Name: _____ Date: _____

Chapter 3: Investigating Spider Inheritance
Chapter Overview

In this chapter, you will look at how the Darwin's bark spider offspring inherit genes. This will allow you to create a final explanation to send to Bay Medical Company, answering the question: *Why do traits for silk flexibility vary within this family of Darwin's bark spiders?*

Name: _____ Date: _____

Lesson 3.1: "Why Are Identical Twins Rare?"

Have you ever wondered why identical twins look exactly alike? In this lesson, you will read an article about identical twins, which will help you understand how organisms end up with the genes that determine their traits. Once you have read this article, you will be able to apply this understanding to the Darwin's bark spider, further understanding why there is variation between and among the spider parents and their offspring.

Unit Question

- Why do traits vary, and why do they vary even between parents and offspring and among siblings?

Chapter 3 Question

- Why do the Darwin's bark spider offspring have different gene combinations even though they have the same parents?

Vocabulary

- feature
- function
- gene
- gene version
- heterozygous
- homozygous
- inherit
- mutation
- protein molecule
- sexual reproduction
- structure
- trait
- variation

Digital Tools

- *Traits and Reproduction* Simulation

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Warm-Up

The last time you saw the sisters pictured above, you considered how different protein molecules in their cells could lead to different traits. Now, you know that genes provide instructions for proteins that lead to traits. How could these sisters have ended up with different genes, leading to their different proteins and traits? Explain your ideas below.

_____

_____

_____

_____

_____

_____

Name: _____ Date: _____

Discussing Spider Silk Claims

With your partner, review the below claims about the spider family, discussing which claim or claims you find most convincing. Is there any information you still need to support or refute these claims?

Question: *Why do traits for silk flexibility vary within this family of Darwin's bark spiders?*

Claim 1: The offspring have **mutations** that affect their traits.

Claim 2: The offspring's traits depend on **which parent the offspring received more copies of genes from.**

Claim 3: The offspring received **different combinations of gene versions from their parents.**

Name: _____ Date: _____

Reading "Why Are Identical Twins Rare?"

1. Read and annotate the article "Why Are Identical Twins Rare?"
2. Choose and mark annotations to discuss with your partner. Once you have discussed these annotations, mark them as discussed.
3. Now, choose and mark a question or connection, either one you already discussed or a different one you still want to discuss with the class.
4. Answer the reflection question below.

Rate how successful you were at using Active Reading skills by responding to the following statement:

As I read, I paid attention to my own understanding and recorded my thoughts and questions.

- ☐ Never
- ☐ Almost never
- ☐ Sometimes
- ☐ Frequently/often
- ☐ All the time

Active Reading Guidelines

1. Think carefully about what you read. Pay attention to your own understanding.
2. As you read, annotate the text to make a record of your thinking. Highlight challenging words and add notes to record questions and make connections to your own experience.
3. Examine all visual representations carefully. Consider how they go together with the text.
4. After you read, discuss what you have read with others to help you better understand the text.

Name: _____ Date: _____

Homework: Observing Inheritance in Darwin's Bark Spiders

Launch the Sim. Then, follow the steps below.

1. Select a female spider. Drag her on top of a male spider so that the spiders reproduce.
2. Press CREATE REPRODUCTIVE CELLS.
3. Once the cells have been produced, press RANDOMLY FERTILIZE to observe fertilization.
4. Compare the offspring with each other and with their parents. Pay careful attention to traits and combinations of gene versions. How are family members similar? How are they different?
5. Pick one feature to observe closely (except for body size) and answer the questions below.

I mated the female spider named _____ with the male spider named _____. I focused on the feature of _____.

How did the offspring's traits compare to their parents' traits?

_____

_____

_____

How did the offspring's gene versions compare to their parents' gene versions?

_____

_____

_____

Name: _____ Date: _____

Homework: Reading "Invasion of the Periodical Cicada"

You have learned a lot about how organisms pass on their genes through reproduction. Read and annotate the "Invasion of the Periodical Cicada" article to learn more about a unique organism called the cicada and how it increases its chances of reproducing successfully. Then, answer the questions below.

