Name _____ Class _____ Date _____

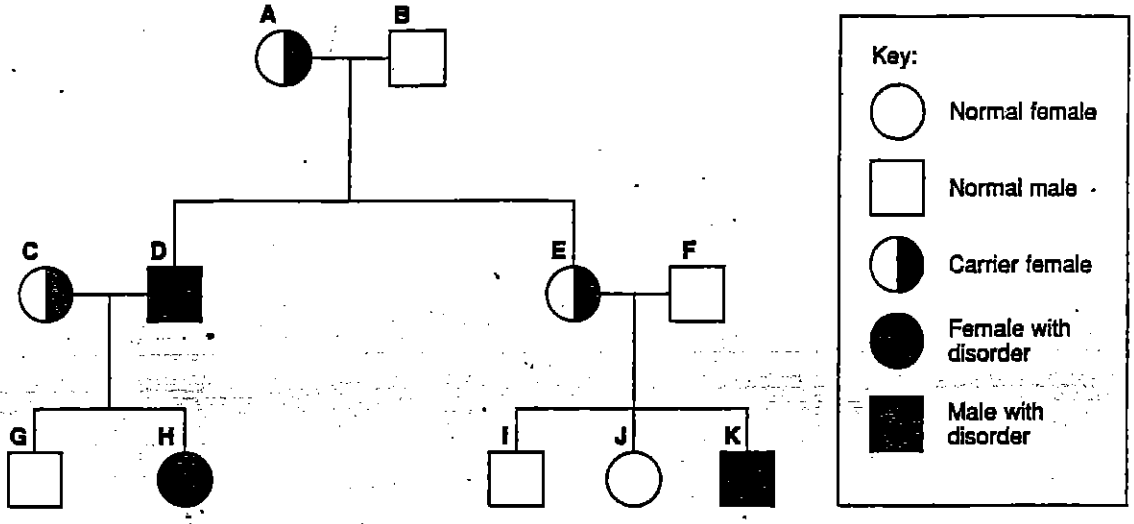
CHAPTER 11

*Human Heredity*
*Section 11–3*

**SKILL ACTIVITY**
**Interpreting diagrams**

# *Applied Genetics*

**A.** Duchenne muscular dystrophy is a deadly disorder in which the muscles grow progressively weaker. The disease is caused by a recessive gene on the X chromosome. The pedigree chart below illustrates the inheritance of this gene. Use the chart to answer the questions that follow.




**1.** Is Duchenne muscular dystrophy more likely to occur in males or in females? Explain your answer.

_____

_____

**2.** Individual H is a female with this disorder. Explain how she inherited this disease. _____

_____

_____

**3.** Individual K has this disorder, yet his father did not. Explain how this is genetically possible. _____

_____

_____

**4.** Individual G does not have the disease, yet his mother was a carrier and his father had the disease. Explain how this is possible. _____

_____

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Use after Section 27:2

# KNOWING YOUR BLOOD TYPE

If you ever have surgery and need blood, your doctor will need to know your blood type. The only type of blood you can receive is blood that will not clot with your blood.

*Use the information on blood types in Chapter 12 and in Section 27:2 to complete the tables.*

**1.** *Fill in the blanks in the table.*

| If you have blood type | your genes are | so you received this gene from one parent | and this gene from the other parent |
|---|---|---|---|
| A | ____ or ____ | | |
| | | | |
| B | ____ or ____ | | |
| | | | |
| AB | ____ | | |
| O | ____ | | |

**2.** *Use the information below to fill in the table.*

Type A has plasma proteins that clot with red cell proteins from donor type B.
Type B has plasma proteins that clot with red cell proteins from donor type A.
Type AB has no plasma proteins that will clot with red cell proteins from any donor types.
Type O has plasma proteins that clot with red cell proteins from donor types A, B, or AB.

| Blood type | Can receive blood type(s) |
|---|---|
| A | |
| B | |
| AB | |
| O | |

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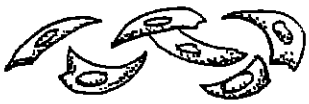
## HUMAN TRAITS

