Chapter 14 Study Guide

Study Tip

Write each Vocabulary term on a separate card, as well as a question for each Key Concept. Place the cards into a hat or a bowl. Have students draw a card and either give the definition of the word or answer the question. Continue until all the cards have been used.

Thinking Visually

1. Autosomes

2.–5. Tay-Sachs disease, achondroplasia, Huntington's disease, sickle cell disease (or any other disorder listed in Figure 14–6 on page 345)

6.–7. Colorblindness, Duchenne muscular dystrophy

Chapter 14 Assessment

Reviewing Content

1. b	**5.** d	**9.** a
2. a	**6.** a	**10.** a
3. c	**7.** d	
4. b	**8.** c	

Understanding Concepts

11. Biologists photograph cells in mitosis, cut out the chromosomes from the photographs, and group them together in pairs. They then check whether any chromosomes are missing or have extra copies.

12. The sex chromosomes, X and Y, determine an individual's sex; the remaining chromosomes are autosomal.

13. A pedigree shows how a genetic trait has been passed from one generation to the next. This information can be used to infer the genotypes of family members and predict the likelihood that a child will have the disorder.

14. Mothers 1 and 6 are carriers. Person 3 can pass his affected X chromosome only to his daughters; his sons inherit his Y chromosome and an X chromosome from their mother.

15. No, the I^A and I^B alleles are codominant. When both alleles are present in an individual, that person has blood type AB.

Chapter 14 Study Guide

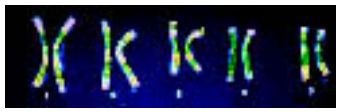
14–1 Human Heredity

Key Concepts

- All human egg cells carry a single X chromosome (23,X). However, half of all sperm cells carry an X chromosome (23,X) and half carry a Y chromosome (23,Y). This ensures that just about half of the zygotes will be 46,XX (female), and half will be 46,XY (male).
- In both cystic fibrosis and sickle cell disease, a small change in the DNA of a single gene affects the structure of a protein, causing a serious genetic disorder.

Vocabulary

karyotype, p. 341
sex chromosome, p. 341
autosome, p. 341
pedigree, p. 342



14–2 Human Chromosomes

Key Concepts

- Males have just one X chromosome. Thus, all X-linked alleles are expressed in males, even if they are recessive.
- If nondisjunction occurs, abnormal numbers of chromosomes may find their way into gametes, and a disorder of chromosome numbers may result.

Vocabulary

sex-linked gene, p. 350
nondisjunction, p. 352

14–3 Human Molecular Genetics

Key Concepts

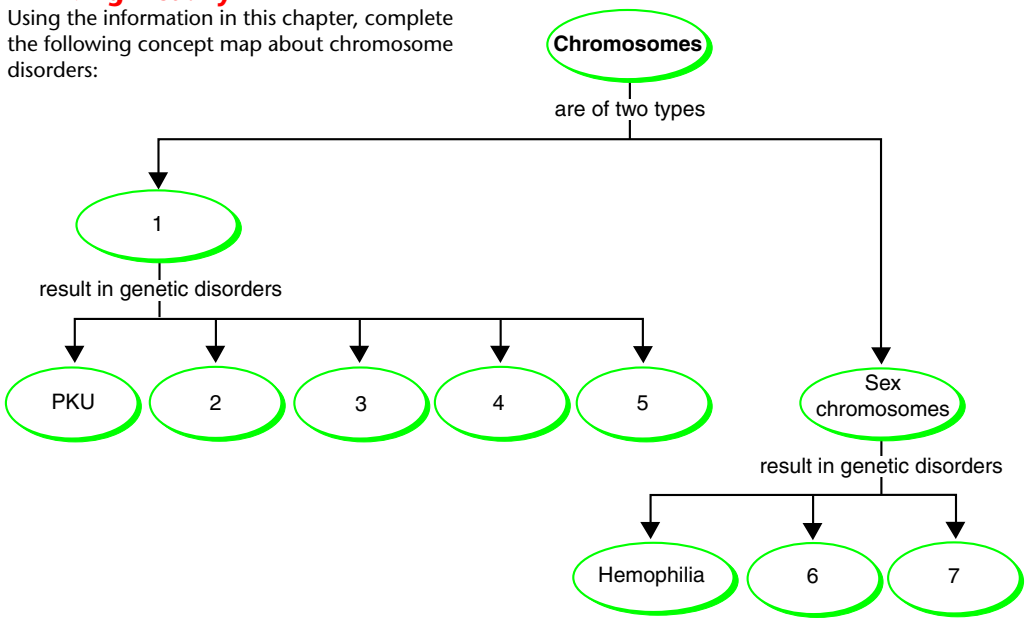
- The Human Genome Project is an ongoing effort to analyze the human DNA sequence.
- In gene therapy, an absent or faulty gene is replaced by a normal, working gene.

