

MYP/3D Science Unit Planner

Marietta City Schools

<b>Grade &amp; Course:</b> 10th Grade Biology	<b>Topic:</b> Structure & Function of Molecular Genetics	<b>Duration:</b> 6 weeks
<b>Teachers:</b> Hunter Fisher, Heather Glazebrook, Mariah Sappington, Uswa Jadoon, Lisa Smith, Rosemary Kamau, O'Neal McRunells, Amber Carr, Zakayo Ruoro, Alvin Tremble		

**Georgia Standards and Content:**

**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.**

a. Construct an explanation of how the structures of DNA and RNA lead to the expression of information within the cell via the processes of replication, transcription, and translation.

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).

c. Ask questions to gather and communicate information about the use and ethical considerations of biotechnology in forensics, medicine, and agriculture. (Clarification statement: The element is intended to include advancements in technology relating to economics and society such as advancements may include Genetically Modified Organisms.)

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

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)**

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

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). (Clarification statement: This includes common examples and characteristics such as, but not limited to, prokaryotic, eukaryotic, unicellular, multicellular, asexual reproduction, sexual reproduction, autotroph, heterotroph, and unique cell structures. Modern classification will be addressed in high school.)

**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)**

Sickle cell disease is a genetic mutation that may be reversed by gene therapy.

**MYP Inquiry Statement:**

Sickle cell disease is the most common inherited blood disorder, affecting 70,000 to 80,000 Americans.

**MYP Global Context:**

Scientific and Technical Innovation: The Biological Revolution

**Approaches to Learning Skills: \*\*\***

Communication Skills  
Collaboration Skills  
Research Skills

**Disciplinary Core Ideas: (KNOWLEDGE & SKILLS)**

Structure of DNA  
DNA replication Cellular reproduction  
(binary fission, mitosis)  
Cancer  
Synthesizing proteins  
Gene mutations  
Biotechnology  
Asexual Reproduction

**Crosscutting Concepts: \*\*\* (KNOWLEDGE & SKILLS)**

Cause & Effect  
Structure and Function  
System and system models

**MYP Key and Related Concepts: \*\***

Key Concept - Cause & Effect  
  
Related Concepts  
Structure and Function  
System and system models  
Sciences - Form and Models

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

All organisms have the same number of chromosomes; DNA is different than chromosomes; mutations in somatic cells are passed along to future generations; mutations are not random; all mutations are negative; nucleus is the “brain” of the cell, but students don’t have a true understanding of why; proteins are just the nutrients found in meats- not aware of the true function and variety of proteins found in organisms; structure of proteins are the same; cancer is caused by environmental factors only; GMOs have negative effects on our health

**Key Vocabulary: (KNOWLEDGE & SKILLS)**

Nucleotide, nitrogenous base, adenine, guanine, thymine, cytosine, uracil, sugar-phosphate backbone, complementary base pairing, antiparallel, double helix, RNA, DNA, deoxyribose, ribose, nucleic acid, semiconservative replication, cell cycle, mitosis, daughter cell, prophase, metaphase, anaphase, telophase, chromosome, chromatin, cytokinesis, cancer, apoptosis, somatic cell, gamete, asexual reproduction, diploid, genetic continuity, binary fission, protein, amino acid, RNA, mRNA, tRNA, rRNA, transcription, translation, peptide, peptide bond, ribosome, nucleus, nucleolus, mutation, variation, phenotype, point mutation, substitution, frameshift, deletion, insertion, genome, artificial selection/selective breeding, genetically modified organisms (GMOs), gene therapy

**Inquiry Questions:****Factual:**

What are the roles of organelles involved in protein synthesis?  
What are the phases of mitosis and what are their functions?  
Which types of cells undergo mitosis?  
What are the three parts of a nucleotide?  
What are the similarities and differences between DNA and RNA?

What is the central dogma of biology?

What are the functions of the processes of transcription and translation?

Which molecules are involved in both transcription and translation?

Where do the processes of transcription and translation take place in the cell?

