CCPS Science Unit Plan

Grade	9-12	**Subject**	Biology	**Unit #**	2
Unit Name	Growth and Heredity		**Timeline**	7 weeks	
How to use the Framework	This Framework should be used to implement daily science instruction. The resources and instructional strategies reflected in the Framework will provide a foundation for effective implementation and student mastery of standards. Please see the hyperlinked abbreviation document to ensure understanding all abbreviations used with this framework.				
Unit Overview	**Note: Structure and function is a major theme throughout growth and heredity. Macromolecules (nucleic acids and proteins) and cell organelles responsible for protein synthesis, meiosis, and sexual vs asexual reproduction should also be taught where appropriate. Lipids and carbohydrates will show up in Unit 2, as well as the other important cellular processes such as photosynthesis, respiration and homeostasis.** **1. Patterns and mechanisms of inheritance** **2. Mendelian genetics** **3. Meiosis** **4. Chromosomes and karyotypes** **5. Sexual and asexual reproduction** **6. Molecular inheritance** **7. DNA replication** **8. Expression of Traits** **9. Mutations** **10. DNA Technology**				
Lesson Plan guidance document and template	Department of Science Guidance Document Lesson Plan Template Week View Biology Teacher Notes				

3Dimensional Instruction

GSE	Science and Engineering Practices	Crosscutting Concepts
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**	**Obtain, evaluate, and communicate information** **Engaging in arguments from evidence** **Asking questions and defining problems** **Developing and using models**	**Structure and function** **Stability and Change** **Patterns** **Cause and Effect**

	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 of ethical consideration of biotechnology in forensics, medicine, and agriculture.** **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 and define problems 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.**		
NGSS Alignment	NGSS Alignment to Disciplinary Core Ideas		

Weekly Lesson Tasks

Week 1					
GSE:SB1b: Develop and use models to explain the role of cellular reproduction (including binary fission, mitosis and meiosis) in maintaining genetic continuity.		**Focused Concept:** **SB2b: 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)** **SB3 a: Use Mendel's laws(segregation and independent assortment) to ask questions and define problems that explain the role of meiosis in reproductive variability.** **b. Use mathematical models to predict and explain patterns of inheritance. (*Clarification state: 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.*)**			
Phenomenon: How do parents have offspring who do not look like their parents?			**DQ: How does sexual reproduction result in greater genetic diversity among offspring?**		
	Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**
Learning Target	**I can compare and contrast asexual and sexual reproduction.**	**I can compare and contrast asexual and sexual reproduction.**	**I can explain how new genetic combinations arise through meiosis.**	**I can explain how new genetic combinations arise through meiosis.**	**I can use mathematical models to predict and explain patterns of inheritance.**
Opening **(5-7 minutes)** **Essential Vocabulary this week:** **asexual reproduction** **sexual reproduction** **meiosis** **crossing over** **nondisjunction** **homozygous** **heterozygous** **dominant** **recessive** **trait** **filial generation** **codominance** **incomplete dominance** **polygenic** **sexlinked**	**TTW share the see-think-wonder for genetics. Teachers will have students Think, Pair, and Share their ideas about what they notice about the images. They will also start a driving question board for students to share their thoughts and questions.**	**TTW have the students identify one advantage of sexual reproduction and one advantage of asexual reproduction.**	**The teacher will pose the question "What could go wrong during meiosis?". Then, in small groups, students will be given a normal and an abnormal karyotype and asked what they see, what they wonder, and what they think about the karyotype.** **see-think-wonder** **Writing prompt- students should answer in a notebook.**	**TTW have the students read page 357 "Using genes to map flyways"** **TSW complete the "Identify patterns" questions.** **What are some reasons that populations of the same species might develop distinct genetic profiles?**	**TTW pose the question" How can we make predictions about which traits are inherited?** **Students will share ideas.** **The teacher will give a mini-lecture on Mendelian Genetics.** **The teacher will model how to set up and work Punnett square practice problems.**
Guided Practice/ Transition	**The teacher will ask**	**The teacher will provide**	**The teacher will utilize**	**TTW explain to the**	**The teacher will**

