

# BIOLOGY

## UNIT ON GENETICS:

STUDENT # \_\_\_\_\_

1. All inherited characteristics in an organism are carried on thread-like structures called \_\_\_\_\_  
1. \_\_\_\_\_
2. In the study of genetics, characteristics are called \_\_\_\_\_  
2. \_\_\_\_\_
3. In one definition, a gene is an inheritable factor associated with the development of one specific trait. Since organisms possess many more traits than chromosomes, it has been suggested that each chromosome consists of (just one/many) genes.  
choose one  
3. \_\_\_\_\_
4. Define gene by writing a sentence containing these three words: gene, trait, chromosome.
5. Chromosomes of the same kind are called \_\_\_\_\_  
Genes of the same kind are called \_\_\_\_\_
6. We can say then that alleles occupy (the same/different) relative positions on homologous chromosomes.  
6. \_\_\_\_\_
7. Mark each gene pair below as either homozygous or heterozygous. 7.  

<u>gene of father</u>		<u>gene of mother</u>
a. brown eyes	and	blue eyes
b. brown hair	and	brown hair
c. curly hair	and	straight hair

(each of the above genes is given to the offspring)
8. An organism that possesses identical alleles for a given trait is said to be \_\_\_\_\_.  
a. homozygous      b. heterozygous      c. homologous  
8. \_\_\_\_\_
9. Genes of the same kind are called \_\_\_\_\_.  
9. \_\_\_\_\_
10. In fruit flies, eye shape is under the influence of genes located on \_\_\_\_\_.  
10. \_\_\_\_\_
11. A fly with one gene for round eye and one gene for bar eye is said to be \_\_\_\_\_ for that trait.  
11. \_\_\_\_\_

12. When an animal is heterozygous for many traits they are often called a \_\_\_\_\_.  
a. dominant                      b. genotype                      c. hybrid
13. Now apply your knowledge of genes and the chromosome theory to the solution of a real and often tragic problem in human heredity. Blood samples showing misshapen red cells reveal that a man and his wife both possess the sickle cell trait. Sickle-cell anemia is a related but more severe misconstruction of red blood cells and is often fatal, so the man asks his doctor, "What are the chances that my wife and I will have children with sickle-cell anemia?"

To answer that question and to understand the hereditary process involved, work through each of the following steps:

- a. The shape of red blood cells is a hereditary characteristic that is influenced by segments of chromosomes called \_\_\_\_\_.  
a. \_\_\_\_\_
- b. A child inherits one set of chromosomes from each of his parents. So each child possesses how many genes for the characteristic?  
b. \_\_\_\_\_
- c. These genes for red cell shape are called \_\_\_\_\_.  
c. \_\_\_\_\_
14. There is incomplete (co) dominance between genes for the normal and sickle shape. In view of that, identify which diagram below represents each description below.
- S - normal shape  
s - sickle shape
- a. The genetic constitution of a person with normal red cells.  
a. \_\_\_\_\_
- b. Persons with severely misshapen or sickle cells.  
b. \_\_\_\_\_
- c. Persons, like the man and wife above, with cells of in-between shape of the sickle cell trait.  
c. \_\_\_\_\_
15. The doctor explained to the man and wife that each possess one gene for normal and one gene for sickle cell. By this he means that each is  
a. homozygous of red cell shape  
b. heterozygous of red cell shape  
15. \_\_\_\_\_
16. Complete the diagram below for these parents of sickle cell.

- Examine the Punnett square above for the next few questions.
17. How many of the four offspring would be homozygous for normal? 17. \_\_\_\_\_
  18. How many would be heterozygous like their parents? 18. \_\_\_\_\_
  19. How many would be heterozygous for sickle cell shape? 19. \_\_\_\_\_
  20. What are the chances that they will have a child with sickle-cell anemia?  
 a. none of the children      b.  $1/4$  (25%)  
 c.  $1/2$  (50%)                  d.  $3/4$  (75%)      20. \_\_\_\_\_
  21. What is the genotype of child #1 in square? 21. \_\_\_\_\_
  22. What is the genotype of child #3? 22. \_\_\_\_\_
  23. What is the phenotype of child #3? (sickle, carrier, normal) 23. \_\_\_\_\_
  24. What is the phenotype of child #1? 24. \_\_\_\_\_
  25. What is the phenotype of child #4? 25. \_\_\_\_\_
  26. If sickle-cell anemia was dominant and not incomplete dominant, what percent of the offspring would be sickle cell? 26. \_\_\_\_\_

A man and his wife are known to be heterozygous for curly hair, a dominant trait. Using C to represent the gene for curly hair and c for straight hair diagram below the sperm and egg cell and the possible offspring.

#27-29

#30-32

27. What percent of the offspring will be like the parents? 27. \_\_\_\_\_
28. What is the phenotype of any homozygous offspring? 28. \_\_\_\_\_
29. If 1000 children from hundreds of families with heterozygous curly-haired parents were studied, approximately how many would probably have straight hair? 29. \_\_\_\_\_

30. If a parent had straight hair and the other parent was homozygous for curly hair, what is the genotype of the first parent?

30. \_\_\_\_\_

31. With the parents in question #30, what percent of the offspring with curly hair will there be?

31. \_\_\_\_\_

32. What is the genotype of all of the offspring in #30?

32. \_\_\_\_\_

Incomplete (co)dominance. In Andalusian chickens, there is incomplete (co)dominance between genes for black (B) and white (b) feather colors. The hybrids are blue. Two hybrid chickens were crossed. Diagram them below.

33. What are the phenotypes of all the possible offspring?

33. a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

34. What percent of the offspring will be the same as the parents?

34. \_\_\_\_\_

35. What percent of the offspring will be black?

35. \_\_\_\_\_

Complete the following Punnett square for a typical dihybrid problem for horses. In horses, black coats (B) are dominant to chestnut (b) and trotting gait (T) is dominant to pacing gait (t). The parents are heterozygous for both traits.

36. What is the genotype of #1?

36. \_\_\_\_\_

37. What is the genotype of #16?

37. \_\_\_\_\_

38. What is the genotype of #7?

38. \_\_\_\_\_

39. What is the genotype of #11?

39. \_\_\_\_\_

40. What is the phenotype of #11?

40. \_\_\_\_\_

41. What is the phenotype of #1?

41. \_\_\_\_\_

42. What is the phenotype of #15?

42. \_\_\_\_\_

9/16 of the above offspring will be black trotters. Fill in the rest of the offspring percentages below.

43. What percent will be black pacers?

43. \_\_\_\_\_

44. What percent will be chestnut trotters?

44. \_\_\_\_\_

45. What percent will be chestnut pacers?

45. \_\_\_\_\_

Dihybrid cross and incomplete dominance  
mice-

F - extremely frizzy hair

f - normal hair

FF - extremely frizzy hair

Ff - mildly frizzy hair

ff - normal hair

B - black hair

b - white hair

BB - black hair

Bb - gray hair

bb - white hair

Sex-linked traits-

hemophilia - (bleeders)

sex -

XX - female

X - male

Drosophila white and red eye trait (gene only carried on X chromosome)

R - normal dominant red eye

Xr Xr ---

r - recessive white eye

Xr XR ---

Xr Y —

XR Y —

What are some more combinations?