Genetics of Inherited Traits Simulation: Genetics

Activity One

Introduction

Why are your eyes a certain color? What makes your hair brown, blonde, red, or somewhere in between? *Genes* from your parents determine these traits. Genes usually occur in pairs, and you get one from each parent. Two children with the same parents may have different hair or eye color because they received a different combination of genes. Depending on the parents' genes, their offspring might be *homozygous,* meaning they have two of the same type of gene. Otherwise, they are *heterozygous,* meaning they have two different types of genes. Often, one gene is *dominant,* meaning it determines the trait; whereas the other gene is *recessive* and does not determine the trait. If you know what genes two parents have, you can figure out the possible genetic combination of their children using a *Punnett Square.* This also lets you determine the *probability* that offspring will have certain traits.

Directions

Some people's earlobes dangle or flap unattached, while others don't. This trait is genetically determined. Use the genetics simulation to explore the genes that determine whether earlobes are attached or unattached. One trait is dominant and the other is recessive. See what happens when you cross parents with different genetic combinations.

Symbol for Dominant Gene		Symbol for Recessive Gene	

Trial 1 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	____ ____
_____	_____ _____	____ ____

Trial 2 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	____ ____
_____	_____ _____	____ ____

Procedures

1. Click on the Start Here button and read the text. If you need more information, click and read the Background. Close the window when you are done.
2. This simulation allows you to investigate genetic traits of different organisms. Click the Organism menu and select Mammals B (humans). You will be exploring two earlobe traits: attached and unattached.
3. **Trial 1** See what happens when you cross a person with attached earlobes (homozygous) and a person with unattached earlobes (homozygous). To choose the first parent, click the Parent 1 menu and select Attached earlobe—uu. To choose the second parent, click Parent 2 and select Unattached earlobe—UU. To see the possible offspring of these two parents, click Generate.
4. First, write the letters used to represent the dominant trait and the recessive trait in the spaces above. Then use the results to complete the first Punnett Square above. Which is the dominant trait? How do you know this?

_____

5. **Trial 2** Using what you've just learned, predict what happens if you cross two people with unattached earlobes, one heterozygous and the other homozygous. Show your prediction in the second Punnett Square above.
6. Now check your prediction. Click Parent 1 and select Unattached earlobe—Uu. Then click Parent 2 and select Unattached earlobe—UU. To see the possible offspring of these two parents, click Generate. Was your Punnett Square correct? What are the chances that the offspring of these parents will have attached earlobes?

_____

Genetics of Inherited Traits Simulation: Genetics

Activity Two

Introduction

Genes determine many of our physical traits. Genetics even affects what our earlobes look like - dangling (unattached) or attached. In Activity One, you saw ways that this trait is inherited when you cross parents with different genetic combinations. In this Activity, you'll investigate other genetic combinations to answer a few challenge questions. You'll also be using this probability formula:

$$\text{Probability} = \frac{\text{Total number of specified outcomes}}{\text{Total number of possible outcomes}} = \frac{\text{Total number of specified outcomes}}{4}$$

The "Total number of specified outcomes" is found in the Punnett Square.

Directions

Use the genetics simulation to investigate the human trait of attached and unattached earlobes. One trait is dominant and the other is recessive. See what happens when you cross parents with different genetic combinations.

Procedures

1. Click on the Start Here button and read the text. If you need more information, click and read the Background. Close the window when you are done.
2. Click the Organism button and select Mammals B (humans). You will explore two earlobe traits: attached and unattached. Click the parent options to see the possible genetic combinations. In the spaces below, write the letters used to represent the dominant trait and the recessive trait.

Symbol for Dominant Gene		**Symbol for Recessive Gene**	

3. **Trial 1** An inherited physical trait, such as brown hair, is called a phenotype. Your combination of genes is called your genotype. Do all people with unattached earlobes have the same genotype? Use the simulation and the Punnett Square below to explain your answer.

Will offspring with the same genotype always have the same phenotype?