	students what type of cellular reproduction might explain how siblings might not look alike or even like their parents. **In small groups, students will be given a diagram of binary fission, mitosis and meiosis and asked to figure out which type of cell reproduction based on the images might explain the phenomena.** ***Teacher will use this time to briefly review binary fission and mitosis, which were previously covered in unit 1.***	**direct instruction on phases of meiosis and the mechanisms of variation in meiosis and fertilization. Students will take notes.** **Teacher will engage students in discussion using level 3 and 4 questions to have the students critically thinking.**	**the gradual release model to engage students in the Karyotype Gizmo with subject A.**	**students the "visual support" on page 349 in the TE textbook. Karyotype is a tool used by medical specialists…**	**introduce the activity: Smiley Face and review key vocabulary genotype, phenotype, dominant, recessive, homozygous, and heterozygous. Students will work in pairs to complete parts A and B** **Once they are finished, ask students if all the outcomes on their Smiley Face follow Mendel's rules.**
Independent Practice **Designing**	**TSW work on the Mitosis Meiosis Compare and Contrast.** **TTW facilitates while students work on the compare and contrast and provide corrective feedback, and reteach as necessary.**	**TSW work on the Mitosis Meiosis Compare and Contrast.** **TTW facilitates while students work on the compare and contrast and provide corrective feedback, and reteach as necessary.**	**TSW complete and analyze the karyotype for subject B while the teacher monitors and provides corrective feedback.** **The teacher will model how to analyze the karyotype to determine the gender of the offspring.**	**TTW assign each student one subject (C, D, or E), and students will analyze the assigned karyotype via Gizmo and complete the Karyotype GRASPS writing assignment.**	**TSW complete part C (creating smiley face) and analysis questions.**
Assessment Summary (5-7 minutes) **TOD Slides**	**Ticket out the door: How do crossing over, segregation and independent assortment provide evidence for increased genetic variation?** **TOD Slides:** **pg 356 review question #2** **Slide #1**	**Ticket out the door: Explain how chromosome segregation during meiosis is one mechanism for why offspring are not exact replicas of their parents.** **TOD Slides:** **pg. 355 "Cause and Effect (CCC)"** **Slide #2**	**Ticket out the door:** **TOD Slides:** **Slide #3**	**Closing Question: Explain how karyotype relate to how new genetic combinations arise through meiosis.**	**Ticket out the Door:** **TOD Slides:** **Slide #4**
Small Group Tasks					

(TBA)					

Week 2					
GSE:SB1b: Develop and use models to explain the role of cellular reproduction (including binary fission, mitosis and meiosis) in maintaining genetic continuity.	**Focused Concept:** **SB2b: 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)** **SB3 a: Use Mendel's laws(segregation and independent assortment) to ask questions and define problems that explain the role of meiosis in reproductive variability.** **b. Use mathematical models to predict and explain patterns of inheritance. (*Clarification state: 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.*)**				
Phenomenon: How do parents have offspring who do not look like their parents?			**DQ: How does sexual reproduction result in greater genetic diversity among offspring?**		
	Day 6	**Day 7**	**Day 8**	**Day 9**	**Day 10**
Learning Target	**I can use Punnett Squares and the rules of probability to analyze non-Mendelian patterns of inheritance (codominance, incomplete, etc).**	**I can use Punnett Squares and the rules of probability to analyze non-Mendelian patterns of inheritance (codominance, incomplete, etc).**	**I can use Punnett Squares and the rules of probability to analyze non-Mendelian patterns of inheritance (codominance, incomplete, etc).**	**I can use Punnett Squares and the rules of probability to analyze non-Mendelian patterns of inheritance (codominance, incomplete, etc).**	**I can use Punnett squares to analyze the inheritance pattern of codominance.**
Opening **(5-7 minutes)** **<u>Essential Vocabulary this week:</u>** **asexual reproduction** **sexual reproduction** **meiosis** **crossing over** **nondisjunction** **homozygous** **heterozygous** **dominant** **recessive** **trait** **filial generation** **codominance** **incomplete dominance**	**TTW show the see-think wonder and allow students to discuss the question, based on what we know so far. How would you explain how a child might not look like either parent?**	**TSW make a prediction using the "predict" question on page 364.**	**TTW ask students which traits on the Smiley face genetics did not follow Mendel's Rules. (See, think, wonder)** **Students will identify those traits and discuss how heterozygous individuals differ from homozygous dominant or homozygous recessive individuals.**	**Create a monohybrid punnett square then explain in words the outcome of the offspring.**	**TTW pose the question: Can blood type be used to determine paternity? (see, think, wonder)**