What are two reasons why arriving above ground all at once increases the cicadas' chances of surviving and reproducing?

_____

_____

_____

Why do scientists think it is helpful to the periodical cicadas to emerge every 13 to 17 years?

_____

_____

_____

Active Reading Guidelines

1. Think carefully about what you read. Pay attention to your own understanding.
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4. After you read, discuss what you have read with others to help you better understand the text.

Name: _____ Date: _____

Lesson 3.2: Gathering Evidence About Inheritance

Have you ever heard someone say: "You look like your mother" or "You look like your father"? How is it possible for someone to look more like one of their parents? Did this person inherit more genes from one parent over the other? Today, you will return to the Sim to answer the Investigation Question: *How do organisms get their genes?* You will gather evidence to either support or refute claim 2 of the Darwin's bark spider claims.

Unit Question

- Why do traits vary, and why do they vary even between parents and offspring and among siblings?

Chapter 3 Question

- Why do the Darwin's bark spider offspring have different gene combinations even though they have the same parents?

Vocabulary

- claim
- evidence
- feature
- gene
- gene version
- heterozygous
- homozygous
- inherit
- protein molecule
- sexual reproduction
- trait
- variation

Digital Tools

- *Traits and Reproduction* Simulation

Name: _____ Date: _____

Warm-Up

In this unit, you have been investigating the following question: *Why do traits for silk flexibility vary within this family of Darwin's bark spiders?*

Review claim 2, which is listed below. This claim provides one possible response to this question.

Claim 2: The offspring's traits depend on **which parent the offspring inherited more copies of genes from.**

Do you agree or disagree with this claim? (circle one)

a. **agree**

b. **disagree**

Explain why you either agree or disagree with the claim. Use what you have learned about genes and inheritance to explain your thinking.

_____

_____

_____

_____

_____

_____

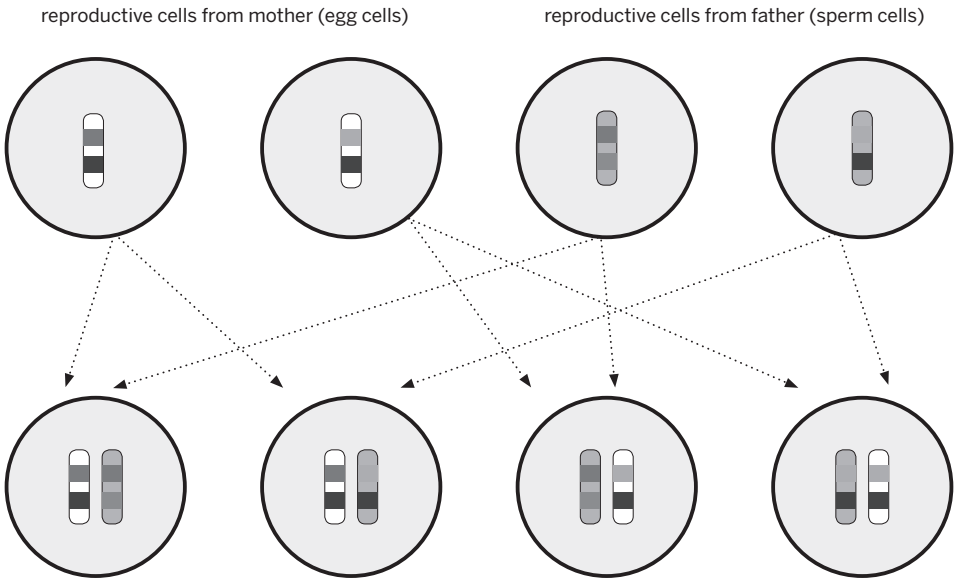
Name: _____ Date: _____

Second Read of "Why Are Identical Twins Rare?

You are investigating the question: *How do organisms get their genes?*

- Read and annotate the second two paragraphs of the "How We Get Our Genes" section of the "Why Are Identical Twins Rare?" article. Identify evidence that helps you answer the above question.
- Review the Sexual Reproduction diagram from the article (included below). Annotate the image.

