Holzman · Ling · Laube · Vontver

COMPREHENSIVE GYNECOLOGY REVIEW

SECOND EDITION

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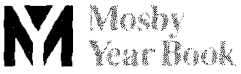
SECOND EDITION

with 114 illustrations

Mosby Year Book

St. Louis Baltimore Boston Chicago London Philadelphia Sydney Toronto



Editor: Stephanie Manning
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Production Editor: Deborah Vogel

SECOND EDITION

Printed in the United States of America

Mosby–Year Book, Inc.
11830 Westline Industrial Drive
St. Louis, Missouri 63146

Library of Congress Cataloging-in-Publication Data

Comprehensive gynecology review / Gerald B. Holzman . . . [et al.].
2nd ed.
p. cm.
Intended to complement: Comprehensive gynecology / Arthur L. Herbst . . . [et al.]. 2nd ed. 1991.
ISBN 0-8016-2279-4 : $23.95
1. Gynecology--Examinations, questions, etc. I. Holzman, Gerald B., 1933- , II. Comprehensive gynecology.
[DNLM: 1. Genital Diseases, Female. 2. Gynecology—methods. WP 140 C737 Suppl.]
RG101.C726 1991 Suppl.
818.1'0076--dc20
DNLM/DLC
for Library of Congress

92-5943
CIP

93 94 95 96 CL/CL/MY 9 8 7 6 5 4 3 2

Preface

This second edition of *Comprehensive Gynecology Review* has been written to complement the second edition of *Comprehensive Gynecology*. Its intended audience is practicing physicians, residents, and students interested in gynecology. It can be used to identify areas of weakness, to reinforce new information obtained by reading the textbook, or to reassure oneself that the subject matter is understood. The format should be familiar: it is the standard testing format used by the Educational Testing Service. *Comprehensive Gynecology Review* chapters follow the textbook chapters exactly. The questions within the chapters have been scrambled, and the answers appear in a separate section. Each answer includes a page reference in *Comprehensive Gynecology*, second edition, occasionally an additional reference, and a comment. Questions were chosen for a variety of reasons. Since the book is to help the learner, the questions are not always of the same difficulty that a final, summative, or certifying examination would accept. The purpose of these examinations is to assure an agency or school that the examinee has attained a requisite amount of knowledge. The examination must discriminate between those who know and those who do not know. Questions that everyone should be able to answer are not included. Since the *Review* is not written with a specific "level" of physician in mind, it was not possible to eliminate a question that everyone might know. Besides, one purpose of the *Review* is to reinforce knowledge. Thus, there are easy questions. Likewise, in a final, or certifying examination one must avoid the controversial; such questions are not avoided in the *Review*. In practice, one has to treat the controversial. For this reason, some readers will disagree with some of our answers, but this is a self-assessment instrument.

An attempt has been made to put the subject in a clinical perspective and to clarify. There are many illustrations that require interpretation. There is a certain amount of cueing in each chapter that would not exist in a final, or certifying examination. In organizing the book by chapters, this could **not** be avoided, as the most conceivable answer for a question in the chapter on endometriosis is likely to be endometriosis.

To simulate test conditions, an examinee should take 45 to 60 seconds to answer each question. Answer all the questions in a chapter before verifying the answers. To reinforce the material, read all the comments.

In this second edition 30% to 40% of the questions have been modified. Questions have been written on new material; there are fewer multiple answer, multiple choice questions; and those that remain conform to the Educational Testing Service format.

We wish to thank the authors of *Comprehensive Gynecology*, Arthur L. Herbst, Daniel Mishell, Jr., Morton Stenchever, and William Droegemueller, for suggesting the *Review* and inviting us to write it. Our thanks to our families for their patience and support, and our gratitude to our editor, Stephanie Manning, for her encouragement.

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Contents

PART ONE BASIC SCIENCES

CHAPTER 1

Embryology

DIRECTIONS for questions 1 - 4: Select the one best answer or completion.