polygenic sexlinked					
Guided Practice/Transition	**The teacher will give a mini lecture on non-Mendelian patterns of inheritance and introduce the Designing an Organism Lab (Chapter 12 Investigation A)** **Teachers will place students in small groups of 2-3.** **The teacher will reference the Smiley face lab from the previous day, model how students will determine traits, and complete the data table.**	**TTW continue the lecture/discussion from the prior day.**	**The teacher will model and demonstrate problems for each type of non-Mendelian pattern of inheritance.** **Students will follow along and work out the teacher's example problems in their notebook for reference.** **Key vocabulary:** **1. incomplete dominance** **2. codominance**	**The teacher will model and demonstrate problems for each type of non-Mendelian pattern of inheritance.** **Students will follow along and work out the teacher's example problems in their notebook for reference.** **Key vocabulary:** **1. multiple alleles** **2. sex linked** **3. epistasis**	**The teacher will provide direct instruction via a mini-lecture on Multiple Allels (see page 372) and blood type inheritance.** **The mini-lecture will include the teacher modeling blood type inheritance problems.** **The students will take notes, follow along, and work on the sample problem with the teacher.** **Teacher Notes for Lab**
Independent Practice **Designing**	**Small groups of 2-3 students will design an organism with three different physical traits and assign alleles for each trait. Determine the probability of each genotype and phenotype by constructing monohybrid crosses.** **Students will complete the Analysis and Conclusion questions.**	**Small groups of 2-3 students will design an organism with three different physical traits and assign alleles for each trait. Determine the probability of each genotype and phenotype by constructing monohybrid crosses.** **Students will complete the Analysis and Conclusion questions.**	**The teacher will divide the students into groups of 3-4. Each group will work on a practice problem with an assigned non-Mendelian pattern of inheritance (Section 12.4, pp. 371-375).** **1. Incomplete dominance** **2. CoDominance** **3. Polygenic Traits** **4. Sex Linked Traits** **More than 1 group may be assigned to a topic.** **Each chart paper should include a sample problem indicating genotypic and phenotypic ratios. and a brief explanation of how that pattern differs from Mendelian patterns.** **The teacher will monitor**	**The teacher will divide the students into groups of 3-4. Each group will work on a practice problem with an assigned non-Mendelian pattern of inheritance (Section 12.4, pp. 371-375).** **5. Incomplete dominance** **6. CoDominance** **7. Polygenic Traits** **8. Sex Linked Traits** **More than 1 group may be assigned to a topic.** **Each chart paper should include a sample problem indicating genotypic and phenotypic ratios. and a brief explanation of how that pattern differs from Mendelian patterns.** **The teacher will monitor**	**Introduce the seven stages of ADI and provide a brief overview of each stage.** **Task: Introduce a phenomenon to figure out and the task to complete.** **Ideas: Highlight some ideas that can be used during the investigation.** **Plan: Create, share, and revise a plan for collecting and analyzing data.** **Do: Collect the data needed and make sense of it.** **Share: Create, share, critique, and revise evidence-based arguments.** **Reflect: Discuss ways to use core ideas and practices in the future.**

			students and ask probing questions, such as how the probability of inheriting a certain trait changes compared to traits that follow Mendelian rules. The teacher will provide feedback. ******* Next Day Students will post their sample problems and do a round-robin to peer assess each group's work. Students can use sticky notes to leave feedback or questions as they peer review. Groups will go back and present to the class using the questions and feedback for guidance.	students and ask probing questions, such as how the probability of inheriting a certain trait changes compared to traits that follow Mendelian rules. The teacher will provide feedback. ******* Students will post their sample problems and do a round-robin to peer assess each group's work. Students can use sticky notes to leave feedback or questions as they peer review. Groups will go back and present to the class using the questions and feedback for guidance.	Report: Write, share, critique, and revise reports about what they figured. Students will complete the Looking at the Data: Blood Type Compatibility assignment on page 370 of the textbook. Students will complete CER: ADI Lab 20 CER:ADI Lab 20 Modified Template
Assessment Summary (5-7 minutes) TOD Slides	3-2-1 Each student will share three things they learned so far, two things that they found interesting, and one thing they have a question about.	Today's Exit question: Why is a recessive allele only expressed when the organism is homozygous for that allele? Pg. 369 #4	Exit Ticket: pg 372 Explain in your own words how incomplete dominance and codominance differ from what is called Mendelian inheritance, which involves dominant and recessive traits. The students will respond to the question by writing their response.	Using the Exit Ticket for the prior day. TTW clarify any misconceptions. TTW ask students to state how these patterns might explain the phenomenon.	Exit question: Page 378 Textbook #5 & 7
Small Group Tasks (TBA)					