Sexual Reproduction
Possible Reproductive Cell Combinations



cells of different possible offspring, each with a different combination of genes

Name: _____ Date: _____

Gathering Evidence from the Sim

Part 1: Gathering Evidence from the Sim: the Bristle Feature

Launch the Sim. As your teacher models this activity, make observations about Otis and Anne's offspring.

Otis

Feature	Trait	Gene versions
bristle	sparse	R1R2

Anne

Feature	Trait	Gene versions
bristle	dense	R1R1

Write your observations of the offspring below.

_____

_____

_____

_____

_____

_____

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Gathering Evidence from the Sim (continued)

Part 2: Gathering Evidence from the Sim: the Body Color Feature

Launch the Sim and follow the steps below.

1. Press BODY COLOR to observe Otis and Anne's traits and gene versions for this feature. Record your observations in the first table.
2. Mate Otis with Anne by moving Anne over Otis until a dotted circle appears.
3. Press CREATE REPRODUCTIVE CELLS. Once the reproductive cells have been created, press RANDOMLY FERTILIZE. Observe as the egg and sperm cells come together to create new offspring.
4. Examine the traits and combinations of gene versions for each offspring. Then, record your observations in the second table below.

Parents

Parents	Gene versions	Trait
Otis		
Anne		

Offspring

	Gene version from Otis	Gene version from Anne	Gene versions	Body color trait
Offspring 1				
Offspring 2				
Offspring 3				
Offspring 4				

Name: _____ Date: _____

Homework: Reading "Why the Corpse Flower Smells So Bad"

You have been learning about how spiders pass on their traits through reproduction, but what about plants? Read and annotate the "Why the Corpse Flower Smells So Bad" article to learn more about a unique organism called the corpse flower. Then, answer the questions below.

Why does the corpse flower smell so bad?

_____

_____

_____

Why does the corpse flower need to attract insects to reproduce?

_____

_____

_____

What is another plant adaptation that helps a plant reproduce?

_____

_____

_____

Active Reading Guidelines

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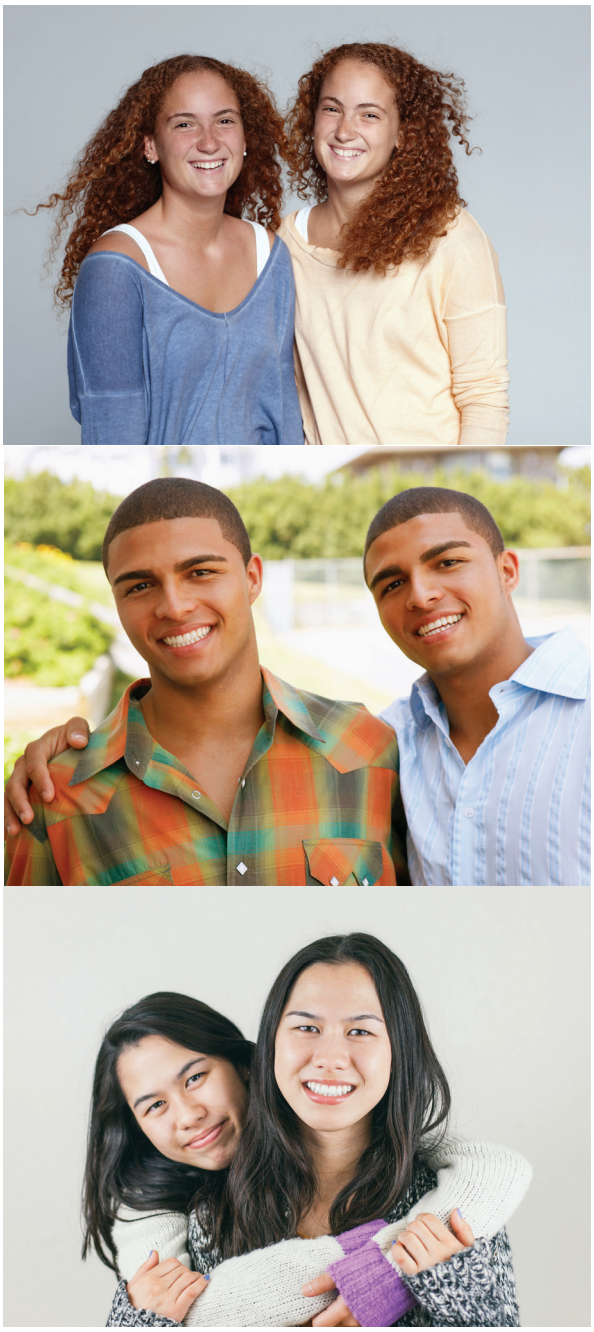
3. Examine all visual representations carefully. Consider how they go together with the text.
4. After you read, discuss what you have read with others to help you better understand the text.