1. Human chorionic gonadotrophin reaches its peak at which week of pregnancy?
   A. 3-4
   B. 9-10
   C. 20-21
   D. 28-30
   E. 38-40
2. Germ cells are derived from the
   A. Primitive coelomic epithelium
   B. Yolk sac
   C. Bone marrow
   D. Germinal epithelium
   E. Ovarian stroma
3. The first functioning organ system in the embryo is the
   A. nervous
   B. digestive
   C. cardiovascular
   D. genitourinary
   E. skeletal
4. Blood formation in the embryo first occurs in the
   A. liver
   B. spleen
   C. bone marrow
   D. lymph nodes
   E. heart

DIRECTIONS for questions 5 - 18: For each numbered item, select the one heading most closely associated with it. Each lettered heading may be used once, more than once, or not at all.

5-8. Match the stages of the first meiotic division with the appropriate description.
   (A) Chromosome pairs in contact
   (B) Condensation of chromatin as thread-like material
   (C) Development of chiasmata
   (D) Migration of chromosomes to equatorial plate
5. Leptotene
6. Zygotene
7. Pachytene
8. Diplotene

9-10. Match the postovulatory day with the appropriate event.
   (A) 3-4
   (B) 6-7
   (C) 9-11
   (D) 12-13
   (E) 15-16
9. Implantation
10. Trophoblastic venous sinuses formed

11-15. Match the male and female homologous structures.
   (A) Vagina
   (B) Labia majora
   (C) Ovarian follicles
   (D) Clitoris
   (E) Round ligament
11. Scrotum
12. Penis
13. Prostatic utricle
14. Seminiferous tubules
15. Gubernaculum testis

16-18. Match the congenital abnormality with the embryonic developmental failure.
   (A) Sinovaginal bulb fails to canalize
   (B) Paramesonephric duct does not develop
   (C) Paramesonephric duct does not fuse
   (D) Failure of rupture of anal membrane
16. Absence of uterus
17. Uterus didelphys
18. Transverse vaginal septum

DIRECTIONS for questions 19 - 26: For each of the questions below, ONE or MORE of the responses is correct. Select the best answer based on the following
A if 1, 2, and 3 are correct
B if only 1 and 2 are correct
C if only 2 and 3 are correct

D if only 1 is correct
E if only 3 is correct

19. Arrest of oocyte meiosis occurs at the
    1. metaphase of the first meiotic division
    2. prophase of the first meiotic division
    3. metaphase of the second meiotic division
20. Which of the following events occur during or concurrent with meiosis?
    1. pairing of homologous chromosomes
    2. ovulation
    3. fertilization
21. True statements regarding fertilization include:
    1. capacitation occurs in the sperm as they are transported up the female genital tract
    2. fertilization usually occurs in the ampulla of the fallopian tube
    3. a significant proportion of fertilized ova do not complete cleavage
22. Effects of a teratogen depend on
    1. duration of exposure of teratogen
    2. stage of embryonic development
    3. dose of teratogen
23. True statements concerning development of the excretory system include: The
    1. pronephros and its ducts serve as the first fetal kidney
    2. mesonephros produces urine for several weeks
    3. metanephros begins as a pelvic organ
24. True statements concerning the development of the genital duct system include:
    1. leydig cells of the fetal testes produce testosterone while Sertoli cells produce MIF (mullerian inhibiting factor)
    2. the paramesonephric duct develops if no gonads are present
    3. structures developing from both mesonephric and paramesonephric ducts occur in some adult females
25. True statements about sex differentiation include:
    1. if testes are to develop, H-Y antigen must be activated.
    2. the ovary differentiates at approximately the 11th week.
    3. a Y chromosome is required for the development of the testes.
26. It is currently believed the suppression of meiosis in the dictyate stage is due to a substance produced in the
    1. granulosa
    2. theca
    3. rete cords

ANSWERS

1. **B,** Page 9. Human chorionic gonadotrophin doubles every 1.2 to 2 days in early pregnancy with its peak being reached at 7 to 9 weeks of pregnancy.
2. **B,** Page 4. Germ cells are derived from the endoderm in the wall of the yolk sac, and migrate to the germinal ridge which later forms the gonads. The "germinal" epithelium is derived from the primitive coelomic epithelium and invests the ovary but does not produce germ cells.
3. **C,** Page 9. Blood vessel formation (angiogenesis) is seen in the extraembryonic mesoderm by day 15 or 16. By the 21st day, the primitive heart is connected with blood vessels of the embryo to become the first functioning organ system.
4. **A,** Page 9. In the embryo, blood formation does not begin until the second month of gestation, occurring first in the developing liver. Blood vessel formation begins in the extraembryonic mesoderm of the yolk sac by day 15 or 16. Embryonic vessels are seen approximately 2 days later.

