

Module 6A- Meiosis

Learning Goals	6A: Engage in argument from evidence that inheritable genetic variation is caused during the formation of gametes. (3.3)
I can statements	• I can use terms such as gametes, chromosomes, crossing over, and mutation correctly. • I can model meiosis to gather evidence about where the genetic variation happens in the formation of gametes. • I can make an argument using gathered evidence to support the claim that inheritable genetic variation is caused during the formation of gametes.
State Standards	Bio 3.3 Engage in argument from evidence that inheritable genetic variation is <u>caused</u> during the formation of gametes. Emphasize that genetic variation may be caused by epigenetics, during meiosis from new genetic combinations, or viable mutations. (LS3.B)
Module Length	1.5 Weeks
Phenomena and Essential Question	6A.1 Biracial Twins Phenomena Why do siblings look different?
Assessments	Assessment: 6A Quiz Meiosis 6A Quiz version 2

Unit 6 Module A Activity Guide

All Links found in Teacher Guide Below

	Approx Time	
Activity 1	15 min	Biracial Twins
Activity 2	45 min	Making Babies
Activity 3	45 min	Meiosis Notes and Simulation
Activity 4	55 min	Modeling Meiosis
Activity 5	45 min	Mutations in Meiosis
Activity 6	45 min	Not so identical twins
Activity 7	30 min	Assessment

Activity 1- Phenomenon Biracial Twins

Teacher instructions	Have the students look at the picture of biracial twins and come up with some questions they would need to know or research to figure out how this is possible. Discuss how twins happen and what types of cells are necessary to make a baby and how we refer to those cells as gametes.
Approx Time	15 min
Lesson Goal	Hypothesize reasons why siblings could look different and determine questions that would be useful to explain
Materials	NA
Starter	What contains the instructions to create characteristics found in organisms?
Student Activity	6A.1 Biracial Twins Phenomena
Formative Assessment	NA

Activity 2- Making Babies

Teacher instructions	Have the students get into groups of two. Tell the class that every single person in here is a heterozygous individual meaning that they have one dominant allele and one recessive allele for each trait. Read the instructions on the front page with your students. Each pair of students will flip coins to determine what their child will look like. Each pair should make 2 children. Each person makes one baby. This is so they can see the differences in the children even though they have the same parents. The goal is for the students to understand that the allele they get is random and that the combination of the alleles that they receive from each parent is what creates the different traits within individuals. I like to help them with the first coin flip to determine if they are having a boy or girl and then have the kids work on the rest from there. At the end of class have the students answer the questions on the analysis page and discuss the answers as a class.
Approx Time	45 min
Lesson Goal	Find a reason as to why siblings may look different from one another.
Materials	Coin (virtual or physical)
Starter	Have the students find a partner and sit together somewhere in class.
Student Activity	6A.2 Making Babies
Formative Assessment	Analysis questions in the Making babies assignment

Activity 3- Meiosis Notes

Teacher instructions	This is really for students to familiarize themselves with the process of meiosis. Emphasize with them that you don't want them to take notes on the process necessarily but the differences they notice between Meiosis and Mitosis (which they have previously learned about) This is also to help them with the new vocabulary words that will be necessary in describing how genetic variation can occur in meiosis such as crossing over, homologous pairs, alleles, etc. As you show the video to the students, pause and discuss with the students what they are noticing about the steps and about what they
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	write down with each step. You could do this as an edpuzzle but I find that the discussion of what is happening is good for them. Afterwards have the students summarize the general concepts of meiosis such as: how many gametes are made at the end? Are they genetically identical? How much genetic information is in the cell?
Approx Time	45 min
Lesson Goal	Compare Meiosis to mitosis and explain how they are different.
Materials	NA
Starter	What are the steps of mitosis?
Student Activity	6A.3 Meiosis Notes and Simulation Video- Amoeba Sisters- Meiosis Updated
Formative Assessment	The review at the end could be made into a multiple choice quiz to receive data.