Why Are Identical Twins Rare?

Everyone is different. We can recognize one another's faces because every face is unique, with different combinations of traits like eye color, skin color, nose shape, and so on. All these differences are called variation. Where does variation come from? Genes instruct for proteins, which determine our traits. People have different traits because our protein molecules are different, and our proteins are different because our genes are different. Every human has a unique set of genes, different from anyone else's...at least, almost all of us do.

Imagine knowing someone who looks almost exactly like you—so much like you that people often mistake you for each other. You are the same height, your hair and eyes are the same colors...even the shape of your smile is the same. If you are an identical twin, you already know what that's like.

Identical means "exactly the same." Identical twins look so much alike because they have the same proteins, and they have the same proteins because their genes are the same. How can two different people end up with identical genes?



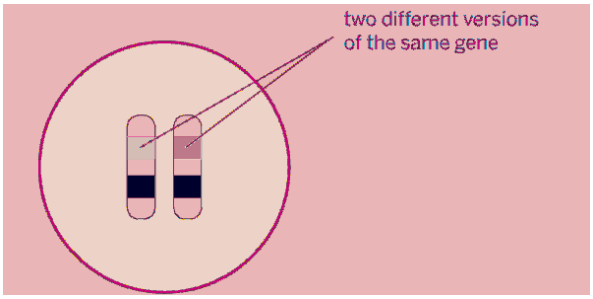
Identical twins are identical because their genes are the same.

How We Get Our Genes

We inherit our genes from our biological parents through the process of sexual reproduction. Each parent has a complete set of genes. These genes are organized on matching pairs of chromosomes. Each chromosome pair has two copies of each gene. However, the two copies of any particular gene can be the same version or different versions.

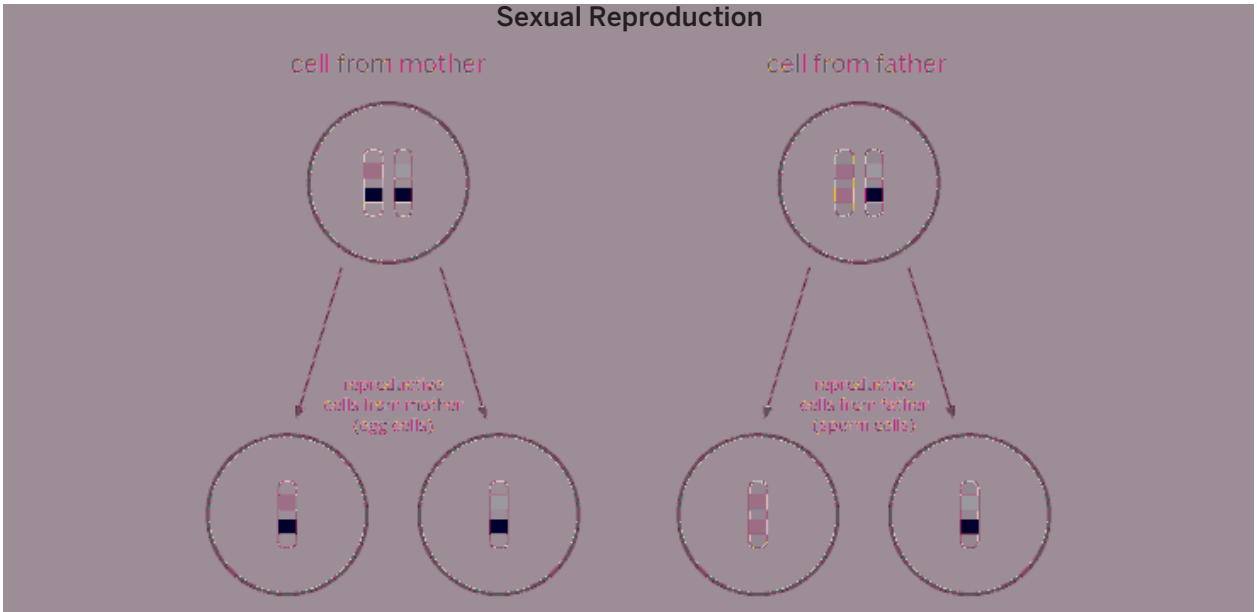
Sexual reproduction involves special reproductive cells from both parents. The mother's reproductive cells are called eggs, and the father's reproductive cells are called sperm. Unlike other cells that have two copies of every gene, egg cells and sperm cells only have one copy of each gene, which means the cell only contains one version of each gene. If a parent has two different versions of the gene, some reproductive cells will end up with one version, while other reproductive cells will end up with the other version. Each time these special cells are produced, the division of genes is different and random. Every sperm or egg cell is unique!

