

**Chapter 11 Introduction to Genetics**

# Investigating Inherited Traits

## Introduction

Heredity is the passing on of traits from parent to offspring. The genetic makeup of an individual is known as its genotype. The physical characteristics of an individual, which are the result of its genotype and its environment, are known as its phenotype.

Some alleles are expressed only when the genotype is homozygous. These alleles are said to produce recessive phenotypes. Alleles that are expressed whether the genotype is homozygous or heterozygous produce dominant phenotypes. An allele that codes for a dominant trait is represented by a capital letter, while an allele that codes for a recessive trait is represented by a lowercase letter. Sometimes when the genotype is heterozygous, neither the dominant nor the recessive phenotype occurs. In this situation, called incomplete dominance, an intermediate phenotype is produced.

In humans, the sex of an individual is determined by the particular combination of two chromosomes called the sex chromosomes. Individuals who have two X chromosomes (XX) are females, whereas those who have an X and a Y chromosome (XY) are males. In this investigation, you will observe how the results of different allele combinations produce certain traits.

## Problem

How are traits inherited?

## Pre-Lab Discussion

Read the entire investigation. Then, work with a partner to answer the following questions.

1. What does a single side of a double-sided coin or disk represent?

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2. What is the probability, in percent, that a single coin toss will result in heads? In tails?

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3. Why is a coin toss a good way to represent allele combinations that occur in nature?

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4. For the traits explored in this lab, do all heterozygous pairs of alleles produce an intermediate phenotype?

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5. Can you accurately determine an organism's genotype by observing its phenotype? Explain your answer.

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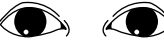
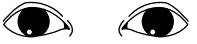
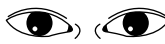
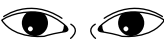


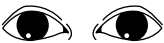
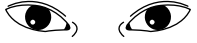
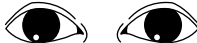
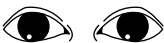

## Materials (per group)

3 textbooks






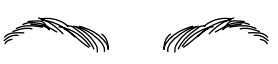


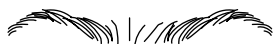









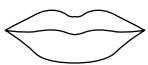
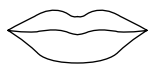
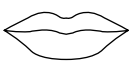





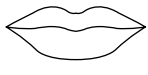
2 coins

## Procedure

1. Place the textbooks on the laboratory table so that they form a triangular well.
2. Determine which partner will toss for the female and which will toss for the male. Remember that there are two genes per trait.
3. Have the partner who is representing the male flip a coin into the well to determine the sex of the offspring. If the coin lands heads up, the offspring is a female. If the coin lands tails up, the offspring is a male. Record the sex of the offspring in the blank at the top of page 111.
4. For all the coin tosses you will now make, heads will represent the dominant allele and tails will represent the recessive allele.
5. You and your partner should now flip your coins into the well at the same time to determine the phenotype of the first trait, the shape of the face. Note: *The coins should be flipped only once for each trait.*
6. Continue to flip the coins for each trait listed in the table in Figure 1. After each flip, record the trait of your offspring by placing a check in the appropriate box in the table. (Note: Some information in Figure 1 has been simplified. Some listed traits are actually produced by two or more genes.)
7. Using the recorded traits, draw the facial features for your offspring in the space on page 111.

| Traits           | Dominant<br>(both heads)                                                                                         | Hybrid<br>(one head, one tail)                                                                                     | Recessive<br>(both tails)                                                                                          |
|------------------|------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Shape of face    | <br>round<br><i>RR</i>          | <br>round<br><i>Rr</i>           | <br>Square<br><i>rr</i>         |
| Cleft in chin    | <br>present<br><i>CC</i>        | <br>present<br><i>Cc</i>         | <br>absent<br><i>cc</i>         |
| Texture of hair  | <br>curly<br><i>HH</i>          | <br>wavy<br><i>Hh</i>            | <br>straight<br><i>hh</i>       |
| Widow's peak     | <br>present<br><i>WW</i>        | <br>present<br><i>Ww</i>         | <br>absent<br><i>ww</i>         |
| Spacing of eyes  | <br>close together<br><i>EE</i> | <br>medium distance<br><i>Ee</i> | <br>far apart<br><i>ee</i>      |
| Shape of eyes    | <br>almond<br><i>AA</i>       | <br>almond<br><i>Aa</i>        | <br>round<br><i>aa</i>        |
| Position of eyes | <br>straight<br><i>SS</i>     | <br>straight<br><i>Ss</i>      | <br>slant upward<br><i>ss</i> |
| Size of eyes     | <br>large<br><i>LL</i>        | <br>medium<br><i>Ll</i>        | <br>small<br><i>ll</i>        |

**Figure 1**

| Traits               | Dominant<br>(both heads)                                                                                        | Hybrid<br>(one head, one tail)                                                                                   | Recessive<br>(both tails)                                                                                     |
|----------------------|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Length of eyelashes  | <br>long<br><i>LL</i>          | <br>long<br><i>Ll</i>          | <br>short<br><i>ll</i>     |
| Shape of eyebrows    | <br>bushy<br><i>BB</i>         | <br>bushy<br><i>Bb</i>         | <br>fine<br><i>bb</i>      |
| Position of eyebrows | <br>not connected<br><i>NN</i> | <br>not connected<br><i>Nn</i> | <br>connected<br><i>nn</i> |
| Size of nose         | <br>large<br><i>LL</i>         | <br>medium<br><i>Ll</i>         | <br>small<br><i>ll</i>     |
| Shape of lips        | <br>thick<br><i>TT</i>        | <br>medium<br><i>Tt</i>       | <br>thin<br><i>tt</i>     |
| Size of ears         | <br>large<br><i>LL</i>       | <br>medium<br><i>Ll</i>       | <br>small<br><i>ll</i>   |
| Size of mouth        | <br>large<br><i>LL</i>       | <br>medium<br><i>Ll</i>      | <br>small<br><i>ll</i>   |
| Freckles             | <br>present<br><i>FF</i>     | <br>present<br><i>Ff</i>     | <br>absent<br><i>ff</i>  |
| Dimples              | <br>present<br><i>DD</i>     | <br>present<br><i>Dd</i>     | <br>absent<br><i>dd</i>  |