_____

Trial 1 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	____ ____
_____	_____ _____	____ ____

Trial 2 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	____ ____
_____	_____ _____	____ ____

4. **Trial 2** Mike and Kathy are both heterozygous for unattached earlobes. They are about to have a baby girl. What are the chances their new daughter will have attached earlobes? Show the outcomes in the Punnett Square above and use the simulation to verify. (Note: Either parent can be parent 1 or 2.)

_____

5. If Mike and Kathy had another baby, what is the probability the child would have attached earlobes? Use the probability formula above.

_____

6. **Trial 3 Trial 4** At the park, you meet a woman and her husband, both with unattached earlobes. They introduce you to their son, who has attached earlobes. Use the Punnett Square below to show the genetic combinations of this family. Next, the old couple introduces you to

their granddaughter (their son's daughter). She has unattached earlobes. Now you know what kind of earlobes her mother has. Use the second Punnett Square below to show the possible genetic combinations of that family.

Trial 3 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	_____ _____
_____	_____ _____	_____ _____

Trial 4 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	_____ _____
_____	_____ _____	_____ _____

7. **Trial 5** Two parents are homozygous for a trait, but all their offspring will be heterozygous. What must be true of the parents? Show your answer in the Punnett Square below.

Trial 5 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	_____ _____
_____	_____ _____	_____ _____

Trial 6 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	____ ____
_____	_____ _____	____ ____

8. **Trial 6** Jane has unattached earlobes, but her father has attached earlobes. Jane marries Bob, who has attached earlobes. Will their children have a greater chance of having attached earlobes or unattached earlobes? Use the simulation and the Punnett Square above to answer the question.

_____

10. What type of earlobes does the person sitting next to you have? What are the possible genotypes that person has for this trait?

Phenotype (Attached or Unattached)		Possible Genotypes	

11. **Trial 7** Figure out the possible genotypes of that person's parents. Show the possible combinations in the Punnett Squares below. (If there are more than two possibilities, draw the Punnett Squares on the back.)

Trial 7 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	____ ____
_____	_____ _____	____ ____

Genetics of Inherited Traits Simulation: Health

Activity One

Introduction

What traits did you inherit from your parents? Brown eyes? Red hair? We tend to think of genetic traits as physical characteristics, but genes passed down by parents play an important role in our health too. Many disorders or diseases that afflict children and adults are genetic. Some examples are sickle cell anemia (a blood disease), Huntington disease (a disease of the nervous system), and cystic fibrosis (a lung disease). Genes that affect your health typically occur in pairs, and you get one from each parent. Depending on the parents' genes, their offspring might be *homozygous,* meaning they have two of the same type of gene. Otherwise, they are *heterozygous,* meaning they have two different types of genes. Often, one gene is *dominant,* meaning it determines the trait; whereas the other gene is *recessive* and does not determine the trait. If you know what genes two parents have, you can figure out the possible genetic combination of their children using a *Punnett Square.* This also lets you determine the *probability* that offspring will have certain traits.

Directions

Use the genetics simulation to investigate a physical trait in humans: unattached earlobes that dangle or flap and attached earlobes that don't. One trait is dominant and the other is recessive. See what happens when you cross parents with different genetic combinations.

Symbol for Dominant Gene		Symbol for Recessive Gene	

Trial 1 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	____ ____
_____	_____ _____	____ ____

Trial 2 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	____ ____
_____	_____ _____	____ ____

Procedures

1. Click on the Start Here button and read the text. If you need more information, click and read the Background, then close the window.
2. This simulation allows you to investigate genetic traits of different organisms. Click the Organism button and select Mammals B (humans). You will be exploring two earlobe traits: attached and unattached.
3. **Trial 1** See what happens when you cross two people with unattached earlobes (both heterozygous). To choose the first parent, click the Parent 1 menu and select Unattached earlobe—Uu. To choose the second parent, click Parent 2 and select Unattached earlobe—Uu. To see the possible offspring of these two parents, click Generate.
4. First, write the letters used to represent the dominant trait and the recessive trait in the spaces above. Then use the results to complete the first Punnett Square above. Which is the recessive trait? How do you know this?