*In your textbook, read about incomplete dominance in Section 27:2.*

1. Red blood cell shape shows incomplete dominance in humans. $R$ is the gene for round cell shape and $R'$ is the gene for sickle cell shape.

   a. Put checkmarks in the following table to show the shape of cells for persons with the genes listed.

| |  |  |  |
|---|---|---|---|
| *R'R'* | | | |
| *RR'* | | | |
| *RR* | | | |

   b. Which gene, $R$ or $R'$, is dominant? _____ Which is recessive? _____

2. a. Describe the condition that a person with $R'R'$ genes has. _____

   _____

   _____

   _____

   b. What is the name of this disease? _____

3. Human blood types show incomplete dominance as well as dominance. Fill in the table at the right showing possible genes a person with each blood type might have.

| Blood type | Possible genes |
|---|---|
| A | or |
| B | or |
| O | |
| AB | |

4. Which blood type genes are dominant to other blood type genes? _____

   _____

5. Which blood type genes show incomplete dominance to each other? _____

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## GENETIC DISORDERS

*In your textbook, read about errors in chromosome number in Section 27:3.*

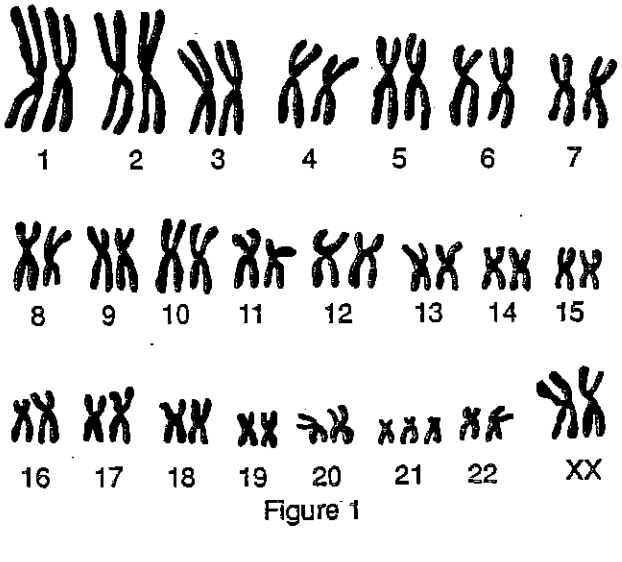



Figure 1

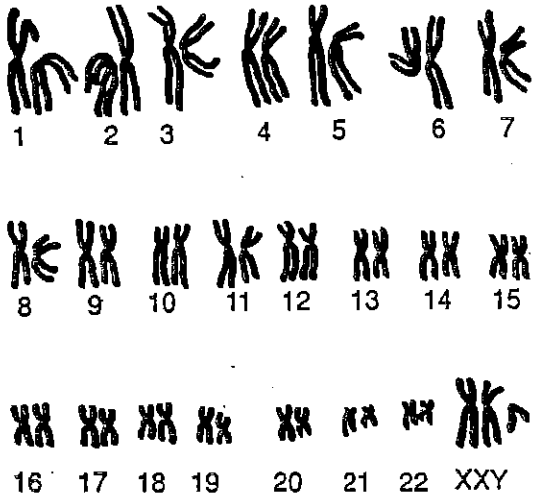



Figure 2

1. Suppose a child was found to have the chromosome pattern shown in Figure 1 above.

   a. Is the child a male or female? _____

   b. Explain your answer. _____

   c. Down syndrome is caused by one extra autosome in each cell. What pair of chromosomes has an extra chromosome? _____

   d. How did this child get an extra chromosome? _____

2. Suppose a child was found to have the chromosome pattern shown in Figure 2 above.

   a. Is the child a male or female? _____

   b. Explain your answer. _____

   c. Which chromosome is the extra chromosome, an X or Y? _____

   d. How did the child get an extra chromosome? _____

1. Mother AB x Father O

2. Mother O x Father O

---

3. Mother AO x Father BO

11. Four babies were born at practically the same time in a small hospital. It was a hectic few minutes and in the confusion, none of the four babies were properly identified with their mothers. Luckily, the babies all had different blood types. From the information below, PLEASE make a happy ending for this mess. Assign each baby to its correct parents.

