

012 Chapter 12

Student: _____

1. Women with X-linked disorders always pass the genes for the disorder to _____, while men with X-linked disorders always pass the genes for the disorder to _____.
 - A. only their daughters; only their daughters
 - B. both their daughters and sons; only their sons
 - C. both their daughters and sons; only their daughters
 - D. both their daughters and sons; their daughters and sons
2. Determine the sequence of genes A, B, C, and D if the distance from A-C is 17 units, A-B is 25 units, A-D is 37 units, B-C is 8 units and B-D is 12 units. The order would be as follows:
 - A. A, B, C, D
 - B. B, C, A, D
 - C. A, C, B, D
 - D. D, C, A, B
3. Which of the following human genetic disorders is NOT caused by nondisjunction?
 - A. Down's syndrome
 - B. Turner's syndrome
 - C. Klinefelter syndrome
 - D. Fragile X syndrome
4. A human male has _____ chromosomes with _____ sex chromosomes.
 - A. 46, XY
 - B. 48, XY
 - C. 46, XX
 - D. 48, XX
 - E. 48, YY

5. X-linkage was discovered for the first time in

- A. ants.
- B. mice.
- C. chickens.
- D. fruit flies.
- E. humans.

6. Which statement is NOT true about X-linked characteristics?

- A. More males than females are affected.
- B. If a female has the characteristic, all her sons will show it.
- C. Females can be carriers of the gene without showing it.
- D. The characteristic often skips a generation, from a woman's father to her son.
- E. Males can have two copies of the alleles for the trait, but females can have only one.

7. Not all sexual organisms utilize an XX and XY system to determine the sex of offspring. Some insects and birds utilize an XX and XO system where females lack one whole chromosome. In some lizards, there is no gene difference between sexes, but the development of a young lizard into a male or female is determined by the temperature at which the eggs incubate. In some shrimp, the young wait to develop until they have detected which sex is least common in the current population, and they can then join the rarest group. And in wasps and bees, the sex is determined by whether the egg is fertilized ($2n$) or not ($1n$). Why might there be so much variation in the mechanisms for producing sexual adults?

- A. It is not always necessary to produce an equal number of males and females for a population to survive.
- B. Some organisms apparently can maintain undifferentiated tissues and the potential to become either sex.
- C. A complex cascade of developmental changes can be triggered by the presence or absence of a simple gene or chromosome or by an environmental change.
- D. All of the choices are correct.

8. In chromosome mapping, one map unit represents

- A. the distance between one gene and the next on a chromosome.
- B. 1% crossing over between two sites on a chromosome.
- C. 1% of the length of the chromosome.
- D. 10% crossing over between two sites on a chromosome.
- E. 10% of the length of the chromosome.

9. "Polyploid" is based on the Greek root words for

- A. appearance and shape.
- B. hereditary and image.
- C. new and form.
- D. birth or origin, and shape.
- E. many and fold.

10. Which of these terms would be equivalent to $3n$ chromosomes?

- A. tetraploidy
- B. trisomy
- C. diploidy
- D. triploidy
- E. etrasomy

11. Which refers to turning a chromosome segment around 180° and rejoining it to the original chromosome?

- A. inversion
- B. translocation
- C. deletion
- D. duplication
- E. monosomy

12. Which refers to the loss of a complete chromosome?

- A. inversion
- B. translocation
- C. deletion
- D. duplication
- E. monosomy

13. Which refers to the movement of a piece of one chromosome to another nonhomologous chromosome?

- A. inversion
- B. translocation
- C. deletion
- D. duplication
- E. monosomy

14. Which refers to the loss of a portion of a chromosome?

- A. inversion
- B. translocation
- C. deletion
- D. duplication
- E. monosomy

15. Which refers to the addition of an extra segment of a chromosome?

- A. inversion
- B. translocation
- C. deletion
- D. duplication
- E. monosomy

16. Consider the case of a lethal recessive gene located on the nonhomologous part of the human X-chromosome; it is therefore sex-linked. Its effect is to prevent the full development of the embryo, which is therefore reabsorbed at an early stage. Beginning with a female who carries this gene in a heterozygous state, what proportion of the offspring will be female?