_____

5. **Trial 2** Using what you've just learned, predict what happens if you cross one person with unattached earlobes (heterozygous) and another with attached earlobes (homozygous). Complete the second Punnett Square above to show your prediction.
6. Now check your prediction. Click Parent 1 and select Unattached earlobe—Uu. Then click Parent 2 and select attached earlobe—uu. To see the possible offspring of these two parents, click Generate. Was your Punnett Square correct? What are the chances that the offspring of these parents will have attached earlobes?

_____

Genetics of Inherited Traits Simulation: Health

Activity Two

Introduction

Genetics can affect people's physical traits, from their eye color to the shape of their nose. But genes passed down by parents play an important role in people's health, too. People can influence their health with their actions (like exercise, eating a healthy diet, and not smoking), but their genes may put them at greater risk for problems and diseases. Like genes for physical traits, genes that affect your health typically occur in pairs, and you get one from each parent. Depending on the parents' genes, their offspring might be *homozygous,* meaning they have two of the same genes, such as two recessive genes or two dominant genes. Or they might be *heterozygous,* meaning they have one dominant gene and one recessive gene. If you know what genes two parents have, you can figure out the possible genetic combination of their children using a Punnett Square. This also lets you determine the possibility, or chances, that offspring will have certain traits.

Directions

Use the genetics simulation to investigate a physical trait in humans: unattached earlobes that dangle or flap and attached earlobes that don't. One trait is dominant and the other is recessive. See what happens when you cross parents with different genetic combinations.

Procedures

1. Click on the Start Here button and read the text. If you need more information, click and read the Background. Close the window when you are done.
2. Click the Organism button and select Mammals B (humans). You will explore two earlobe traits: attached and unattached. Click the parent options to see the possible genetic combinations. In the spaces below, write the letters used to represent the dominant trait and the recessive trait.

Symbol for Dominant Gene		**Symbol for Recessive Gene**	

3. **Trial 1** An inherited physical trait, such as brown hair, is called a phenotype. Your combination of genes is called your genotype. How could two sisters with the same phenotype have different genotypes? Use the simulation and the Punnett Square below to explain your answer.

_____

Trial 1 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	____ ____
_____	_____ _____	____ ____

Trial 2 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	____ ____
_____	_____ _____	____ ____

4. **Trial 2** Two parents have different genotypes. However, all their offspring will have the exact *same* genotype as each other. How could this happen? Use the simulation and the Punnett Square above to explain your answer.

_____

5. In Trial 2 above, what is the phenotype of all the offspring?

_____

6. **Trial 3** Two parents are both carriers for the cystic fibrosis gene. What are the chances that their child will have the disease? Use the Punnett Square below to answer the question.

Trial 3 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	____ ____
_____	_____ _____	____ ____

Trial 4 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	____ ____
_____	_____ _____	____ ____

7. **Trial 4** If one parent is a carrier for the cystic fibrosis gene and the other parent does not carry the gene at all, what are the chances that their children will have the disease? Use the Punnett Square above to answer the question.

_____

8. **Trial 5** Another example of a genetic disorder is Huntington disease, a disease of the nervous system. Unlike cystic fibrosis, the gene for Huntington disease is dominant. If a man with Huntington disease (if he has just one gene) marries a woman without the disease, what are the chances their children will inherit the disease? Use the Punnett Square below to explain your answer.

_____

Trial 5 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	_____ _____
_____	_____ _____	_____ _____

Trial 6 Parent 1 genes → ↓ Parent 2 genes	_____	_____
_____	_____ _____	_____ _____
_____	_____ _____	_____ _____

9. **Trial 6** You have a friend with Huntington disease. His father also has the disease, but his sister and mother do not. With this information, you know the genotype of all four family members. Use the Punnett Square above to show the genetic combinations of this family.