5-8. 5, **B;** 6, **D;** 7, **A;** 8, **C;** Page 4. In the earliest stage, the leptotene stage, chromatin material condenses into threadlike structures. During zygotene, migration to the equatorial plate occurs and homologous chromosomes pair up to form bivalents. At the end of this phase, tight pairing of the chromosomes along their entire length, synapsis, takes place. During the subsequent pachytene stage, each chromosome splits into two chromatids united at the centromere. The bivalent is thus transformed into tetrads. There are 23 tetrads in the human ovum. During diplotene, the chromosomes of the bivalents are held together at points called chiasmata, where crossing over of genetic material occurs between chromatids of homologous chromosomes.

9-10. 9, **B;** 10, **C;** Pages 6-7. Subsequent to the first mitotic division, the cells continue to divide as the embryo passes along the fallopian tube and into the uterus. This takes 3 to 4 days after fertilization, and the embryo enters the uterus in any form, from 32 cells to the early blastula stage. Implantation typically occurs 3 days after the embryo enters the uterus. Invading syncytiotrophoblast comes in intimate contact with endometrial capillaries to form venous sinuses at 7 1/2 to 9 days after con-

TABLE 1-1. Events of Implantation

Event	Days After Ovulation
Zona pellucida disappears	4-5
Blastocyst attaches to epithelial surface of endometrium	6
Trophoblast erodes into endometrial stroma	7
Trophoblast differentiates into cytotrophoblastic and syncytial trophoblastic layers	7-8
Lacunae appear around trophoblast	8-9
Blastocyst burrows beneath endometrial surface	9-10
Lacunar network forms	10-11
Trophoblast invades endometrial sinusoids, establishing a uteroplacental circulation	11-12
Endometrial epithelium completely covers blastocyst	12-13
Strong decidual reaction occurs in stroma	13-14

ception which would be 9-11 days after ovulation.

11-15. 11, **B;** 12, **D;** 13, **A;** 14, **C;** 15, **E;** Table 1-2, Page 14. There are homologous male and female derivatives for each embryonic structure. Paired structures include scrotum/labia majora, penis/clitoris, prostatic utricle/vagina, seminiferous tubules/ovarian follicles, and gubernaculum testis/round ligaments.

16-18. 6, **B;** 17, **C;** 18, **A;** Page 13. Abnormalities in specific developmental processes can result in discrete congenital abnormalities. If the paramesonephric duct does not develop, absence of the uterus occurs. Uterus didelphys is a result of lack of fusion of the paramesonephric duct. A transverse vaginal septum results from failure of the sinovaginal bulb to canalize.

19. **C** (2, 3); Page 4. At approximately 5 months gestation, oocytes of the fetus enter the process of meiosis and progress to the prophase of the first meiotic division before entering the first arrest, which lasts for several years. After puberty maturation of selected follicles continues to the second meiotic metaphase, when the second arrest occurs. This arrest lasts until the oocyte is activated by fertilization.

20. **A** (All); Page 4. One of the first events in meiosis is the tight pairing of homologous chromosomes. This is followed by the formation of a tetrad, as each chromosome of the pair splits longitudinally forming 2 chromatids. Meiosis is arrested at this point until after puberty. In each cycle a few follicles ripen and in those follicles the oocyte resumes meiosis. Ovulation begins during the 2nd meiotic division, and the final steps of the 2nd meiotic division are completed after fertilization.

21. **A** (All); Page 6. As the spermatozoa are transported through the cervical mucus, uterus, and fallopian tubes, they undergo capacitation and acrosome reaction, thus activating enzyme systems to make it possible for the sperm to penetrate the barrier of the zona pellucida. Once the sperm enters the cytoplasm of the egg, the sperm head swells and gives rise to the male pronucleus. The egg casts off the second polar body and the female pronucleus is formed. The pronuclei contain the haploid sets of chromosomes of maternal and paternal origin. Although the two do not fuse, the nuclear membranes surrounding them disappear, and this establishes the diploid complement of chromosomes. Cleavage gives rise to the two-cell embryo while still in the fallopian tube. Due to failure of chromosome arrangement on the spindle, gene defects, and environmental factors, a significant number of fertilized ova do not complete cleavage.