| Baby | Baby's Blood Type | Parents and Blood Type | Which Baby belongs to? |
|---|---|---|---|
| Aaron | O | 1. AB X O | 1. |
| Bobby | A | 2. B X B | 2. |
| Charlie | B | 3. O X O | 3. |
| Daniel | AB | 4. A X B | 4. |

12. A man with type AB blood marries a woman with type O blood. What are the possible blood types of their offspring?

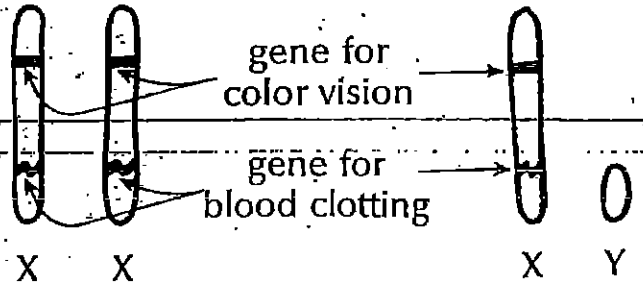
13. A child has O blood. Her three siblings (brothers & sisters) have the following blood types: A, B, and AB. What is the genotype of each parent? What is the genotype of each of the four children?

14. Cross a man with type AA blood with a woman with type BO blood. What are the possible genotypes and phenotypes of their offspring?

# Sex-linked Traits

Female sex chromosomes

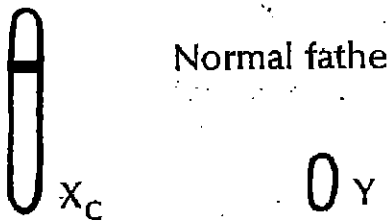
Male sex chromosomes



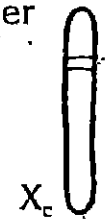

Let ▬ show a gene for normal color vision (dominant).

Let ▭ show a gene for color blindness (recessive).

Normal father




Color-blind mother




| | |
|---|---|
| Hybrid daughter<br>$X_c$ $X_C$<br>(carrier) | Color-blind son<br>$X_c$ Y |
| Hybrid daughter<br>$X_c$ $X_C$<br>(carrier) | Color-blind son<br>$X_c$ Y |

Corresponding Punnett square

| | $X_C$ | Y |
|---|---|---|
| $X_c$ | $X_cX_C$ | $X_cY$ |
| $X_c$ | $X_cX_C$ | $X_cY$ |

**IV. SEX LINKAGE (Genes carried on the X chromosome. Females have two X chromosomes and males only have one X and one Y.)**

25. Color-blindness is a sex-linked characteristic in humans. If a normal woman has a genotype XX, what would a normal male be?

If a colorblind female is $X^CX^C$, what would a colorblind male be?

What would be the genotype of a woman who is a carrier?

26. Cross a woman who is colorblind and a man with normal vision. Describe expected offspring.

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27. Cross a woman with normal vision who carries a gene for colorblindness with a man with normal vision. Describe expected offspring.

28. Cross a woman whose vision is normal with a man who is colorblind. Describe expected offspring.

29. A man with normal vision whose father was colorblind marries a colorblind woman. What would be the probabilities of their sons and daughter being colorblind?

30. A boy whose parents and grandparents have normal vision is colorblind. Draw a family chart which gives genotypes for this boy, his mother and father, and his maternal grandparents.

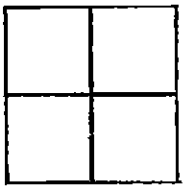
31. In humans, the gene for hemophilia is sex-linked on the X chromosome. A young woman whose brother has hemophilia is contemplating marriage to a young man who has no history of hemophilia in his family. What is the probability that any of her children have hemophilia? Show your work.