What are the different types of genetic mutations and what effect do these mutations have on organisms?

What are the advantages and disadvantages of sexual and asexual reproduction?

**Conceptual:**

How are DNA and RNA utilized in the process of transcription?

How are mRNA, rRNA, and tRNA utilized in the process of translation?

Why do cells perform mitosis?

How are protein synthesis and mutations related?

How is the function of a protein affected if the shape of the protein is changed (due to a mutation)?

Why do cells undergo the cell cycle, and what are the functions of each phase and subphase?

How do cells undergo the process of mitosis, and how do the daughter cells relate to the parent cells?

How does mitosis maintain genetic continuity?

Why is DNA replication referred to as "semiconservative"?


How is the structure of DNA and RNA different ?


How do the ethical implications of different types of DNA technology influence society?

**Debatable:**

Should GMOs be used in foods for human or livestock consumption?

MYP Objectives	Summative assessment	
<b>Sciences</b> <b>Design</b>	Common Assessments: <ul style="list-style-type: none"><li>● Common formative assessment DNA Structure and Replication</li><li>● Common formative assessment Protein Synthesis</li><li>● Common summative assessment Structure and Function of Molecular Genetics</li><li>● MYP A: Short answer on summative 1 (topic: cell cycle and cancer)</li><li>● MYP D: GMO Debate</li></ul>	Relationship between summative assessment task(s) and statement of inquiry:  The CFAs provide formative feedback to determine student progress through the unit. This data informs the teacher who needs to be accelerated, who is on target for mastery, and who needs remediation before moving forward.  The summative assessments serve to test student knowledge, understanding, and application of living systems in terms of structures of organisms and how genetic information is expressed in cells.
<b>Unit Objectives:</b>		

Learning Activities and Experiences	Inquiry & Obtain: (LEARNING PROCESS)	Evaluate: (LEARNING PROCESS)	Communicate: (LEARNING PROCESS)
<b>Weeks 1-2:</b>	<p><b>Phenomenon:</b> DNA is the code to life. One small mistake in the DNA can have large consequences.</p> <p><b>Alternative Phenomenon:</b> The Human Genome Project mapped out the complete sequence for each chromosome</p> <p><b>Gathering</b> Strawberry DNA Extraction investigation</p>	<p>DNA and RNA comparison chart</p> <p>DNA and DNA replication Instruction Video</p> <p>Graphic organizer on DNA and RNA</p> <p>Digital Base Pair Practice</p>	<p>DNA RNA Model Lab: Students will build DNA and RNA nucleotides out of twizzlers and marshmallows and to show how DNA replicates. They will also have to design their own RNA nucleotide using their knowledge gained in earlier lessons.</p> <p>Optional DNA Origami model to share</p>
<b>Week 3:</b>	<p><b>Phenomenon:</b> Some lizards will lose their tails to escape their predators. Later they grow them back.</p>  <p><b>Optional Phenomenon:</b> Humans lose approximately one million skin cells daily.</p> <p><b>Optional Phenomenon:</b> The HPV Vaccine is recommended for both sexes to help reduce the number of cancer cases.</p>	<p>HHMI Cell Cycle and Cancer Interactive Schoology activity <a href="https://marietta.schoology.com/course/5131394795/assessments/5583851540">https://marietta.schoology.com/course/5131394795/assessments/5583851540</a></p> <p>Cell Cycle Modeling activity</p> <p>Optional cell cycle &amp; mitosis tutorial</p> <p>Optional Cell cycle &amp; Cancer online lab</p>	<p>Cell cycle (PMAT) Video Activity</p> <p>CER: Which patients have cancer? Students will examine histopath slides of tissues and determine which patients have cancer and support their claim with evidence.</p> <p><a href="http://static.nsta.org/extras/adi-bio/lab4studenthandout-normalandabnormalcelldivision.pdf">http://static.nsta.org/extras/adi-bio/lab4studenthandout-normalandabnormalcelldivision.pdf</a></p> <p>Students construct an explanation for how having one of the “cancer” genes can lead to the development of cancer.</p> <p>Students construct explanations from lab data.</p>
<b>Week 4:</b>	<p><b>Phenomenon:</b> Sickle Cell anemia - one small nucleotide change can lead to a change in shape of red blood cells which affects their function in the body.</p> <p><b>Gathering:</b> Protein Synthesis and Mutations Media Presentation</p> <p><b>Optional Phenomenon:</b> The instructions to make the protein hemoglobin in blood</p>	<p>Protein synthesis Modeling Activity</p> <p>Protein Synthesis Group Activity “The classroom is a “cell”</p> <p>Thalassemia Causes &amp; Effects Activity</p>	<p>3D Molecular kits to model protein synthesis</p> <p>Rice Krispie Mutations Activity</p> <p>Optional Sickle Cell Anemia Mutation Activity</p>