- A. one-half
- B. two-thirds
- C. three-fourths
- D. all, because the lethal recessive gene will express itself in the absence of any genes on the short Y-arm for the XY male embryos
- E. No offspring will be produced at all.

17. Which of the following is NOT true about a karyotype?

- A. Homologous chromosomes are paired.
- B. Sex chromosomes are identified separately from autosomes.
- C. Chromosome pairs are numbered from smallest to largest.
- D. Chromosome pairs are assorted by both size and shape.
- E. Banding patterns are used in pairing chromosomes.

18. Karyotyping can be used to diagnose which of the following genetic disorders?
- A. Down syndrome
 - B. color-blindness
 - C. muscular dystrophy
 - D. hemophilia
 - E. All of the choices.
19. Chorionic villus sampling uses what tissue to analyze the fetal cells and provide a karyotype?
- A. fetal blood tissue
 - B. cells floating in the amniotic fluid
 - C. a small biopsy from the embryo itself but it readily heals
 - D. membrane tissues from the embryo side of the placenta
 - E. membrane tissues from the mother's side of the placenta
20. When homologous chromosomes fail to separate during meiosis, this is termed
- A. cross-over.
 - B. RFLP.
 - C. linked genes.
 - D. disjunction.
 - E. nondisjunction.
21. Generally, it is not possible to determine whether nondisjunction failed to occur in oogenesis or spermatogenesis. However, it is possible to assert that _____ resulted in nondisjunction in _____.
- A. XXY; oogenesis
 - B. XYY; spermatogenesis
 - C. XXX; oogenesis
 - D. XXY; spermatogenesis
 - E. XO; oogenesis
22. In some cases of Down syndrome, there is a translocation between chromosomes
- A. 21 and 13.
 - B. 21 and 14.
 - C. 21 and 18.
 - D. 21 and 22.
 - E. X and Y.

23. Which statement is NOT true about Down syndrome?
- A. It is caused by a third copy of chromosome 21.
 - B. Greatly increased incidence occurs with fathers over age 35.
 - C. It is associated with chromosomal nondisjunction in meiosis.
 - D. Characteristics include mental retardation and extra eyelid folds.
 - E. Affected individuals have a considerably shortened life expectancy.
24. Considering that males are produced by Klinefelter (XXY) syndrome, XYY and normal XY chromosome combinations, and females are produced by Turner (XO) syndrome, triple-X (XXX) and normal XX combinations, it is obvious that
- A. maleness is caused by the presence of only one X chromosome.
 - B. femaleness is caused by the presence of two or more X chromosomes.
 - C. maleness is caused by the minimal presence of one Y chromosome.
 - D. maleness occurs in the absence of two or more X chromosomes.
 - E. sex determination is a delicate balance between X and Y chromosomes.
25. Which genetic trait is NOT associated with the chromosome involved in Down syndrome?
- A. increased incidence of leukemia
 - B. cataracts
 - C. mental retardation
 - D. Alzheimer disease
 - E. cystic fibrosis
26. Which one of these is caused by repeats of base triplets rather than a whole chromosome?
- A. Down syndrome
 - B. Edward syndrome
 - C. Klinefelter syndrome
 - D. fragile-X syndrome
 - E. Turner syndrome
27. Which sex chromosome anomaly is correctly associated with the proper genotype?
- A. Turner syndrome XYY
 - B. triplo-XXO
 - C. Klinefelter syndrome XXY

28. A male with underdeveloped testes, breast development, subnormal intelligence, and an abnormal karyotype is likely to have
- A. Turner syndrome.
 - B. Hemophilia.
 - C. Klinefelter syndrome.
 - D. Down syndrome.
29. If a woman is a carrier for the color-blind recessive allele and her husband is normal, what are their chances that a son will be color-blind?
- A. None since the father is normal.
 - B. 50% since the mother is the only carrier.
 - C. 100% because the mother has the gene.
 - D. 25% because the mother is a hybrid.
 - E. None since he will also be just a carrier.
30. Queen Victoria and some of her descendants carried an X-linked gene for
- A. male pattern baldness.
 - B. sickle-cell disease.
 - C. color blindness.
 - D. hemophilia.
 - E. Duchenne muscular dystrophy.
31. A genetic disorder (not counting disjunctions) is more likely to be common in the population if it
- A. does not manifest itself until after reproductive age has passed.
 - B. is recessive.
 - C. bestows some benefit in a heterozygous state.
 - D. is not sex-linked if recessive.
 - E. All of the choices would increase the survival of a deleterious gene.
32. In humans, X-linked diseases include all of the following EXCEPT
- A. color blindness.
 - B. hemophilia.
 - C. sickle-cell trait.
 - D. fragile X syndrome.