Activity 4- Modeling Meiosis

Teacher instructions	Students are going to model how meiosis creates variation in cells. At the beginning of class have them go through with their elbow partner and match the words they will see in meiosis with the definitions. Go over them with the students so that they have a word bank that will help them as you model the steps of meiosis. Provide the students with the print outs and have them cut them all out. You should have a teacher example so the students know exactly what their chromosomes should look like and avoid any accidental deletions of genes. When students have finished cutting out they should have a whiteboard marker in which they can draw a giant cell on their desk and place the chromosomes inside of it. Run through each step of meiosis with your students. After you complete each step, discuss with your students if anything you did in that step caused genetic variation. If the answer is yes, have them discuss as a class how genetic variation was caused. Emphasize processes like crossing over in prophase 1 and random assortment metaphase 1 and 2. After meiosis 1 have the students take a picture and divide their cell into 2. After Meiosis 2 have the students take a picture and divide their cells
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	into 2. Emphasize that at the end of meiosis you end up with 4 genetically different cells containing one copy of each gene. Have students complete the exit ticket at the bottom of the page.
Approx Time	55 min
Lesson Goal	Identify how and where the genetic variation occurs during the process of meiosis
Materials	6A.4 Chromosomes paper model ½ Pink F1 - F4 Chromosomes ½ Blue M1-M4 Chromosomes Scissors Tape White board marker
Starter	Have the students go through the vocab words in the assignment on their own as the starter to save time.
Student Activity	6A.4 Modeling Meiosis 6A.4 Modeling Meiosis- Printable Version 6A.4 Modeling Meiosis- Teacher (Key)
Formative Assessment	Exit ticket at the end of student worksheet

Activity 5- Mutations in Meiosis

Teacher instructions	Print out pages of chromosomes and hand each group of students one set that is a normal male or female and one that has a chromosomal mutation. It is helpful if you cut these out on a cardstock with each set (normal vs mutated) in different colors so students don't mix them up. Have each set of students organize the karyotypes and discuss the similarities and differences they notice between them. They should pick up on the fact that there is either one less or one more chromosome than usual. Move into the phenomenon video where it shows a set of twins, one with down syndrome and one without and have the students analyze why that may be possible. Help the students get to the conclusion that they must have come from individual eggs and sperm. Have the students get in groups of four and give them the reading to explore the different viable mutations that may occur in humans. Have
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	them divide up the work and then share between them. In the end have them come back and try to explain from what we learned in meiosis what they think has occurred to cause mutations like we see in these other people. Discuss as a class what they think is the likely cause of these mutations.
Approx Time	60 min
Lesson Goal	Explain how mutations can occur in meiosis and that some of them are viable but may cause complications
Materials	6A.5 Karyotype cutouts -Prepare One set of normal and One set of mutated for each group. Article for Students- Digital or Print
Starter	What steps cause genetic variation when creating gametes?
Student Activity	6A.5 Mutations in Meiosis
Formative Assessment	Exit ticket found at the end of the lesson plan

Activity 6- Not So Identical Twins

Teacher instructions	Begin by showing the students the picture of the two genetically identical mice and explain to them that they are identical twins. Have the students explain what it means to be genetically identical and wonder about how you could be genetically identical and somehow still look different. Once the students have written down their hypothesis you can have students share out what they think is going on. Then watch this video till the 3:05 mark epigenetics Have the students write down what they know about cancer and hypothesize what could cause one twin to get cancer but not the other. A lot of the time they will come up with the environment may play a factor which is what we want them to get to. Afterwards have them go to this website Learn Genetics Epigenetics Gene Control Activity To investigate how genes interact with genetic markers. Afterwards discuss their findings.
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	Then have them investigate how markers could change using the diagram shown in the assignment. Have them answer the questions and then return to the mice at the beginning and hypothesis using the information they learned about how the mice could be genetically identical but look so different. Once they've written their hypothesis, watch the rest of the epigenetics video and have the students compare if they came up with a similar conclusion. Finally end by giving the students the information that now we know that epigenetic markers can pass from parent to offspring. How could that affect the variation that occurs during meiosis?
Approx Time	45 min
Lesson Goal	Explain how epigenetics causes variation during meiosis.
Materials	Computer access
Starter	How do we get genetic variation during meiosis?
Student Activity	6A.6 Epigenetics Assignment - Not So Identical Twins
Formative Assessment	Final question on assignment. Assessment: 6A Quiz Meiosis 6A Quiz version 2

Activity 7- Assessment

Teacher instructions	
Approx Time	30 min
Lesson Goal	Students will put together all the information they have learned and apply it to new situations in the assessment.
Materials	Computer access
Starter	
Student Activity	Assessment: 6A Quiz Meiosis 6A Quiz version 2
Formative Assessment	