Week 3	
GSE: SB3. Obtain, evaluate, and communicate information to analyze how biological traits are passed on to successive generations. SB2. Obtain, evaluate, and communicate information	Focused Concept: SB3b. Use mathematical models to predict and explain patterns of inheritance. (Clarifications 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, and incomplete dominance.

to analyze how genetic information is expressed in cells.		**SB2a. 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.**			
Phenomenon: How do parents have offspring who do not look like their parents? (Day 6 and 7) How can we slow the spread of a virus?			**DQ: How is genetic information transferred and regulated?**		
	Day 11	**Day 12**	**Day 13**	**Day 14**	**Day 15**
Learning Target	**I can use Punnett squares to analyze the inheritance pattern of codominance.**	**I can use mathematical models to predict and explain patterns of inheritance.**	**I can use mathematical models to predict and explain patterns of inheritance.**	**I can compare and contrast the structures of DNA and RNA and identify their role in genetic expression.**	**I can compare and contrast the structures of DNA and RNA and identify their role in genetic expression.**
Opening (5-7 minutes)	**TTW ask students to identify any patterns they see in the see-think-wonder Slide #7.**	**TTW explain to students that they've worked on problems that focus on one trait. What happens when there's more than one trait? Do the Punnett Square rules still apply? What do you notice in image A and how does it differ from a traditional punnett square (image B)? (split this discussion into two days for deeper discussion)**	**TTW explain to students that they've worked on problems that focus on one trait. What happens when there's more than one trait? Do the Punnett Square rules still apply? What do you notice in image A and how does it differ from a traditional punnett square (image B)? (split this discussion into two days for deeper discussion)**	**TTW instruct students on the quiz before starting the lesson. Students will take a quiz before engaging with the mini lecture.**	**TTW ask students what they notice about the images and how the images relate to what we've learned previously. Then the teacher will introduce the phenomena: How can we slow the spread of a virus? TTW pose the question, how do you think the field of genetics can be used to help slow the spread of a virus? Students will share ideas on a driving question board.**
Guided Practice/Transition	**The teacher will provide direct instruction via a mini-lecture on Multiple Allels (see page 372) and blood type inheritance. The mini-lecture will include the teacher modeling blood type inheritance problems. The students will take notes, follow along, and work on the sample**	**The teacher will provide direct instruction to review Mendel's law of independent assortment. The teacher will model how to work out a dihybrid cross problem. Students will take notes and work on problems with the teacher in their notebooks.**	**The teacher will provide direct instruction to review Mendel's law of independent assortment. The teacher will model how to work out a dihybrid cross problem. Students will take notes and work on problems with the teacher in their notebooks.**	**TTW have students complete and discuss Pivot Interactive: DNA to Proteins, completing part 1 TTW give a mini-lecture on the structure of DNA, base pairing rules, and RNA structure. Students will take notes. Suggestion: Use a**	**TTW have students complete and discuss Pivot Interactive: DNA to Proteins, completing part 1 TTW give a mini-lecture on the structure of DNA, base pairing rules, and RNA structure. Students will take notes. Suggestion: Use a**

	problem with the teacher. Teacher Notes for Lab			compare and contrast chart. See Table 11.1 on page 321.	compare and contrast chart. See Table 11.1 on page 321.
Independent Practice	Introduce the seven stages of ADI and provide a brief overview of each stage. Task: Introduce a phenomenon to figure out and the task to complete. Ideas: Highlight some ideas that can be used during the investigation. Plan: Create, share, and revise a plan for collecting and analyzing data. Do: Collect the data needed and make sense of it. Share: Create, share, critique, and revise evidence-based arguments. Reflect: Discuss ways to use core ideas and practices in the future. Report: Write, share, critique, and revise reports about what they figured. Students will complete the Looking at the Data: Blood Type Compatibility assignment on page 370 of the textbook. Students will complete CER: ADI Lab 20 CER:ADI Lab 20 Modified Template	Students will review the Student Guide (Student Guide SB3b) and complete the accompanying Student Journal. The teacher will monitor, provide feedback, and answer questions as needed.	Students will review the Student Guide (Student Guide SB3b) and complete the accompanying Student Journal. The teacher will monitor, provide feedback, and answer questions as needed.	TSW complete Pivot Interactive: Part 2	TSW complete Pivot Interactive: Part 2