33. Fragile X syndrome is characterized by all of the following EXCEPT

- A. fragile X syndrome is second only to Down syndrome as a genetic cause of mental retardation.
- B. may be asymptomatic in up to 20% of males with a fragile X.
- C. differs in the usual pattern for X linked genetic conditions in that the number of base triplet repeats determines whether the individual is symptomatic or not.
- D. this is never found in females to any degree of expression.

34. All of the following are conditions associated with changes in human chromosome numbers EXCEPT

- A. Down syndrome.
- B. Turner syndrome.
- C. Klinefelter syndrome.
- D. Jacobs syndrome.
- E. Fragile X syndrome.

35. Human syndromes associated with deletion of a piece of a chromosome are

- A. Klinefelter's syndrome.
- B. Williams and Cri du Chat syndromes.
- C. Burkitts lymphoma and Alagille syndrome.
- D. All of the choices are correct.

36. Alagille Syndrome

- A. is due to a translocation between chromosomes 2 and 20.
- B. may also have a deletion on chromosome 20.
- C. presents with severe itching and abnormalities of the eyes and internal organs.
- D. All of the choices are correct.

37. The first eukaryotic genome to be completely base sequenced were those of

- A. *Saccharomyces cerevisiae* and *Caenorhabditis elegans*.
- B. *Drosophila*.
- C. *Neurospora*.
- D. the garden pea studied by Mendel.

38. What causes Down syndrome?

- A. the lack of pigment production
- B. an extra chromosome 21
- C. the presence of two different codominant alleles
- D. inability to produce normal connective tissue
- E. the environment interacting with the genotype

39. Which is associated with the inability to produce factor VIII in the blood?

- A. Williams syndrome
- B. trisomy 21
- C. color-blindness
- D. hemophilia
- E. Duchenne muscular dystrophy

40. What kind of mutation causes trisomy 21 or Down syndrome?

- A. change in the number of chromosomes
- B. change in the base sequence of DNA in a single gene
- C. change in the arrangement of alleles on a chromosome
- D. duplication of an allele with change in the base sequence of one of the copies
- E. recombination of genetic information between unpaired chromosomes

41. Individuals who display an aneuploid condition have an abnormal number of chromosomes.

True False

42. Polyploid plants are usually sterile.

True False

43. The chromosomes that are the same in both males and females are called the sex chromosomes.

True False

44. Sex chromosomes only contain genes coding for sexual characteristics.

True False

45. An example of an X-linked trait is red eye color in the fruit fly *Drosophila*.

True False

46. A small number of recombinants will occur due to crossing over between linked genes on homologous chromosomes.
- True False
47. Polyploidy is important in the production of new species of animals.
- True False
48. Trisomy occurs when a chromosome, usually an autosome, is lost during meiosis.
- True False
49. The development of the chromosomal theory of inheritance is an example of how different avenues of research can result in a major scientific discovery.
- True False
50. Non-sex determining chromosomes are called autosomes.
- True False
51. There are 23 pairs of autosomes in the human cells.
- True False
52. Karyotyping can be used to tell whether the chromosome number and structure are normal in prenatal diagnosis.
- True False
53. Nondisjunction increases rapidly with age, particularly in the development of sperm cells.
- True False
54. The cure for Down syndrome will probably soon be developed through genetic engineering.
- True False
55. Despite having extra X chromosomes, a triple-X female has only a few problems with menstrual irregularity.
- True False