22. **A** (All); Page 10. All organ systems are usually formed from the fourth to the seventh week of gestation. A teratogenic event occurring during this time will result in a malformation related to the organ systems developing at the time of insult. In addition, the effects of a teratogen depend on dose and duration of exposure to the teratogen, as well as the genetic makeup of the individual. Therefore, cardiovascular abnormalities are expected if ateratogen is to take effect early in the embryonic period. Teratogens may be chemical substances, their by-products, or physical conditions such as temperature elevation and irradiation. After the 49th day teratogens usually will not cause specific malformations. They may kill the embryo or injure cells leading to cellular malfunction or growth retardation.

23. **C** (2, 3), Pages 10-11. Three sets of excretory ducts and tubules develop bilaterally in the fetus. First, the pronephros forms at about the fourth week after conception.

The associated tubules probably have no excretory function. Late in the fourth week, the mesonephric tubules develop. The mesonephros functions as a fetal kidney, producing urine for 2 or 3 weeks. The permanent kidney, the metanephros, originally a pelvic organ, begins development in the fifth week and by differential growth it ultimately relocates in the lumbar region. The fetus produces urine throughout gestation, but the placenta handles the excretory functions of the fetus.

24. **A** (All), Pages 11, 13. The mesonephric duct development precedes the paramesonephric duct development with the latter set developing on each side from evaginations of the coelomic epithelium. The mesonephric duct differentiates into the vas deferens, epididymis, and seminal vesicles. Leydig cells produce testosterone and the Sertoli cells of the testes produce mullerian inhibiting factor. In the presence of ovaries or if no gonads are present at all, the mesonephric ducts regress and the paramesonephric ducts develop. Structures developing from both mesonephric (Gartner's duct and paraovarian cysts) and paramesonephric (tubes and uterus) duct systems occur in some adult females.
25. **A** (All), Pages 17, 19. In general a Y chromosome is required for the development of the testes. Genes on the Y chromosome are either responsible for the development of the H-Y antigen or for activator genes that will induce production of the H-Y antigen. In some rare instances, the H-Y antigen may express itself in the absence of the Y chromosome. In such cases, the gene for H-Y antigen expression is expected to be found on another chromosome, probably the X chromosome. Another theory proposes an interaction of 2 genes, a testes determining gene on the Y chromosome and an ovary determining gene on the X or an autosome. Their presence and timing of their expression initiatesthe formation of the gonad. In order for testes to be formed, however, the H-Y antigen must be activated. For normal male development, the testes must differentiate and function normally. The ovary, which develops at the 11th or 12th week, requires two functional X chromosomes. In cases where one X chromosome is missing, ovaries almost invariably lack oocytes. Conversely, germ cells in testes develop best when only one X chromosome is present.
26. **D** (1 only), Pages 4, 6. Meiosis is stimulated by a meiotic inducing substance produced in the rete cords. As the ovary develops the granulosa cells surround the ova and separate them from the rete. The granulosa produces an inhibiting substance. Loss of contact with the rete and the granulosa produced inhibiting substance act to suppress meiosis in the dictyate stage. Meiosis will resume after puberty when each set of follicles begins to grow. The theca is not known to participate.

CHAPTER
2 Genetics

DIRECTIONS for questions 1 - 14: Select the one best answer or completion.