Assessment Summary (5-7 minutes) TOD Slides	**page 370 Looking at the Data activity question 3:** Students will determine the offspring's blood type and identify all the family members who could donate blood. Students will answer on index cards. After collecting all the cards, the teacher will review the correct answer and provide clarification.	TOD Slides: Slide #5	TOD Slides: Slide #6	TOD Slides: Slide #7 4 Corners- Students will move to the corner that matches what they think is the correct answer to the question.	Exit Assessment: Compare and contrast in your own words, the structures of DNA and RNA and identify their role in genetic expression.
Small Group Tasks (TBA)					

Week 4					
GSE: SB3. Obtain, evaluate, and communicate information to analyze how biological traits are passed on to successive generations. SB2. Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells.	**Focused Concept: SB3b. Use mathematical models to predict and explain patterns of inheritance. (Clarifications 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, and incomplete dominance. SB2a. 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.**				
Phenomenon: How do parents have offspring who do not look like their parents? How can we slow the spread of a virus?			**DQ: How is genetic information transferred and regulated?**		
	Day 16	**Day 17**	**Day 18**	**Day 19**	**Day 20**
Learning Target	**I can model how the processes of transcription and translation determine the amino acids in a protein.**	**I can model how the processes of transcription and translation determine the amino acids in a protein.**	**I can explain how DNA and RNA lead to the expression of Sickle Cell via the processes of replication, transcription and translation.**	**I can explain how DNA and RNA lead to the expression of Sickle Cell via the processes of replication, transcription and translation.**	**I can identify non-lethal errors during replication, such as insertions, deletions, and substitutions.**
Opening (5-7 minutes)	**TTW ask students to share how they think DNA makes proteins based on the illustration on the See Think Wonder.**	**TTW ask students to share how they think DNA makes proteins based on the illustration on the See Think Wonder.**	**TTW ask students to share what they notice about the two images. Then the teacher will show the video and ask**	**TSW explain how the structure of DNA relates to its replication.**	**The Teacher will show the See, Think, Wonder and ask students how they think the images are related. Depending on the**

	(Slide #9)	(Slide #9) Teachers will also ask students what organelles they think are involved in the process.	students why the blood cells in people with sickle cell anemia come out misshapen. See Think Wonder. Slide #10		students' background knowledge, the teacher may also show the trailer for Five Feet Apart.
Guided Practice/Transition	TSW complete the "Explore" activity on page 324. The teacher will give a mini-lecture on DNA replication, transcription, and translation.	TSW complete the "Explore" activity on page 324. The teacher will give a mini-lecture on DNA replication, transcription, and translation.	The teacher will give a mini-lecture on how to read the amino acid charts. The teacher will model how to analyze the circle and traditional codon charts.	The teacher will give a mini-lecture on how to read the amino acid charts. The teacher will model how to analyze the circle and traditional codon charts.	The teacher will assign groups of students to create posters on the types of gene mutations (frameshift and point-silent, missense, nonsense) and chromosomal mutations (translocation, duplication and inversion). See pages 358-360
Independent Practice	TTW pass out the DNA Strand cards and mRNA strand cards. TTW explain the code from DNA has been taken from the DNA in the nucleus, out into the cytoplasm, and to the ribosome to prepare for translation. Students will complete part II of the Student Guide and Journal TTW will have students translate their mRNA into amino acids using the mRNA Codon Chart located in the part of the room labeled ribosome. Students will complete activity according to the directions in the Student guide and Journal. Student Guide:	TTW pass out the DNA Strand cards and mRNA strand cards. TTW explain the code from DNA has been taken from the DNA in the nucleus, out into the cytoplasm, and to the ribosome to prepare for translation. Students will complete part II of the Student Guide and Journal TTW will have students translate their mRNA into amino acids using the mRNA Codon Chart located in the part of the room labeled ribosome. Students will complete activity according to the directions in the Student guide and Journal. Student Guide:	Students will work independently to complete the Genetics of Sickle Cell Assignment. The teacher will monitor students, provide feedback, and answer questions.	Students will work independently to complete the Genetics of Sickle Cell Assignment. The teacher will monitor students, provide feedback, and answer questions.	In small groups students will research their assigned type of mutation and create an infographic on chart paper. The teacher will monitor students and provide feedback as needed. Students will then fill out a graphic organizer on the types of mutations.
Assessment Summary (5-7 minutes) TOD Slides	Exit Question: Explain the process and outcome of transcription.	Exit Question: Compare and contrast the processes of transcription	Exit Question: State one new thing you learned today and one	Exit Question: Students will explain how someone with the sickle	TOD Slides: The diagram shows a