56. Monosomy of the X chromosome produces Turner syndrome.

True False

57. Most cases of color blindness are seen in females.

True False

58. How are X-linked genes inherited differently from autosomal genes?

59. Explain the difference between triploidy and trisomy.

60. Explain how chromosome mapping can be used to determine the relative placement of three linked genes.

61. Scientists have been able to take separately fertilized nonidentical embryos of mice at the 64-cell stage and fuse them together as a one cell cluster. Instead of developing into two mice, this develops into one mouse (called a chimera) that has tissues originating from two separate sets of parental mice! More recently, a strange case occurred in a European hospital where a child with blood type AB was born to a mother with blood type O. Ruling out the possibility of a mix-up in parents, the medical researchers examined the mother's parents and found many genetic markers that indicated that the type O mother who gave birth to the type AB child was actually a chimera (a fusion of two embryos) where one embryo gave rise to her blood-forming tissues and the other developed her reproductive tissues. Briefly describe, with the help of a diagram if you wish, the blood type of the child, the two tissue types existent in the mother and which contributed to the child, and the necessary blood types of the grandparents. What effect, if any, does the possibility of chimeras in humans have upon the ability of geneticists to testify with absolute certainty at trials on the disputed paternity of children?
62. In honeybees, unfertilized eggs develop into male drone bees. Since the male bee is already haploid or $1N$, meiosis is modified so that half the sperm receive the full haploid component of chromosomes and half the sperm receive nothing. In this chapter, nondisjunction in humans is justly portrayed as problematic and leading to various disorders. (1) However, is nondisjunction in bee sperm production problematic? (2) Nondisjunction in humans can occur in either meiosis I or meiosis II. Does nondisjunction in male bee's sperm production have the option of occurring in either meiosis I or meiosis II?
63. Explain why the deletion or duplication of autosomal chromosomal material generally results in the death of the resultant individual in the embryonic stage.
64. Describe the cause and characteristics of Down syndrome.

65. Explain why the deletion or duplication of sex chromosomal material is not so much of a problem, and individuals are able to survive with X0, XXX, XXY, or XYY.
66. Describe the cause and characteristics of fragile-X syndrome.
67. Describe the cause and characteristics of Turner syndrome.
68. Describe the cause and characteristics of Klinefelter syndrome.
69. Scientists conducted experiments fusing embryonic cell clusters at the 64-cell stage from many purebred lines of mice in an attempt to form a chimera with 2,3,4, etc., sets of parents. No matter how many clusters were fused, they could never get more than three sets of traits to develop into the chimeric mice. The interpretation of this phenomenon is that at the normal 64-cell stage, only 3 cells continue on to develop into the mouse while 61 cells grow to become the mouse's side of the placenta (the chorionic villi, etc.). Considering the time that an embryonic and infant mouse (or human) has to develop versus the time the placenta must perform its function, explain why scientists would consider this a good interpretation for this indirect evidence.

70. Chorionic villus biopsy was first clinically developed in the People's Republic of China as a technique for early detection of genetic disorders. However, due to vast overcrowding and limited food supplies, China also enacted a "one child" policy to prevent overpopulation leading to starvation. A male child has traditionally been valued for carrying on the family name. Why did mainland China discontinue research and use of chorionic villus biopsy? What is a possible consequence (in 20 years) if China made this diagnostic procedure widespread today?

71. Discuss how a pedigree chart is used in evaluating and counseling a family with respect to genetic disorders.

012 Chapter 12 **Key**

1. C
2. C
3. D
4. A
5. D
6. E
7. D
8. B
9. E
10. D
11. A
12. E
13. B
14. C
15. D
16. B
17. C
18. A
19. D
20. E
21. B

22. B

23. B

24. C

25. E

26. D

27. C

28. C

29. B

30. D

31. E

32. C

33. D

34. E

35. B

36. D

37. A

38. B

39. D

40. A

41. TRUE

42. FALSE

43. FALSE

- 44. FALSE
- 45. TRUE
- 46. TRUE
- 47. FALSE
- 48. FALSE
- 49. TRUE
- 50. TRUE
- 51. FALSE
- 52. TRUE
- 53. FALSE
- 54. FALSE
- 55. FALSE
- 56. TRUE
- 57. FALSE
- 58. Answers will vary.
- 59. Answers will vary.
- 60. Answers will vary.
- 61. Answers will vary.
- 62. Answers will vary.
- 63. Answers will vary.
- 64. Answers will vary.
- 65. Answers will vary.

66. Answers will vary.

67. Answers will vary.

68. Answers will vary.

69. Answers will vary.

70. Answers will vary.

71. Answers will vary.