

Chapter 14 The Human Genome

Investigating Inherited Traits

Introduction

Heredity is the passing on of traits, or characteristics, from parent to offspring. The genetic makeup of an individual is known as its genotype. The physical traits you can observe in a person are his or her phenotype. Phenotype is a result of the genotype and the individual's interaction with the environment.

The units of heredity are called genes. Genes are found on the chromosomes in a cell. An allele is one of two or more forms of a gene. When the two alleles of a pair are the same, the genotype is homozygous, or pure. When the two alleles are not the same, the genotype is heterozygous, or hybrid. In nature, specific combinations of alleles happen only by chance.

Some alleles are expressed only when the dominant allele is absent. These alleles produce recessive phenotypes. Alleles that are expressed when the genotype is either 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 recessive phenotype occurs. In this case, called incomplete dominance or codominance, an intermediate phenotype is produced.

In humans, the sex of a person is determined by the combination of two sex chromosomes. People who have two X chromosomes (XX) are females, while those who have one X chromosome and one Y chromosome (XY) are males.

In this investigation, you will see how different combinations of alleles produce different characteristics.

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 the coin or disk represent?

2. What are the chances that any coin or disk tossed will land heads up?

3. How is a coin toss like the selection of a particular allele?

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

5. Can you accurately determine a person's genotype by observing his or her phenotype?

Materials (per pair)

- 3 textbooks
- 2 coins

Procedure

1. Place the textbooks on the laboratory table so that they form a triangular well.
2. Obtain two coins. You and your partner will each flip a coin to determine the traits in a hypothetical offspring.
3. Start by determining the sex of the offspring. Flip the coins into the well. If both coins land the same side up, the offspring is a female. If the coins land different sides up, the offspring is a male. Record the sex of the offspring in the blank on page 117.
4. For the rest of the coin tosses you will 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.* After each flip, record the trait of your offspring by placing a check in the appropriate box in Figure 1.
6. Continue to flip the coins for each trait listed in the table in Figure 1. **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 provided on page 117.

Name _____ Class _____ Date _____

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

Figure 1

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

Figure 1 continued

Name _____ Class _____ Date _____

Sex of offspring _____

Drawing of Offspring