Chromosome Pair



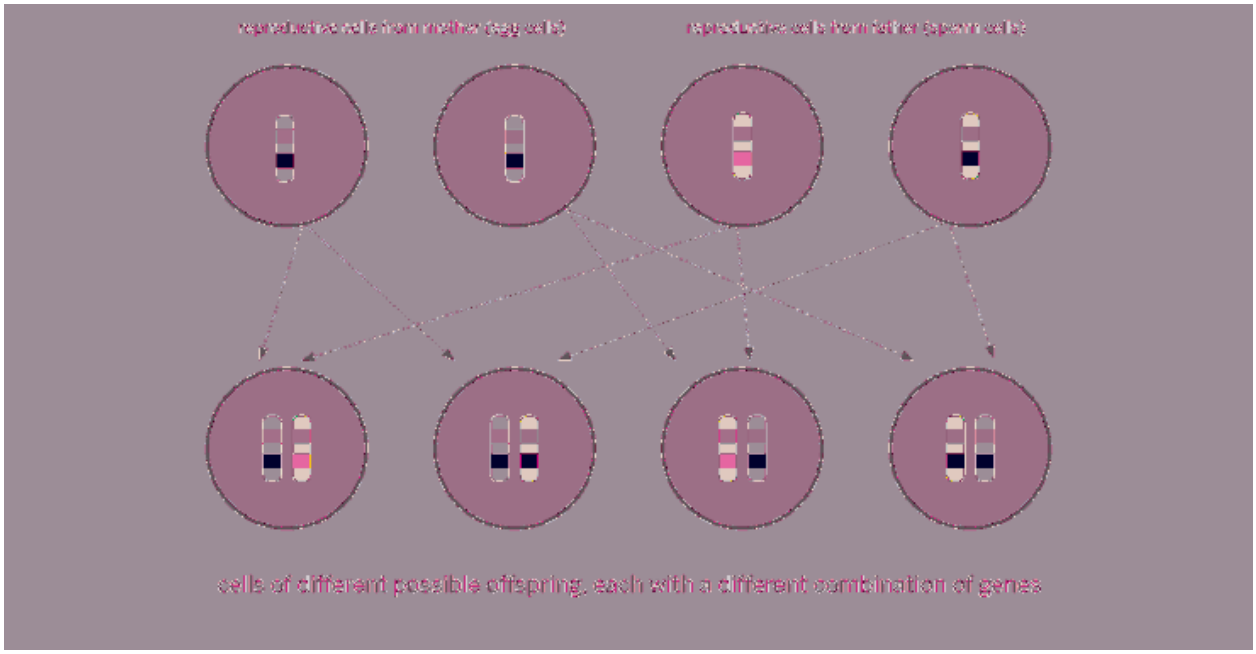
This is a simplified diagram. It shows a cell with just one pair of chromosomes. People don't really have one pair: we have 23 pairs! That's too many to show in this diagram.