		and translation. Highlight at least three main differences. ***Homework: Complete Pivote Interactive DNA to Protein Part 3.***	**thing you need to know more about. Both regarding today's lesson.**	**cell trait has both normal and sickle-shaped red blood cells.**	**deletion mutation. Slide #8**
Small Group Tasks (TBA)					

Week 5					
GSE: **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).**	**Focused Concept:** **Mutations** **Genetic Technology**				
Phenomenon: How can we slow the spread of a virus?			**DQ: How does protein synthesis work with vaccine development?**		
	Day 21	**Day 22**	**Day 23**	**Day 24**	**Day 25**
Learning Target	**I can identify non-lethal errors during replication, such as insertions, deletions, and substitutions.**	**I can explain how mutations lead to changes in gene expression.**	**I can explain how mutations lead to changes in gene expression.**	**I can explain how genetic technology uses DNA or RNA to make vaccines.**	**I can explain how genetic technology uses DNA or RNA to make vaccines.**
Opening	**Thinking ahead: Page**	**The teacher will show the**	**TSW read "Genetic**	**The teacher will have**	**The teacher will have**

(5-7 minutes)	358, TSW explain how mutations can affect protein synthesis, and, in turn, the expression of a trait.	See Think Wonder and ask the students what they notice about the pattern of inheritance. During the discussion, the teacher will remind students that DNA codes for particular proteins and that changes in DNA can lead to changes in proteins.	Variation" on page 361 Answer the review question #1.	students start a KWL on vaccines. Students will share what they know about vaccines and how vaccines might be related to DNA and RNA. See, think, wonder slide #13	students update their KWL on vaccines and ask students to discuss why we need a flu vaccine every year or why health officials suggest boosters for COVID-19. See, think, wonder slide #14
Guided Practice/ Transition	TTW have a brief lecture/discussion regarding the types of gene mutations (frameshift and point-silent, missense, nonsense) and chromosomal mutations (translocation, duplication and inversion). See pages 358-360	The teacher will provide a mini-lecture on the types of mutations. Students will make corrections or add information from the previous lesson to the graphic organizer.	Have the students connect the opening reading and questions to the questions "How does protein synthesis work with vaccine development?"	The teacher will discuss and show the video " How mRNA viruses work? from Learn Genetics Utah.	The teacher will give a mini lecture (7 minutes) on Vaccine Technologies, Influenza, and COVID-19 (pp. 410-413). Students will take notes.
Independent Practice (45-50 minutes) Teacher Prep- Make copies of • Mutations graphic organizer • Mutation Pogil Modified • Modeling mRNA vaccine Teacher instructions	In small groups students will research their assigned type of mutation and create an infographic on chart paper. The teacher will monitor students and provide feedback as needed. Students will then fill out a graphic organizer on the types of mutations.	Students will use their notes and graphic organizer to complete the modified Pogil Activity. The teacher will monitor and provide feedback and correction as needed.	Students will use their notes and graphic organizer to complete the modified Pogil Activity. The teacher will monitor and provide feedback and correction as needed.	Using paper cutouts, students model the translation process to make a small piece of a coronavirus spike protein—the protein for which the mRNA vaccine codes. Students will discuss the following questions: Does a cell treat the mRNA from a vaccine differently from the mRNA the cell makes? Students will watch the "How mRNA Vaccines were engineered?" video. Student Instructions Cutouts	Using paper cutouts, students model the translation process to make a small piece of a coronavirus spike protein—the protein for which the mRNA vaccine codes. Students will discuss the following questions: Does a cell treat the mRNA from a vaccine differently from the mRNA the cell makes? Students will watch the "How mRNA Vaccines were engineered?" video. Student Instructions Cutouts
Assessment Summary (5-7 minutes)	Exit question: Page 361 #4 "compare".	TOD Slides: Slide #9	Exit questions: Explain how mutations	Ticket out the door; 3-2-1	Exit Question: Explain how genetic

