reproduction other than what is commonly thought of in terms of sexual and asexual reproduction. Students may think that the genotype of one generation of offspring will affect the genotypes of future offspring. Students may think that dominant traits are more prevalent and/or they are more advantageous to have in a population.

Key Vocabulary: (KNOWLEDGE & SKILLS)

centrioles, centromere, chromosome, chromatid, daughter cells, fertilization, genes, gametes, genetic continuity, homologous chromosome, meiosis I, meiosis II, parent cell, replicated chromosome, unreplicated chromosome, sister chromatids, spindle fibers, chromosomal mutation, crossing over, genetic variation, karyotype, nondisjunction, recombinant DNA, trisomy, pedigree analysis, allele, autosomal chromosome, sex chromosome, carrier, codominance, incomplete dominance, crossing over, monohybrid cross, dihybrid cross, diploid, haploid, dominant trait, recessive trait, genotype, phenotype, heterozygous, homozygous, hybrid, probability, Punnett square, purebred (true breeding), ratio, sexual reproduction, trait, X-linked trait

Inquiry Questions:

Factual:

What are the stages of meiosis?

What type of reproduction results in genetic variation?

What type of reproduction is an advantage when you need to increase the population numbers quickly?

What type of reproduction involves genetic material from two parents?

What type of reproduction involves genetic material from only one parent?

During what phase of meiosis does crossing over occur?

During what phase of meiosis can nondisjunction occur?

What type of inheritance does blood type follow?

Conceptual:

How does a malfunction in meiosis (nondisjunction) lead to genetic disorders in organisms?

How can karyotypes be useful in determining genetic changes in an organism?

How does meiosis lead to variation in a population?

How does meiosis help maintain genetic continuity in a population?

What are the disadvantages and advantages of asexual reproduction?

What are the disadvantages and advantages of sexual reproduction?

How do punnett squares tell the probability of the genotypes and phenotypes of offspring?

How does crossing over help to encourage evolution within a population?

How is it possible that an offspring can have a 3rd and different phenotype than either of the parent phenotypes?

If two heterozygous parents are crossed, and the F1 generation is 25% homozygous recessive, what are the chances that the same parents will produce another homozygous recessive offspring in a different cross?

How do the daughter cells compare to the parent cell in meiosis?

Debatable:

Do environmental or genetic factors cause mutations that result in more diversity in a population?

Were Mendel's results of inheritance too perfect?		
MYP Objectives	**Summative assessment**	
Sciences **Design**	Common Formative Assessments Common Summative Assessments MYP Essay	Relationship between summative assessment task(s) and statement of inquiry: The CFAs help to monitor and determine student progress as we move through the unit. This data informs the teacher of which students to accelerate, and which to remediate prior to the unit summative. The summative assessments serve to test students' mastery of the learning targets at the proficient and distinguished level of the Achievement Level Descriptors for Biology.

Unit Objectives:			
Learning Activities and Experiences	**Inquiry & Obtain:**	**Evaluate:**	**Communicate:**
Week 1/2: **Topic 1: Meiosis & Sexual Reproduction** - benefits of sexual reproduction - main events of meiosis I and II - crossing over → variation & continuity	Common Openers & Closers for Patterns of Heredity Unit Meiosis & Patterns of Heredity PPT (Honors) Meiosis PPT (On-Level) Patterns of Heredity PPT (On-Level)	Meiosis Exploration Meiosis Modeling Activity Mitosis v Meiosis Graphic Organizer Mitosis v Meiosis Review	• Unit 4 Study Guide (Digital) • Unit 4 Study Guide
Week 2/3: **Topic 2: Nondisjunction & Genetic Abnormalities** - non disjunction → variation - examples of nondisjunction **Topic 3: Mendel's Laws of Heredity** - Mendel's law of dominance - Mendel's law	Meiosis & Patterns of Heredity PPT (Honors)	Mendel's Laws of Heredity Exploration Intro to Basic Punnett Squares Students will use the chromosome kits to create a karyotype model of their patient. They will be able to determine if it is abnormal or normal and also the sex. Students will then research the disorder and present it to the class. Optional Online Activity http://www.biology.arizona.edu/	Blue People of Kentucky: Students will first gather information about the blue people of Kentucky through various resources. They will examine the pedigree of the Kentucky families. Using information gathered, they will develop a CER to justify if the trait for blue skin is dominant or recessive. Common Formative Assessment (Topics 1, 2, and 3)

of segregation - Mendel's law of independent assortment		human_bio/activities/karyotyping/karyotyping.html Optional Genetics Disorder and Karyotyping Project. Students will work individually to research a genetic disorder. In the report a karyotype must be included along with a description of the karyotype. Students will be given a list of disorders to choose from.	
Week 3/4: Topic 4: Interpreting Punnett Squares and Pedigree Analysis - finding expected genotype and phenotype ratios from completed Punnett squares - understanding how to use pedigrees to determine patterns of inheritance	Meiosis & Patterns of Heredity PPT (Honors)	Genetics Crosses Practice Dihybrid Crosses Labrador Retrievers Practice Activity	MYP Essay (Topics 1, 2, 3, and 4)
Week 4/5: Topic 5: Non-Mendelian Patterns of Inheritance - codominance, incomplete dominance - sex linked (intro level only	Meiosis & Patterns of Heredity PPT (Honors)	Patterns of Inheritance Practice Problems Non-Mendelian Patterns of Inheritance Practice Problems	Codominance Lab with Blood Typing: Blood Typing Lab: Students will work in collaborative groups to determine a scenario with blood type. ● Who's the father? ● Murder Mystery. Students will be given synthetic blood and be able to determine blood types. They will either be investigating a crime scene or figuring out a paternity scenario. They must complete a CER at the end of their investigation and share their claim with the class.
Week 5/5.5: Assess & Remediate - Common Summative Assessment & Unit Remediation			Common Summative Assessment CK12 Unit Remediation

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 the unit	During teaching	After teaching the unit
Students tend to struggle with vocabulary. The content is engaging, however, meiosis is difficult. To address the struggles, students will model and practice the vocabulary and meiosis.		