1. The pedigree in Figure 2-1 suggests the inheritance of a trait that is
   A. autosomal dominant
   B. autosomal recessive
   C. X-linked recessive
   D. X-linked dominant
   E. male-limited autosomal dominant
2. Assume the trait is fully penetrant. The pedigree in Figure 2-2 is most consistent with a gene that is a(n)
   A. autosomal dominant
   B. autosomal recessive
   C. X-linked recessive
   D. X-linked dominant
   E. male-limited autosomal dominant
3. A couple who had a barren marriage for 10 years now have had two spontaneous abortions at 6 and 8 weeks. A karyotype was done on both the husband and wife. He is 46 XY, and her karyotype is reproduced in Figure 2-3. She is 30 and he is 32. Which of the following statements are correct and should be mentioned during counseling?
   A. patients with her karyotype do not carry to term
   B. patients with her karyotype do not give birth to a chromosomally normal neonate
   C. they might have a chromosomally abnormal neonate, but it would be identical to that of its mother
   D. there is an increased risk of having a child with a trisomy
   E. there is no chromosomal explanation for their poor reproductive history
4. A couple who has had recurrent abortions had a karyotype done on the last abortus. The karyotype was 47 XX, +16. Given this information, you would tell the couple

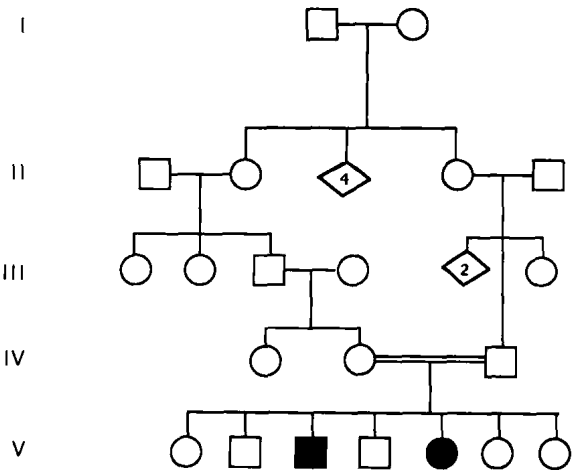

FIGURE 2-2.

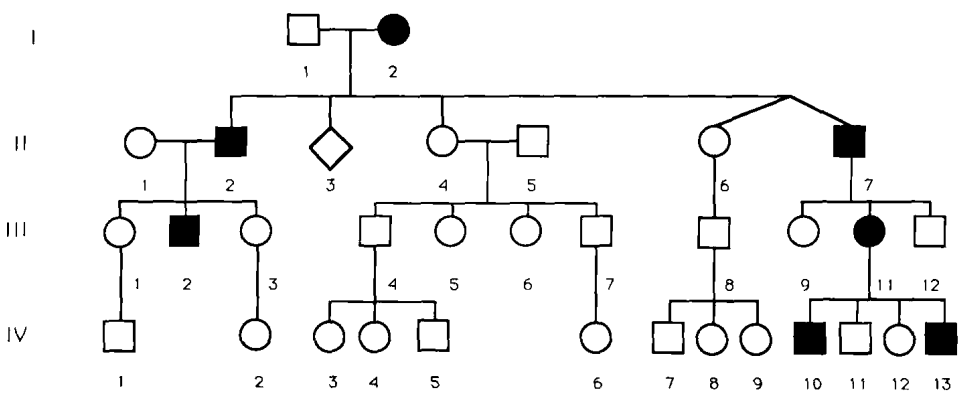

FIGURE 2-1.