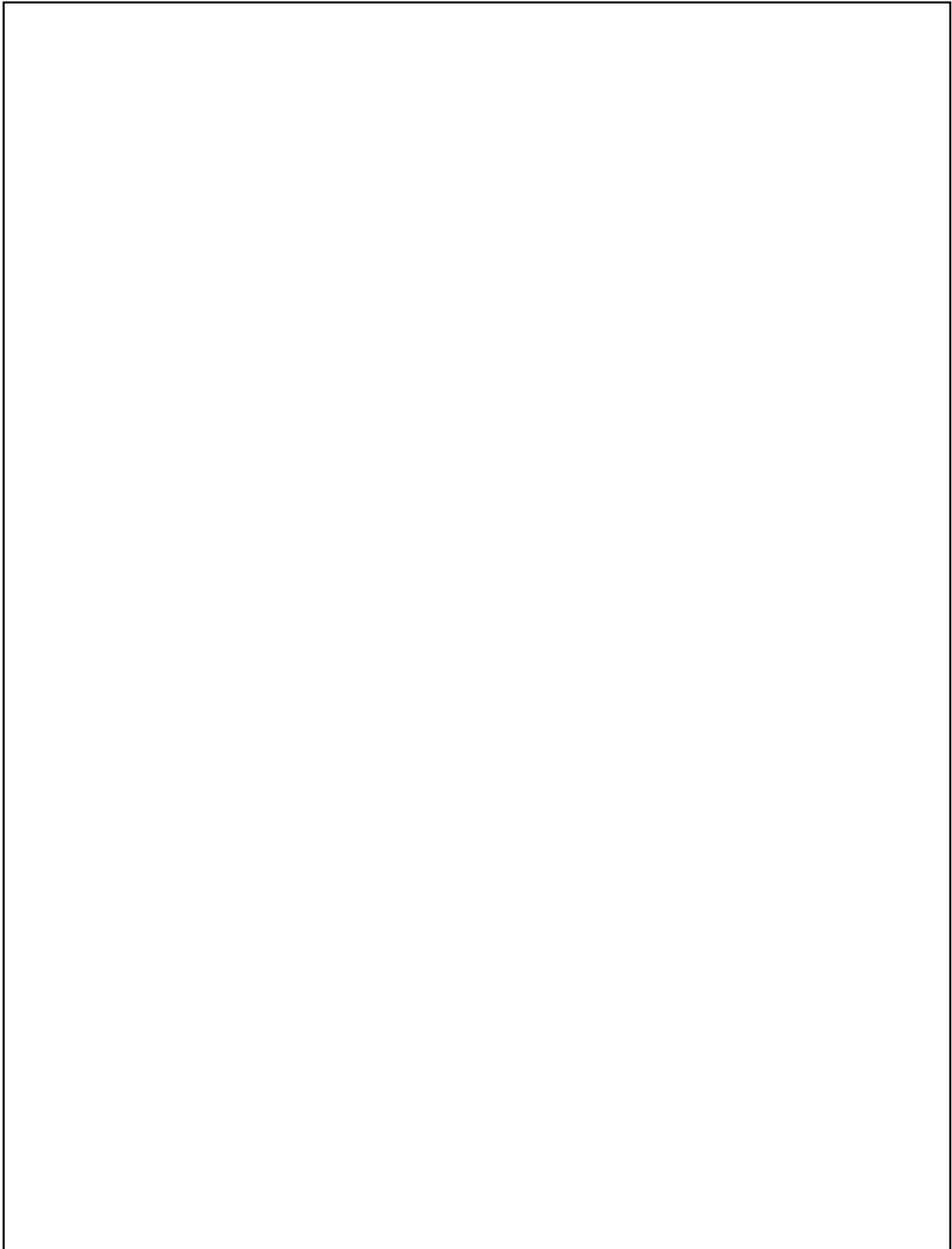
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**Figure 1** *continued*

Name \_\_\_\_\_ Class \_\_\_\_\_ Date \_\_\_\_\_

Sex of offspring \_\_\_\_\_

### **Drawing of Offspring**



## Analysis and Conclusions

1. **Inferring** What are the possible genotypes of the parents of an offspring who has wavy (*Hh*) hair?

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2. **Predicting** Would you predict that another pair of students in your class would have an offspring genetically identical to yours? Support your answer.

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3. **Drawing Conclusions** Do you think anyone in your class has all the same genetic traits that you have? Explain your answer.

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4. **Comparing and Contrasting** How is this coin-toss model similar to the way in which traits are inherited in living things? How is the model different?

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## Going Further

Some inherited diseases cause an individual to die before reaching reproductive age. Using library or Internet resources, read about one of these diseases, and write a brief report about what is understood about its transmission, and in what types of populations it tends to occur. Some examples of inherited diseases that cause early death include Duchenne muscular dystrophy, Tay-Sachs disease, and Krabbe's disease.