	that carries oxygen is found in DNA.		
<b>Week 5:</b>	<p><b>Phenomenon:</b> DNA can be altered to allow the snouts of pigs to glow.</p> 	<p>Webquest on DNA technology</p> <p>Debate on Genetically Modified Foods</p>	<p>Science Takeout Kit: Genetic Engineering. <a href="https://www.sciencetakeout.com/wp-content/themes/accelerate/images/teacher_guides/134.pdf">https://www.sciencetakeout.com/wp-content/themes/accelerate/images/teacher_guides/134.pdf</a></p> <p>Optional Jewel Thief Gel Group Activity</p>
<b>Week 6: Remediation</b>	<p><b>Phenomenon:</b> Some <b>bacteria</b> like <i>Escherichia coli</i> can divide every 20 minutes. This means that in just 7 hours one bacterium can generate 2,097,152 <b>bacteria</b>. After one more hour the number of <b>bacteria</b> will have risen to a colossal 16,777,216</p> <p><b>Phenomenon:</b> Sea stars and salamanders can regrow lost limbs.</p> <p><b>Optional Phenomenon:</b> Whiptail lizards of the Southwest are a result of parthenogenesis</p>	<p>Venn diagram on Sexual and Asexual reproduction</p> <p>Model of binary fission in bacteria used in genetic engineering</p>	<p>Reproductive Strategies Team Activity</p> <p>CER: Advantages of sexual and asexual reproduction</p>

**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
<p>Students enjoy transcription, translation, and mutation activities.</p> <p>Students struggle with cell cycle and mitosis. Students understand DOK level 1 questions, but struggle with higher level application. Implement warm up questions with standardized practices questions. ( Focusing on higher DOK levels )</p>	<p>(click here)</p>	<p>(click here)</p>

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**Curriculum Unit Approval Statement**  
*Every team member is expected to read and review the unit planner and contents contained in the unit planner.*

This unit meets the rigorous review and approval process of Marietta City Schools. All components of the unit have been reviewed and approved including learning experiences, materials, resources, texts, and assessments. This unit’s components:

- Are aligned to Georgia Standards of Excellence and MYP/DP subject area guide (if applicable)
- Are aligned to the pacing of the approved Subject Group Overview
- Provide resources that are appropriate for students’ grade level, subject/course level, etc.
- Provide learning experiences that prepare students for course assessments

PLCs review each learning experience using three criteria and collaborate to provide explicit and specific information.

<b>Criteria I: Standards Alignment:</b> <i>Learning experiences should provide alignment to the standards and the MYP subject area guide (if applicable).</i>	<b>Criteria II: Materials, Resources, and Text Complexity and Controversial Topics and Issues:</b> <i>Materials, resources, and texts are grade level and content appropriate.</i>	<b>Criteria III: Assessment Alignment:</b> <i>Since assessment drives instruction, learning experiences must align to and prepare students for regular common formative and summative assessments used to determine whether students are mastering standards-based content and ATL skills.</i>
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**Common Formative and Summative Assessments**

