**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Per \_\_\_\_\_**

**Genetics[[1]](#footnote-1)**

Why do parents and their children have similar characteristics?

To answer this question, we will investigate:

* how genes influence our characteristics and
* how genes are inherited by children from their parents.

**How do genes influence our characteristics?**

**1.** A **gene** is a segment of a \_\_\_\_\_\_\_\_ molecule that gives the instructions for making a protein. Different versions of the same gene are called **alleles**, and different alleles give the instructions for

making different versions of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. These different versions of a protein can result in different observable characteristics.

Each cell in your body has two copies of each gene (one inherited from your mother and one inherited from your father).

* If both copies of a gene have the same allele, the person is **homozygous** for that gene.
* If the two copies of a gene have different alleles, the person is **heterozygous** for that gene.

**2a.** This chart shows an example of how genes influence our characteristics. Circle the genotypes in the chart that are homozygous. Fill in the empty box to complete the chart.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Genotype** | **→** | **Protein** | **→** | **Phenotype** (characteristics) | |
| **AA** | **→** |  | **→** | Normal skin and hair color |  |
| **Aa** | **→** | Enough normal enzyme to make melanin in skin and hair | **→** | Normal skin and hair color |
| **aa** | **→** | Defective enzyme that does not make melanin | **→** | Very pale skin and hair color (albino) |

**2b.** Explain how the two different homozygous genotypes result in different phenotypes.

**3.** For many genes, in a heterozygous person a **dominant** allele determines the phenotype and the other **recessive** allele does not affect the phenotype. This means that a heterozygous person has

the same phenotype as a person who is homozygous for the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ allele.

(dominant/recessive)

Answer question 4 based on the information in the above chart.

**4a.** Which allele is dominant? \_\_\_ **A** \_\_\_ **a**

**4b.** Which allele is recessive? \_\_\_ **A** \_\_\_ **a**

**4c.** What evidence supports your conclusion about which allele is dominant and which is recessive?

This example illustrates how meiosis and fertilization can result in a child who has a different phenotype than either of his/her parents. Answer **questions 11-13** to evaluate whether other pairs of parents could also have a child with a phenotype that neither parent has.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **11a.** Complete this Punnett  square for two parents who  are homozygous **aa**. | | | | **11b.** Complete this Punnett square  for a mother who is heterozygous **Aa**  and a father who is homozygous **aa**. | | | | **11c.** Complete this Punnett square  for a mother who is homozygous **aa**  and a father who is homozygous **AA**. | | | |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

**12a.** For each of these three Punnett squares, circle the genotype of any parent or child who would be albino.

**12b.** Considering all four Punnett squares, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the children with normal skin and

(all/most/none)

hair color have at least one parent who also has normal skin and hair color. A couple is most likely

to have an albino child if \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the parents is/are albino.

(none/one/both)

These findings help us to understand why children tend to resemble their parents.

**13.** Explain why two albino parents will not have any children with normal skin and hair color, but two parents with normal skin and hair color could have an albino child.

**14.** Albino children are rare in the general population. Based on this observation, what is the most common genotype for parents? Explain your reasoning.

1. By Drs. Scott Poethig, Ingrid Waldron, and Jennifer Doherty, Dept. Biology, Univ. Pennsylvania, © 2017. This Student Handout, a Genetics Supplement with an alternative module that does not assume prior completion of "[Meiosis and Fertilization – Understanding How Genes Are Inherited](http://serendip.brynmawr.edu/sci_edu/waldron/#meiosis)" and additional modules, and Teacher Preparation Notes with instructional suggestions and background information are available at <http://serendip.brynmawr.edu/sci_edu/waldron/#genetics> [↑](#footnote-ref-1)