Vocabulary

DNA fingerprinting, p. 357

Thinking Visually

Using the information in this chapter, complete the following concept map about chromosome disorders:



CHAPTER RESOURCES

Print:

- ***Teaching Resources,*** Chapter Vocabulary Review, Graphic Organizer
- ***Chapter Tests: Levels A and B,*** Chapter 14 Test
- ***Laboratory Assessment,*** Laboratory Assessment 4

Technology:

- ***Computer Test Bank,*** Chapter 14 Test
- ***iText,*** Chapter 14 Assessment

Chapter 14 Assessment

Reviewing Content

Choose the letter that best answers the question or completes the statement.

1. A normal human diploid zygote contains
a. 23 chromosomes. **c.** 44 chromosomes.
b. 46 chromosomes. **d.** XXY chromosomes.

2. A chart that traces the inheritance of a trait in a family is called a(an)
a. pedigree. **c.** genome.
b. karyotype. **d.** autosome.

3. Traits that are caused by the interaction of many genes are said to be
a. polyploid. **c.** polygenic.
b. linked. **d.** autosomal.

4. An example of a trait that is determined by multiple alleles is
a. Huntington's disease. **c.** Down syndrome.
b. ABO blood groups. **d.** hemophilia.

5. Most sex-linked genes are found on the
a. Y chromosome. **c.** YY chromosomes.
b. O chromosome. **d.** X chromosome.

6. Hemophilia is a genetic disorder that is
a. sex-linked.
b. sex-influenced.
c. fairly common.
d. more common in women than men.

7. Which parental pair could produce females with colorblindness?
a. homozygous normal-vision mother, father with colorblindness
b. mother with colorblindness, normal-vision father
c. heterozygous normal-vision mother, normal-vision father
d. heterozygous normal-vision mother, father with colorblindness

8. A common genetic disorder characterized by bent and twisted red blood cells is
a. cystic fibrosis.
b. hemophilia.
c. sickle cell disease.
d. muscular dystrophy.

9. Which of the following techniques takes advantage of repeated DNA sequences that do not code for proteins?
a. DNA fingerprinting
b. DNA sequencing
c. genetic engineering
d. rapid sequencing

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10. The process of attempting to cure genetic disorders by placing copies of healthy genes into cells that lack them is known as
a. gene therapy.
b. DNA fingerprinting.
c. rapid sequencing.
d. the Human Genome Project.

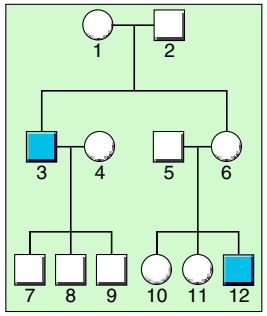
Understanding Concepts

11. Describe how a karyotype is prepared and analyzed.

12. What is the difference between autosomes and sex chromosomes?

13. How can a family pedigree be helpful in determining the probability of having a child with a genetic disorder?

14. In the pedigree below, the shaded symbols indicate people who have hemophilia. Which mothers certainly are carriers? Why did the sons of person 3 not inherit the trait?



15. Is it possible for a person with blood type alleles I^A and I^B to have blood type A? Explain your answer.

16. Explain the significance of the Rh factor in blood groups.

17. What is Tay-Sachs disease?

18. What determines whether an allele is dominant, recessive, or codominant?

19. What is a chromosomal disorder? Name one chromosomal disorder that can result from nondisjunction.

20. Describe the process of DNA fingerprinting.

21. Describe what is meant by the term *rapid sequencing.*

22. How does an open reading frame help molecular biologists search for genes?

HOMEWORK GUIDE

Section:	Questions:
Section 14–1	1–4, 11–18, 23, 24, 27
Section 14–2	5–8, 19, 25, 26, 28–30
Section 14–3	9, 10, 20–22

If your class subscribes to the iText, your students can go online to access an interactive version of the Student Edition and a self-test.

(Continued from page 362)

16. Giving a person a transfusion of blood with the wrong Rh factor could be fatal.

17. Tay-Sachs disease is an autosomal recessive genetic disease that causes nervous system breakdown and death.

18. The nature of the gene's protein product and its role in the cell; for example, if one copy of the normal allele can supply cells with enough protein to function, then the normal allele is dominant. If both alleles contribute to the phenotype, they are codominant.

19. A chromosomal disorder occurs when abnormal numbers of chromosomes find their way into the gametes. Chromosomal disorders resulting from nondisjunction include Down syndrome, Turner's syndrome, and Klinefelter's syndrome.

20. A small sample of DNA is cut with restriction enzymes. The fragments are separated by size using electrophoresis. Fragments containing highly variable regions of DNA are detected with a DNA probe.

21. It is a sequencing technique in which widely separated regions of DNA on each chromosome are first sequenced. Then, the sequence of bases on randomly generated fragments of DNA are determined. Computers then find overlapping regions between the fragments and put the fragments together by linking overlapping areas. Computers then align the fragments relative to the known markers to assemble the final sequence.