TOD Slides			lead to changes in gene expression.	Students will share 3- things they learned 2- things they found interesting 1- question they still have	technology uses DNA or RNA to make vaccines.
Small Group Tasks (TBA)					

Week 6					
GSE: **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).**		**Focused Concept:** **Mutations** **Genetic Technology**			
Phenomenon: How can we slow the spread of a virus?			**DQ: How does protein synthesis work with vaccine development?**		
	Day 26	**Day 27**	**Day 28**	**Day 29**	**Day 30**
Learning Target	**I can explain how genetic technology uses DNA or RNA to make vaccines.**	**I can explain how genetic technology uses DNA or RNA to make vaccines.**	**I can explain how gel electrophoresis is used to compare DNA samples.**	**I can explain how gel electrophoresis is used to compare DNA samples.**	**I can ask questions to gather and communicate information about the use of biotechnology in agriculture.**
Opening (5-7 minutes)	**TSW read page 381 "Case study" as you read, generate questions that**	**TSW read page 406 "Vaccine Development" Complete the Identify.**	**The teacher will display the See Think Wonder and ask students what**	**TSW answer question #2 on page 418. Comparing two samples of DNA.**	**The teacher will lead a discussion communicating about**

	would help determine when genetic technology should be used to solve medical or scientific problems. (Ask Questions)		they notice about the Ancestry DNA Results.		farmers and their crops. Students will generate a list of some of the challenges farmers face in a growing season. This list can be written on the board or in a shared document.
Guided Practice/Transition	The teacher will give a mini lecture (7 minutes) on Vaccine Technologies, Influenza, and COVID-19 (pp. 410-413). Students will take notes.	TTW summarize the Vaccine technologies, review Table 13-1 on page 410 and allow the students to discuss the DNA & RNA connection.	The teacher will explain that today we're going to be genetic scientists, and we will learn how to analyze DNA results using Pivot Interactives Gel Electrophoresis Basics. The teacher will model how to access the Pivot Interactive Platform and help students complete part I	TTW facilitate a discussion on the question from the opening allowing the students to discuss their answers.	The teacher will tell students they will model what happens in a cornfield when there are weeds present. Students will obtain information about what causes the weeds to spread in a farmer's field by modeling corn and weeds in the field. Students will notice that more weeds equals fewer corn plants, reducing the harvest and profit for the farmer.
Independent Practice	Using the notes and information presented in the previous lesson, students will complete the Revisit Viral Spread on page 419. They will work in pairs to answer the two questions on chart paper and then take notes.	TSW work in pairs to read, discuss and complete the 1 - Define the problem 2- Design Solution 3 - Evaluate Solutions "tying it all together" page 417	Students will complete the Gel Electrophoresis activity on Pivot Platform.	Students will complete the Gel Electrophoresis activity on Pivot Platform.	After evaluating the effects of weeds in a corn field, students will pair up and discuss the effects of weeds on the farmer's crops. Then students will research and share why the farmer should or should not use GMOS or other biotechnology to combat the problem. Students will share on chart paper then do a round robin to see what other groups decided about the ethical use of GMOs or biotechnology in agriculture.
Assessment Summary (5-7 minutes) TOD Slides	Exit Question: How does the process of creating the COVID-19	Exit Question: Explain how genetic technology uses DNA or	TOD Slides: Slide #10 Who's the Daddy?	Exit Question: Explain how gel electrophoresis is used to	Students will complete a CER: How has GMO usage affected crop

	vaccine differ from the process of creating the polio vaccine?	RNA to make vaccines.		compare DNA samples	yields?
Small Group Tasks (TBA)					

Week 7					
GSE: SB2. Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. c. Ask questions to gather and communicate information about biotechnology's use and ethical considerations in forensics, medicine, and agriculture. SB3. Obtain, evaluate, and communicate information to analyze how biological traits are passed on to successive generations.	Focused Concept: Biotechnology and Genetics Review				
Phenomenon: Weeds vs Plants			DQ: Should people consume GMOs?		
	Day 31	Day 32	Day 33	Day 34	Day 35
Learning Target	I can ask questions to gather and communicate information about the use of biotechnology in agriculture.	I can analyze how biological traits are passed on to successive generations.	I can analyze how biological traits are passed on to successive generations.	I can communicate information to analyze how genetic information is expressed in cells.	I can communicate information to analyze how genetic information is expressed in cells.
Opening (5-7 minutes)	*The teacher can extend the discussion from the prior day. The teacher will lead a discussion communicating about farmers and their crops. Students will generate a list of some of the challenges farmers face in a growing season. This list can be written on	The teacher will review the See Think Wonder from week one and explain that today is a day to review standard SB3 and cell reproduction standard SB1b.	The teacher will review the See Think Wonder from week one and explain that today is a day to review standard SB3 and cell reproduction standard SB1b.	TTW will have students share on chart paper around the room how protein synthesis relates to vaccine development. This will allow students to revisit the previous phenomenon on vaccines.	TTW will have students share on chart paper around the room how protein synthesis relates to vaccine development. This will allow students to revisit the previous phenomenon on vaccines.

