GENOTYPES: 3324

The genotype of an organism displays the genetic makeup of that organism. It is an expression of the alleles or genes of that organism.

Upon successful completion of this unit, you should be able to do the following:

1. Explain the difference between a homozygous and a heterozygous genotype.
2. Determine the dominant and/or recessive allele given the genotype.
3. Determine the trait of an organism given the genotype.
4. Define the following terms:

<table>
<thead>
<tr>
<th>genotype</th>
<th>dominant</th>
</tr>
</thead>
<tbody>
<tr>
<td>allele</td>
<td>recessive</td>
</tr>
<tr>
<td>homozygous</td>
<td>homozygous dominant</td>
</tr>
<tr>
<td>heterozygous</td>
<td>homozygous recessive</td>
</tr>
<tr>
<td>trait</td>
<td>homozygous dominant</td>
</tr>
</tbody>
</table>
The word *genotype* is used to describe the two alleles, or genes, that an individual has for a particular trait. A *gene* is a segment of a chromosome that codes for a trait. There are thousands of genes on a chromosome. An example of a trait that a gene would code for is height. An *allele* is an alternate form of the same trait. For the trait of height, there would be a tall allele and a short allele.

To symbolize the genes, letters are used. Usually, the capitalized first letter of the dominant trait is used to represent the allele for the dominant trait. The lower case letter is used to represent the allele for the recessive trait.

**REMEMBER THIS!!!**

The genotype is the genetic makeup of an organism, plant or animal. It is expressed by using the letters which represent the alleles or genes for a trait, such as Bb or BB.

For example, in pea plants, tallness is dominant over shortness. The letter “T” is used to represent the dominant allele for tallness. The letter “t” is used to represent the recessive allele for shortness. Therefore, a tall pea plant can either have a “TT” or “Tt” *genotype*. The short pea plant must have the “tt” *genotype*.

In pea plants, yellow seeds are dominant over green seeds. So, “Y” is used to represent the dominant allele for yellow seeds and “y” is used to represent the recessive allele for green seeds. A yellow seed may be either “YY” or “Yy”, but the green seed must be the “yy” *genotype*.

**Question 1:** What is a gene?

**Question 2:** What is an allele?

**Question 3:** If “M” represents the dominant condition for a trait and “m” represent the recessive condition for that same trait. What is the genotype for a recessive offspring?______.

What are the two possible genotypes for an offspring with the dominant trait? ______ or ______.
There are two alleles, or genes, for each trait in an individual, one from each parent. For instance in an offspring with an “Hh” genotype, one allele, “H” came from one parent while the other allele, “h” came from the other parent. If an individual has two alleles for a trait that both code for the same expression of that trait, the individual has a homozygous genotype.

Question 4. If an offspring has a genotype of “Dd” and we know it received the “D” allele from the male parent, where did it receive the “d” allele?

For example, if a pea plant has two dominant alleles for tallness, it is homozygous dominant, and its genotype is “TT”. If an individual has two recessive alleles for shortness, it is homozygous recessive, and its genotype is “tt”. If a pea plant has two dominant alleles for yellow seeds, its genotype is “YY”. If an individual has two recessive alleles for green seeds, its genotype is “yy”. All of these pea plants have homozygous genotypes because all of them have two of the same alleles that code for the same expression of that trait. Homozygous means “the same”.

Question 5. An individual with a genotype of Gg will show the dominant trait. Is this individual also homozygous dominant? Explain your answer.

What about an offspring with an “Rr” genotype? If an individual has two alleles for a trait that are not the same, the individual has a heterozygous genotype. For example, if a pea plant has one allele for tallness and one allele for shortness, its genotype is “Tt”, heterozygous dominant. If a pea plant has one allele for yellow seeds and one allele for green seeds, its genotype is “Yy.” These plants have heterozygous genotypes because they have two alleles that do not code for the same expression of that trait.

Question 6. Given the heterozygous condition, “Aa”, will this individual express the dominant trait?
REMEmber this!!!

Genotypes are written with 2 letters. If the two letter match, the organism is homozygous. However, if one of the letters is a capital and the other is a small case, then the organism is heterozygous. Here are several examples:

- AA = homozygous dominant
- aa = homozygous recessive
- Aa = heterozygous dominant

Note: there is no such thing as heterozygous recessive, because as long as at least one dominant allele is present, the dominant trait will be expressed.
Genotypes:
TEST YOURSELF
Matching - Two choices will be used more than once.

____ 1. genotype  a. a homozygous genotype
____ 2. homozygous  b. a heterozygous genotype
____ 3. heterozygous  c. describes the two alleles of an individual
____ 4. YY  d. a genotype that has two alleles that are the same
____ 5. Yy  e. a genotype that has two alleles that are not the same

_____ 6. yy
_____ 7. TT
_____ 8. Tt
_____ 9. Tt

True or False
____ 1. Genotype describes how two alleles are outwardly expressed in an individual.
____ 2. Genotype describes the two alleles that an individual has for a trait
____ 3. Genotypes can be homozygous or heterozygous.
____ 4. Genotypes are homozygous when the two alleles are different.
____ 5. Genotypes are homozygous when the two alleles are the same.
____ 6. Genotypes are heterozygous when the two alleles are different.
____ 7. Genotypes are heterozygous when the two alleles are the same.
____ 8. YY is a homozygous genotype.
____ 9. YY is a heterozygous genotype.
____ 10. Yy is a homozygous genotype.
____ 11. Yy is a heterozygous genotype.
____ 12. yy is a homozygous genotype.
____ 13. yy is a heterozygous genotype.
____ 14. TT is a homozygous genotype.
____ 15. TT is a heterozygous genotype.
____ 16. Tt is a homozygous genotype.
17. Tt is a heterozygous genotype.
18. tt is a homozygous genotype.
19. tt is a heterozygous genotype.

Fill in the Blank - Words may be used more than once.

- genotype
- homozygous
- heterozygous
- dominant
- recessive

1. Two letters are used to represent the _______ of an individual.
2. The ___________ allele for a gene is represented with the capital letter.
3. The ___________ allele for a gene is represented with a lower case letter.
4. If the two alleles are the same, the genotype is ________________.
5. If the two alleles are different, the genotype is ________________.
6. YY is a ___________ genotype.
7. Tt is a ________________ genotype.
8. tt is a ________________ genotype.

Answer the Following

1. What is the word genotype used to describe?
2. How are genotype usually represented?
3. What is a homozygous genotype?
4. What is a heterozygous genotype?
5. If we are looking for a trait (Z), where Z = dominant and z = recessive, what is its genotype for the following?
   a) heterozygous dominant __________________
   b) homozygous recessive __________________
   c) homozygous dominant __________________
**Genotypes**

3.3.2.4

**Short Answer Questions**

**Question 1:** If “M” represents the dominant condition for a trait and “m” represent the recessive condition for that same trait. What is the genotype for a recessive offspring?______.

What are the two possible genotypes for an offspring with the dominant trait? ____ or ____.

**Question 2.** If an offspring has a genotype of “Dd” and we know it received the “D” allele from the male parent, where did it receive the “d” allele?

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**Question 4.** Given the heterozygous condition, “Aa”, will this individual express the dominant trait?
**Genotypes**

**Answer Sheet**

**Question 1**: What is a gene?

**Question 2**: What is an allele?

**Question 3**: If “M” represents the dominant condition for a trait and “m” represent the recessive condition for that same trait. What is the genotype for a recessive offspring?______.

What are the two possible genotypes for an offspring with the dominant trait? _____ or ______.

**Question 4**. If an offspring has a genotype of “Dd” and we know it received the “D” allele from the male parent, where did it receive the “d” allele?

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