22. An open reading frame helps biologists find a gene's promoter as well as its introns.

Chapter 14 Study Guide

Critical Thinking

23. Neither parent has the disease because the Tay-Sachs allele is recessive. They have a 1 : 4 chance of having a child with Tay-Sachs disease and a 1 : 2 chance of having a healthy child who will carry the Tay-Sachs allele.

24. One hypothesis is that sickled red blood cells lack a substance *P. falciparum* needs to live. Another is that when the body destroys the sickled red blood cell, it also destroys *P. falciparum.*

25. There is a 50 percent chance that either a son or a daughter will have the disorder.

26. 0.1%; 0.2%; 1.0%; 8.0%; The incidence of Down syndrome increases with the age of the mother.

27. No, cystic fibrosis is caused by a gene mutation. Karyotypes can only detect abnormalities in chromosome number.

28. Possible genotypes of the parents of a male child with colorblindness are X^CX^c and X^CY, X^CX^c and X^cY, X^cX^c and X^CY, or X^cX^c and X^cY. Students may point out that the father's genotype does not affect his son's colorblindness, since he does not pass on an X chromosome to his son.

29. Turner's syndrome; only one X chromosome is present, and there is no Y chromosome.

30. All three disorders are caused by the nondisjunction of chromosomes during meiosis. Nondisjunction can occur when the homologous chromosomes fail to separate during anaphase I.

Writing in Science

Students should explain in their paragraphs that hemophilia is a recessive disorder linked to the X chromosome. It is more common in men because men have just one X chromosome, so the allele for hemophilia is always expressed if it is present. People with hemophilia lack a protein required for normal blood clotting and can bleed to death from minor cuts.

Chapter 14 Assessment

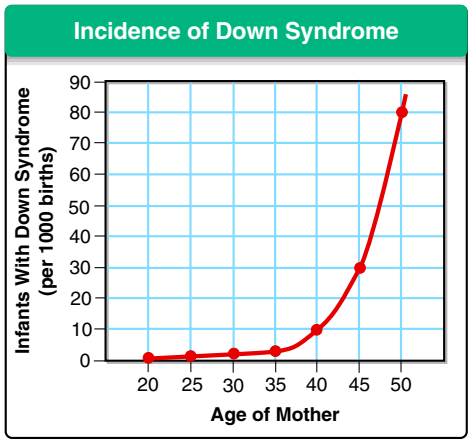
Critical Thinking

23. Predicting Two prospective parents learn that they each carry one allele for Tay-Sachs disease. Why does neither of them suffer from Tay-Sachs disease? If they decide to have children, what are the chances a pregnancy will produce a baby with Tay-Sachs disease? What are the chances that one of their healthy children will carry the Tay-Sachs allele?

24. Formulating Hypotheses *Plasmodium falciparum,* a protist, causes a fatal form of malaria. Propose a testable hypothesis to explain why *P. falciparum* can live in red blood cells that contain normal hemoglobin but not in red blood cells that contain the sickle cell allele.

25. Predicting A man with colorblindness marries a woman who is a carrier of the disorder. Determine the probability that any son will have the disorder. Determine the probability that any daughter will have the disorder.

26. Using Tables and Graphs Study the graph and answer the question below.

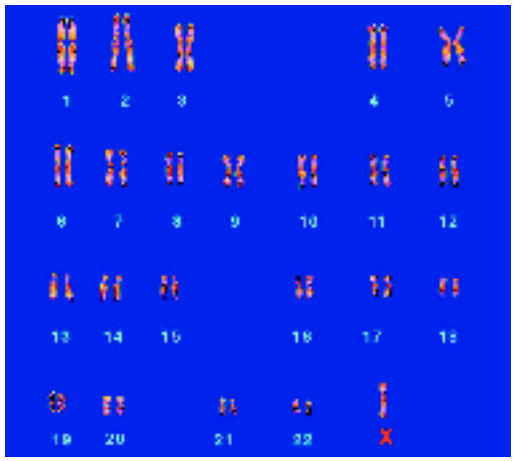


What percent of children born to women under age 30 has Down syndrome? Age 35? Age 40? Age 50? What can you infer about how the age of the mother is related to the incidence of Down syndrome?

27. Inferring Can a genetic counselor use a karyotype to identify a carrier of cystic fibrosis? Explain.

28. Predicting What are the possible genotypes of the parents of a male child with colorblindness?

29. Interpreting Graphics Analyze the human karyotype below. Identify the chromosomal disorder that it shows.



30. Connecting Concepts Explain the relationship between meiosis and Down syndrome, Turner's syndrome, and Klinefelter's syndrome. You may wish to refer to Chapter 11.

Writing in Science

Write a paragraph explaining, in your own words, how hemophilia is inherited. Your paragraph should include both a description of the disease and an explanation of why the disease is found almost exclusively in men. (*Hint:* Begin your paragraph with a topic sentence that expresses the paragraph's main idea.)

Performance-Based Assessment

Interviewing a Geneticist Your career ambition is to be a science reporter. You are sent by your school newspaper to interview a geneticist who works with human genetic disorders. Prepare a script of the questions you would like answered.

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