Name: _____ Row: _____

Date: _____ Period: _____

# Sex-Linked Traits Worksheet

1) Albinism is a recessive autosomal genetic disorder that causes the complete or partial absence of pigments in the skin, hair and eyes. Fill in the Punnett square and determine the expected genotypic ratios from crossing homozygous recessive and heterozygous dominant parents.

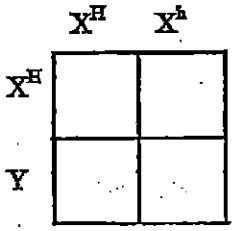


Genotypes: _____ Genotypic Ratio: _____

Phenotypes: _____

% of kids with disorder: _____ % of carrier kids: _____

2) Red-Green color blindness is a recessive sex-linked (X chromosome) genetic disorder where the middle (green) or long (red-yellow) wavelength cones in the eyes have a partial or complete loss of function. Fill in the Punnett square and determine the expected genotypes and phenotypes from crossing a normal male and a female who is a carrier for colorblindness.

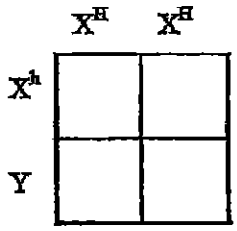



Genotypes: _____

Circle all phenotype(s): normal male, male with colorblindness, normal female, carrier female, female with colorblindness

% of kids with disorder: _____ Circle their gender(s) male / female

3) Color blindness is a recessive sex-linked genetic disorder located on the X chromosome. Fill in the Punnett square for a cross of a male with color blindness and a normal female.

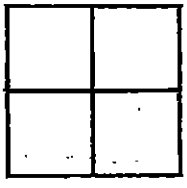



Genotypes: _____

Circle all phenotype(s): normal male, male with colorblindness, normal female, carrier female, female with colorblindness

% of kids with disorder: _____ Circle their gender(s) male / female

4) Color blindness is a recessive sex-linked genetic disorder located on the X chromosome. Fill in the Punnett square for a cross of a male who is color blind and a female who is a carrier for color blindness.

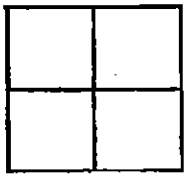


Genotypes: _____

Circle all phenotype(s): normal male, male with colorblindness, normal female, carrier female, female with colorblindness

% of kids with disorder: _____ Circle their gender(s) male / female

5) Color blindness is a recessive sex-linked genetic disorder located on the X chromosome. Fill in the Punnett square for a cross of a normal male and a female who is color blind.

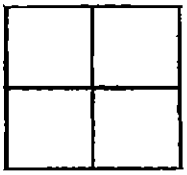


Genotypes: _____

Circle all phenotype(s): normal male, male with colorblindness, normal female, carrier female, female with colorblindness

% of kids with disorder: _____ Circle their gender(s) male / female

6) Color blindness is a recessive sex-linked genetic disorder located on the X chromosome. Fill in the Punnett square for a cross of a color blind male and a color blind female.



Genotypes: _____

Circle all phenotype(s): normal male, male with colorblindness, normal female, carrier female, female with colorblindness

% of kids with disorder: _____ Circle their gender(s) male / female

7) Explain how sex-linked traits are different than autosomal traits.

_____

_____

_____

_____

8) Explain why males have more sex-linked disorders than females. _____

_____

_____

_____

_____

**Sex Determination and Linkage**
**http://www2.edc.org/weblabs/SexDetermination/sexdetermination.html**

1. What are the sex chromosomes of a male? _____ What sex chromosomes can be present in his sperm? _____

2. What are the sex chromosomes of a female? _____ What sex chromosomes can be present in her eggs? _____

3. Explain why very little genetic information is carried on the X chromosome. _____
_____
_____
_____

4. List the possible gene combinations for a colorblind female.
_____

5. List the possible gene combinations for a colorblind male.
_____

6. Why is there a difference between the gene combinations for colorblind males and females? _____
_____
_____
_____

7. Why are there more colorblind males than females?_____
_____
_____
_____
_____

8. Why do you think that colorblindness is called a sex-linked trait? _____
_____
_____
_____
_____

9. What other sex-linked trait is mentioned in this web lab?
_____