Sexual Reproduction



While all other cells contain two gene copies, reproductive cells are different. They contain just one gene copy.

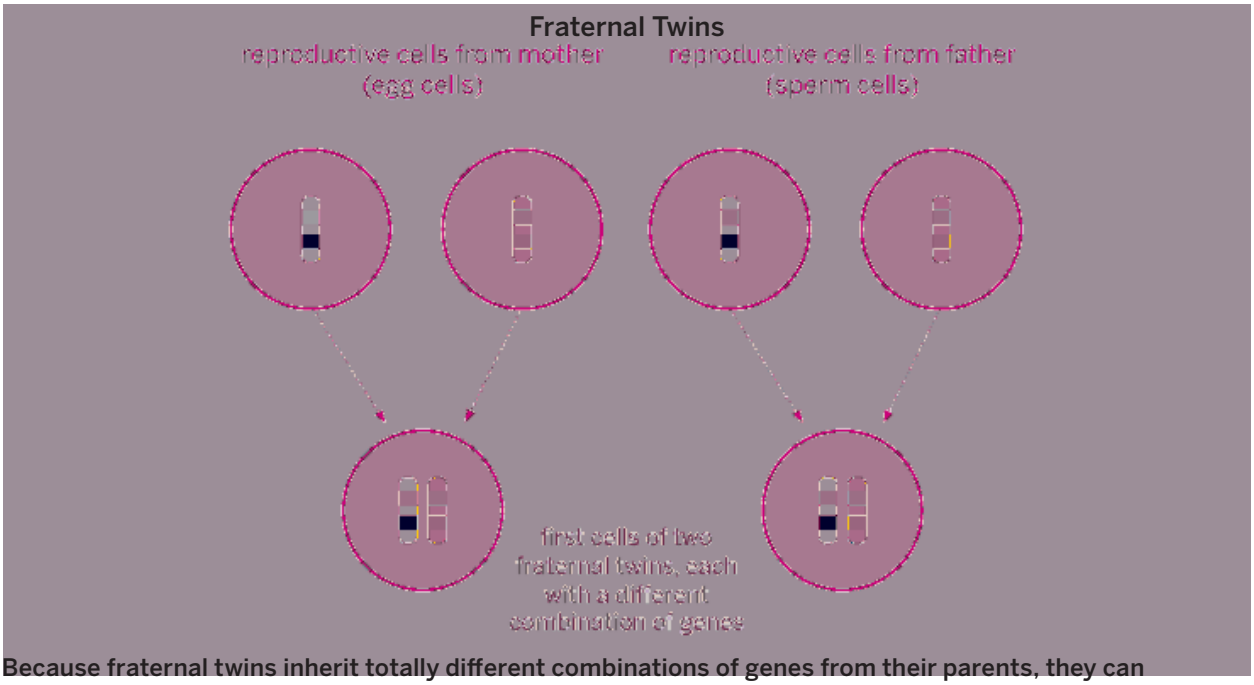
Sexual Reproduction
Possible Reproductive Cell Combinations



Reproductive cells can combine in lots of different ways. This diagram shows four possible combinations for just one chromosome. Remember, humans have 23 chromosomes! The possibilities are practically endless.

When the egg and sperm cells from two parents come together, fertilization occurs. Fertilization is when these cells combine to form the first cell of a new offspring. This new cell has two copies of each gene, one from each parent. Each parent randomly passes on only one copy of each gene, so there can be lots of possible combinations of genes passed on from two parents. The many possible combinations of genes are what give us variation.

All variation in humans comes from sexual reproduction. Identical twins DO vary from their parents; however, identical twins have the same gene versions as each other. How is this possible? To understand why, let's think about the difference between identical twins and fraternal twins.



Because fraternal twins inherit totally different combinations of genes from their parents, they can vary genetically.

Not All Twins Are Identical

Many sets of twins are fraternal twins. Unlike identical twins, fraternal twins have different traits. They may have different eye colors and different heights, and can even be different sexes. There can be lots of variation between fraternal twins.

