An organism can be thought of as a large collection of phenotypes. A phenotype is the appearance of a trait and is determined by pairs of genes. The pairs of genes represent the genotype for the trait. If you were told a large enough number of phenotypic traits that belonged to another person, you would be able to recognize that person.

In this Exploration, you will determine some of your own phenotypic traits. From these, you will be able to determine what your genotypes are for some of the traits. If a trait is dominant and you possess that trait, you will not be able to determine your exact genotype because you could be either homozygous or heterozygous for the gene. However, if a trait is determined by incomplete dominance, you can tell if you are homozygous or heterozygous. Genotypes of recessive traits can be identified. By comparing your genotypes and phenotypes with other people in your class, you will see why you are a unique individual. Given the almost limitless number of gene combinations, it is almost impossible that anyone would have all the same traits as you.

**OBJECTIVES**
- Determine your phenotype for nine different characteristics.
- Determine your possible genotypes for the nine different characteristics.
- Compare your phenotypes and genotypes with those of other students in the class.
- Evaluate your uniqueness as an individual.

**MATERIALS**
- PTC taste paper
- untreated taste paper
- mirror

**PROCEDURE**
1. Obtain one piece each of PTC paper and untreated taste paper from your teacher. First, place the untreated paper on your wet tongue to see how it tastes. Then dispose of it in the wastebasket, and place the PTC paper on your wet tongue to see if you can taste phenylthiocarbamide—PTC.
2. PTC is quite bitter and you will notice readily whether or not you have the ability to taste this chemical. If you can taste PTC, enter “taster” in the proper place in the “Your Phenotype” column in the table. If you cannot taste the chemical, enter “nontaster” in the table. Discard the taste paper in the wastebasket.
3. Now that you have determined your phenotype, enter in the column marked “Your Possible Genotypes” what your genotype could be. Tasters are either TT or Tt. Nontasters are tt.
4. For each of the following traits, observe and record your phenotype in the table. Then record your possible genotypes.
a. hairline—The widow's peak hairline comes to a point in the center of the forehead (WW or Ww). Individuals that lack the trait are ww.

b. eye shape—Almond-shaped eyes (AA or Aa) are dominant to round eyes (aa).

c. eyelash length—Long eyelashes (EE or Ee) are dominant to short eyelashes (ee).

d. tongue rolling—The ability to roll the tongue (CC or Cc) is dominant to the lack of this ability (cc).

e. thumb—One whose thumb tip bends backward more than 30 degrees (hitchhiker's thumb) is dominant (BB or Bb) to a straight thumb (bb).

f. lip thickness—Thick lips (LL or Ll) are dominant to thin lips (ll).

g. hair texture—Curly hair (HH) is incompletely dominant to straight hair (SS). Those that have wavy hair are HS.

h. inter-eye distance—The distance between the eyes is an example of incomplete dominance. Close-set eyes are DD, eyes set far apart are FF, and medium-set eyes are DF.
**DATA AND OBSERVATIONS**

Table 1. Human Phenotypes and Genotypes

<table>
<thead>
<tr>
<th>Traits</th>
<th>Dominant</th>
<th>Recessive</th>
<th>Your phenotype</th>
<th>Your possible genotypes</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTC taste</td>
<td>Taster</td>
<td>Nontaster</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hairline</td>
<td>Widow's peak</td>
<td>Straight line</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eye shape</td>
<td>Almond</td>
<td>Round</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eyelash length</td>
<td>Long</td>
<td>Short</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tongue dexterity</td>
<td>Can roll</td>
<td>Unable to roll</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thumb</td>
<td>Hitchhiker's thumb</td>
<td>Straight thumb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lip thickness</td>
<td>Thick</td>
<td>Thin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hair texture</td>
<td>Curly</td>
<td>Wavy</td>
<td>Straight</td>
<td></td>
</tr>
<tr>
<td>Inter-eye distance</td>
<td>Close together</td>
<td>Medium distance</td>
<td>Far apart</td>
<td></td>
</tr>
<tr>
<td>Lip protrusion</td>
<td>Protruding</td>
<td>Slightly protruding</td>
<td>Not protruding</td>
<td></td>
</tr>
</tbody>
</table>

**ANALYSIS**

1. Which traits do you have that are dominant? 

2. Which traits do you have that are recessive? 

3. Which of your traits are governed by incomplete dominance? 

4. Which of your traits do you share with one or more of your classmates? 

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Figure 9. 

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**Notes:** 

- lip protrusion—Protruding lips (PP) are incompletely dominant to nonprotruding lips (NN). Slightly protruding lips are PN.
5. Which of your traits are unique to you? ________________________________________________________________

6. If you and a particular classmate shared all of the same traits examined in this Exploration, what traits could you describe to prove your uniqueness? ________________________________________________________________

7. What determines your traits? ________________________________________________________________

8. With knowledge of the phenotype of a human, how can a person's genotype be determined? ________________________________________________________________

9. Why was untreated paper used in the PTC taste test? ________________________________________________________________

FURTHER EXPLORATIONS

1. Books from the library or your teacher on human genetics will discuss many other human characteristics. Identify some other characteristics that you or your classmates have and try to determine the genotypes that cause them.

2. Calculate the percentage of the class that has each phenotype and compare these figures with national averages. Suggest reasons why your class might differ from the national percentages of some phenotypes.