	the board or in a shared document.				
Guided Practice/Transition	**Students continuing the prior day activity. Obtaining information about what causes the weeds to spread in a farmer's field by modeling corn and weeds in the field. Students will notice that more weeds equals fewer corn plants, reducing the harvest and profit for the farmer.**	**TTW lead a series of review activities/ games for students to review material on Mendelian Genetics and other patterns of inheritance.**	**TTW lead a series of review activities/ games for students to review material on Mendelian Genetics and other patterns of inheritance.**	**The teacher will introduce the Protein Synthesis STEMcase Gizmo. Students will assume the role of pediatricians investigating a disorder and the genetics behind it.**	**The teacher will introd the Protein Synthesis STEMcase Gizmo. Students will assume the role of pediatricians investigating a disorder and the genetics behind it.**
Independent Practice	**After evaluating the effects of weeds in a corn field, students will pair up and discuss the effects of weeds on the farmer's crops. Then students will research and share why the farmer should or should not use GMOS or other biotechnology to combat the problem. Students will share on chart paper then do a round robin to see what other groups decided about the ethical use of GMOs or biotechnology in agriculture.**	**Students will explain which organelles are involved in the processes of meiosis.** **Students will participate in a series of review activities while the teacher answers questions and addresses misconceptions as students may have questions during the review activities.** **Example: Beginning Learner Stations Developing/Proficient Learner Stations Proficient/Distinguished Learner Review**	**Students will explain which organelles are involved in the processes of meiosis.** **Students will participate in a series of review activities while the teacher answers questions and addresses misconceptions as students may have questions during the review activities.** **Example: Beginning Learner Stations Developing/Proficient Learner Stations Proficient/Distinguished Learner Review**	**Students will complete the Case study on their own. TTW monitor and answer questions as needed.**	**Students will complete the Case study on their own. TTW monitor and answer questions as needed.**
Assessment Summary (5-7 minutes) TOD Slides	**Students will complete a CER: How has GMO usage affected crop yields?**	**Students will complete open ended review questions.**	**Students will complete open ended review questions.**	**TOD Slides: Huntington's Disease Slide #11**	**TOD Slides: Huntington's Disease Slide #12**
Small Group Tasks (TBA)					

Week					
GSE:		**Focused Concept:**			
Phenomenon:			**DQ:**		
	Day	**Day**	**Day**	**Day**	**Day**
Opening					
Guided Practice/Transition					
Independent Practice					
Assessment/Summary					
Small Group Tasks (TBA)					

Assessment Prep

Prepare students for assessment by reviewing the following Assessment Prep Presentation.
Genetics Assessment Prep Presentation

Provide the following guidance:
Ask the students to use what they know about the tasks completed to answer the provided assessment prep question.

- What is the question asking you?
- What do you know about the vocabulary or concept in the question?
- Is this question similar to any investigations or tasks we've completed?
- How can what you've done help you answer this question?

Guide students to think about how their experience connects to the question.
Using the answer choices provided, ask the students the following:

- Identify a wrong answer: How do I know this answer is incorrect?
- Identify the right answer: How do we know this answer is correct?

Allow the students time to discuss in collaborative groups.

*

Labs / Investigations		
Mandatory Labs	**Explore Learning Gizmo**	**Pivot Interactives/Phet**

ADI Lab 20: Inheritance of Blood Type: Are all of Mr. Johnson's children, his biological offspring?	**Building DNA Gizmo** **Karyotype Gizmo** **Protein Synthesis StemCase**	**Gel Electrophoresis**
Additional Resources/Tasks		
Supplemental Resources	Meowsis Stemcase (Explore Learning) Investigation A: Investigating the Building Blocks of Life	