Common Formative and Summative Assessments		
<p><b>Assessment Title</b></p>	<p><b>Criteria I:</b> Does the PLC have any <u>concerns</u> or <u>issues</u> regarding the <u>alignment of learning experiences, materials, and resources to:</u></p> <ol style="list-style-type: none"> <li>1. <b>State Standards</b></li> <li>2. <b>MYP/DP (if applicable) components</b></li> <li>3. <b>Aligned to learning experiences</b></li> </ol> <p>Respond below with a N/A if you have no concerns or provide explicit comments related to concerns including method of resolution.</p>	<p><b>Criteria II:</b> Does the PLC have any <u>concerns</u> or <u>issues</u> regarding</p> <ol style="list-style-type: none"> <li>1. <b>Complexity of resources including text and vocabulary</b></li> <li>2. <b>Controversial topics and issues in learning experiences, materials or resources</b></li> </ol> <p>Respond below with a N/A if you have no concerns or provide explicit comments related to concerns including method of resolution. Include the <b>specific quote(s)</b> and reference <b>page numbers</b> or <b>location</b> (ex: time in video).</p>
<p><b>Formative Assessment(s):</b></p>		
<p><b>Summative(s) Assessment:</b></p>		
<p>Plan to address issues or concerns noted:</p>		

**Learning Experiences**  
Add additional rows below as needed.

<b>Learning Experience Title</b>	<b>Criteria I:</b> Does the PLC have any <u>concerns</u> or <u>issues</u> regarding the <u>alignment of learning experiences, materials, and resources to:</u> 1. <b>State Standards</b> 2. <b>MYP/DP (if applicable) components</b>  Respond below with a N/A if you have no concerns or provide explicit comments related to concerns including method of resolution.	<b>Criteria II:</b> Does the PLC have any <u>concerns</u> or <u>issues</u> regarding 1. <b>Complexity of resources including text and vocabulary</b> 2. <b>Controversial topics and issues in learning experiences, materials or resources</b>  Respond below with a N/A if you have no concerns or provide explicit comments related to concerns including method of resolution. Include the <b>specific quote(s)</b> and reference <b>page numbers</b> or <b>location</b> (ex: time in video).	<b>Criteria III:</b> Does the PLC have any <u>concerns</u> or <u>issues</u> regarding 1. <b>Common Assessment alignment to instruction and/or standards</b>  Respond below with a N/A if you have no concerns or provide explicit comments related to concerns including method of resolution.
LE 1:			
LE 2:			
LE 3:			
Plan to address issues or concerns noted:			

**Resources listed on unit planner**  
Add additional rows below as needed.

<b>Resources</b>	<b>Criteria I:</b> Does the PLC have any <u>concerns</u> or <u>issues</u> regarding the <u>alignment of learning experiences, materials, and resources to:</u> 1. <b>State Standards</b> 2. <b>MYP/DP (if</b>	<b>Criteria II:</b> Does the PLC have any <u>concerns</u> or <u>issues</u> regarding 1. <b>Complexity of resources including text and vocabulary</b> 2. <b>Controversial topics and issues in learning experiences, materials or</b>	<b>Criteria III:</b> Does the PLC have any <u>concerns</u> or <u>issues</u> regarding 1. <b>Common Assessment alignment to instruction and/or standards</b>  Respond below with a N/A if you



	<b>applicable) components</b>	<b>resources</b>	
	Respond below with a N/A if you have no concerns or provide explicit comments related to concerns including method of resolution.	Respond below with a N/A if you have no concerns or provide explicit comments related to concerns including method of resolution. Include the <b>specific quote(s)</b> and reference <b>page numbers</b> or <b>location</b> (ex: time in video).	have no concerns or provide explicit comments related to concerns including method of resolution.
<b>Resource:</b>			
Plan to address issues or concerns noted:			

***By typing my name below I am acknowledging that I have fully read, reviewed, listed concerns with resolutions, and approved of all contents included in the unit planner including learning experiences, materials, resources, texts, and assessments referenced on it. All other content and materials not included on the unit planner are the local school's responsibility (BOE IKB).***

Curriculum Team Signatures: