Pedigrees

3.3.2.6

A pedigree is a chart that is used to explain patterns of inheritance within a family.

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

1. Explain how a pedigree is organized.
2. Determine the genotype for an individual by using a pedigree.
3. Determine the phenotype for an individual by using a pedigree.
4. Use the following scientific terms correctly:

- pedigree
- genotype
- phenotype
A pedigree is a diagram that displays a family tree. It can also show the history of a particular trait or disorder from generation to generation in a family. By looking at the parents and the offspring of an individual, the genotype can often be determined.

**REMEMBER THIS!!!**

A genotype is the genetic makeup of the individual. It shows the genes for an organism, such as HH or Hh=normal blood cells and hh=sickle-cell blood cells.

The phenotype is what they organism looks like. For instance, the horse has brown eyes. The phenotype is determined by the genotype.

Examine the pedigree below. It characterizes a family tree that carries the genetic disorder, **sickle-cell anemia**.

For your reference, the individuals are numbered for easy identification. Also, circles = females; squares = males. Colored in circles or squares = individual has the disease – in this case, sickle-cell anemia.
REMEMBER THIS!!!

To determine the genotype of an individual, you may have to look at the parents or the offspring.

On the pedigree above, Individual #1 is a female. She is married to Individual #2. They have four children, three boys and one girl, Individual #4.

Individual #3 is married to the girl, individual #4. They have three children. One of their children, individual #9, has sickle cell anemia. Sickle cell anemia is caused by inheriting two recessive alleles for malformed hemoglobin. (H = allele for normal hemoglobin, h = allele for sickle cell anemia)

From this pedigree, the genotypes of certain individuals can be determined. It is easy to determine the genotype for individual #1 and #2. They must both be Hh because individual #6 has to be hh because he has sickle cell anemia. Therefore both parents must carry the sickle-cell gene. If either parent were HH, then all of their offspring would be HH or Hh.

Look at the pedigree and determine why this has to be true.

Question 1. By looking at the pedigree how would you know who has the sickle-cell anemia trait.
Question 2. Examine the pedigree. What is the genotype of individual 3 and 4? Explain your answer.

Question 3. What is the phenotype of individual 3 and 4 and how do you know?

Question 4. What are the possible genotypes for individual 7? Explain your answer.

Question 5. What is the phenotype for individual 7 and how do you know?

Question 6. What is the genotype for individual 9? Explain your answer.

Question 7. What is the phenotype for individual 9? Explain your answer.
True or False

_____ 1. A pedigree is used to predict all of the genotypes of the possible offspring between two parents.

_____ 2. A pedigree is a diagram that shows the family history of a particular trait.

_____ 3. A female is always represented on a pedigree by a circle.

_____ 4. A male is always represented on a pedigree by a circle.

_____ 5. A female is always represented on a pedigree by a square.

_____ 6. A male is always represented on a pedigree by a square.

_____ 7. On the example pedigree, individual #7 is a female.

_____ 8. On the example pedigree, individual #7 is a male.

_____ 9. On the example pedigree, individual #10 is a female.

_____ 10. On the example pedigree above, individual #10 is a male.

_____ 11. Individual #3 must have an HH genotype.

_____ 12. Individual #3 must have an Hh genotype.

_____ 13. Individual #3 must have an hh genotype.

_____ 14. Individual #6 must have an hh genotype.

_____ 15. Individual #7 must have an HH genotype.

_____ 16. Individual #8 must have an HH genotype.

_____ 17. Individual #1 has sickle cell anemia.

_____ 18. Individual #6 has sickle cell anemia.

_____ 19. Individual #9 has sickle cell anemia.

_____ 20. Individual #10 may have HH or Hh as a genotype.

_____ 21. The phenotype of individual 2 is non-sickle-cell.

_____ 22. The phenotype of individual 6 is sickle-cell.

Fill in the Blank

Use the example pedigree below to fill in the blanks. Answers may be used more than once.

The example pedigree illustrates the inheritance of albinism, the recessive trait of having no skin or hair pigment. N = Normal pigmentation; n = albinism
1. Individual #1 and individual #2 are ______________ in this ______________.
2. Individual #1 must have a _____ genotype.
3. Individual #2 must have a _____ genotype.
4. Individual #1 and individual #2 had ________ children.
5. The offspring of individual #1 and #2 that had albinism was a ________.
6. The genotype of individual #4 had to be ________.
7. The genotype of individual #5 could be ________ or ________, but not ________.
8. The genotype of individual #8 had to be ________.
9. Individual #14 and #15 are ________________.
10. Individual #8 and #9 had ____________ children.

Answer the Following

1. What is a pedigree?

2. How can a pedigree be used to determine the genotype or phenotype of an individual?

3. How can the genotypes of individuals on a pedigree be determined?
4. How can the phenotype of an individual be determined by using a pedigree?