The difference between fraternal twins and identical twins has to do with fertilization. In fraternal twins, fertilization happens twice. A sperm cell from the father combines with an egg cell from the mother to form the first cell of one twin. At around the same time, a different sperm cell from the father fertilizes another egg cell from the mother to form the first cell of the other twin. The cells of these two twins inherit completely different combinations of genes from the parents. Because they inherited different genes, the fraternal twins will have different proteins—which will interact to determine different traits. Because sexual reproduction happens twice, and each time one copy of each gene is randomly passed on to each of the offspring, fraternal twins have lots of opportunities for genetic variation.

Fraternal twins can be of the same sex or different sexes.

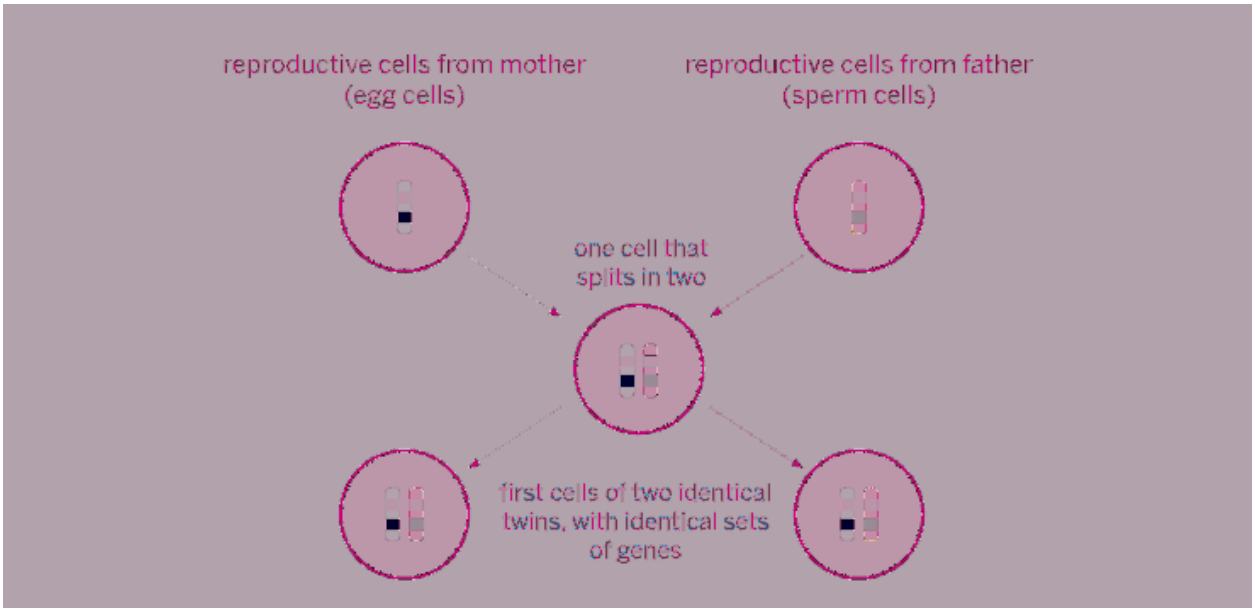
How Identical Twins Get Identical Genes

On the other hand, in identical twins, fertilization happens only once. A sperm cell from the father combines with an egg cell from the mother to form a cell. Then this single cell copies itself and splits, forming two identical cells—the first cells of two identical twins. The cells of these twins inherit the same combinations of gene versions, because they were produced from the same egg and sperm cells. Because they have the same genes, the identical twins will have identical genetic traits.

Of course, even identical twins will develop in different ways over their lives, becoming individual people with different talents and experiences. One twin may train to become a muscular body builder, while the other may sit at a computer writing all day. Just because they inherited the same genes, that doesn't mean they are the same person. Even identical twins aren't identical in every way.

Identical twins are the result of one fertilized egg splitting into two. Both twins have the same genes, which means they also have the same genetic traits.

Identical Twins



Identical twins happen when one fertilized egg splits into two cells. The two cells have exactly the same genes.