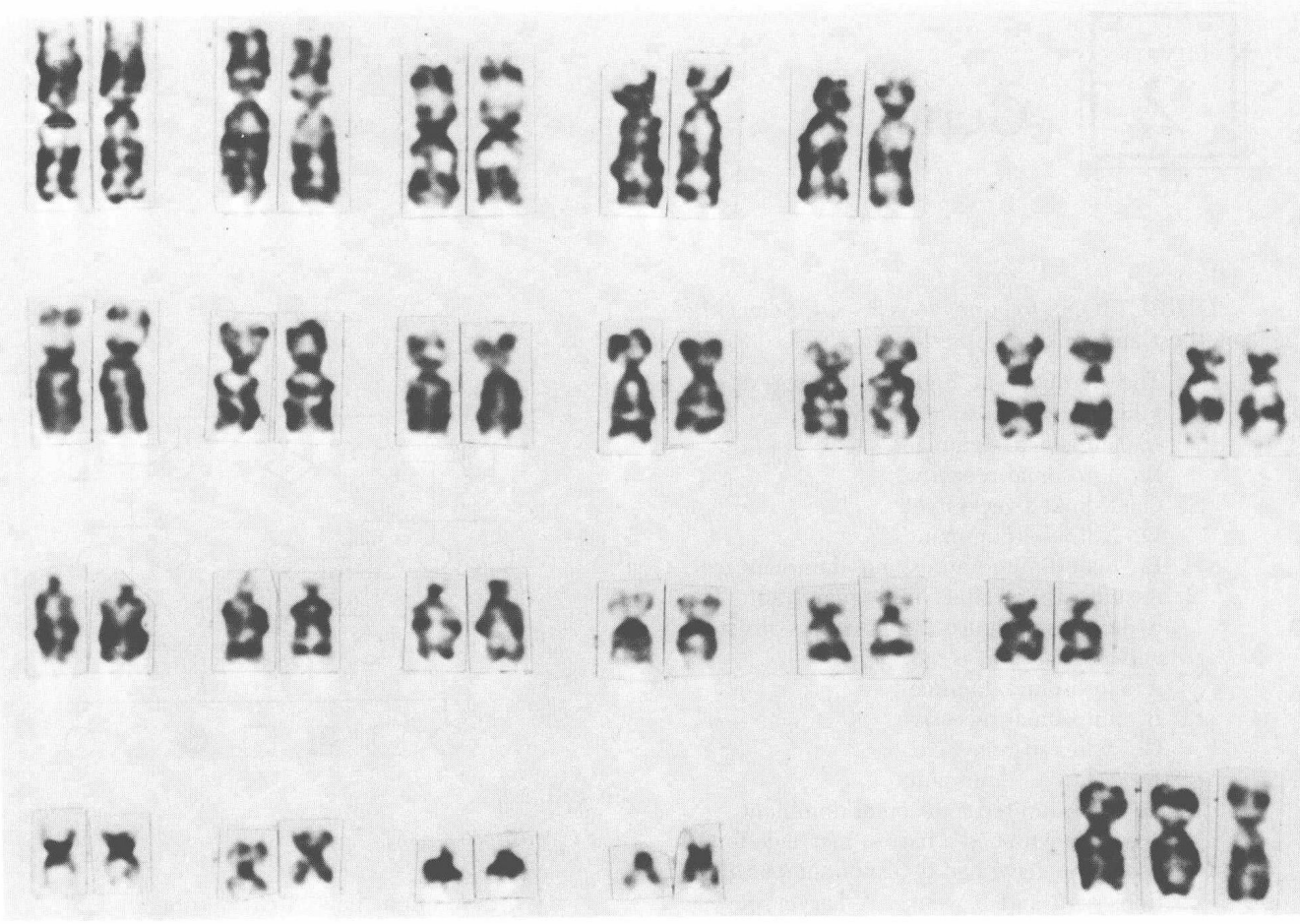

FIGURE 2-3.

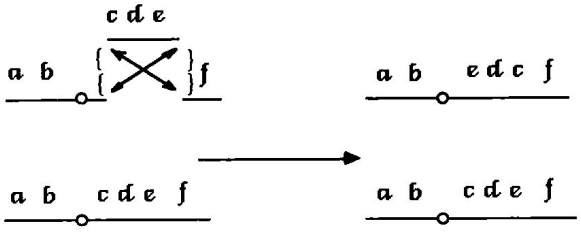

FIGURE 2-4.

that the chance of delivering a live-born infant with a trisomy is approximately
A. 0.1%
B. 1%
C. 5%
D. 10%
E. 25%

5. Figure 2-4 represents a(n)
A. Robertsonian fusion (translocation)
B. isochromosome
C. reciprocal translocation
D. pericentric inversion
E. paracentric inversion

6. A prenatal patient has had her karyotype reported as containing a Robertsonian fusion involving chromosome 21.

Theoretically, the likelihood of her having a live-born with a trisomy is
A. none
B. 25%
C. 33%
D. 50%
E. 100%

7. The actual risk of giving birth to a trisomic infant in the situation mentioned in question 6 is
A. 1%
B. 5%
C. 10%
D. 25%
E. 33%

8. The spontaneous abortion figure quoted in most textbooks is 10% to 20%. If this number includes all embryos that do not result in live-born infants, the number
A. is correct
B. should be 20%-30%
C. should be 31%-40%

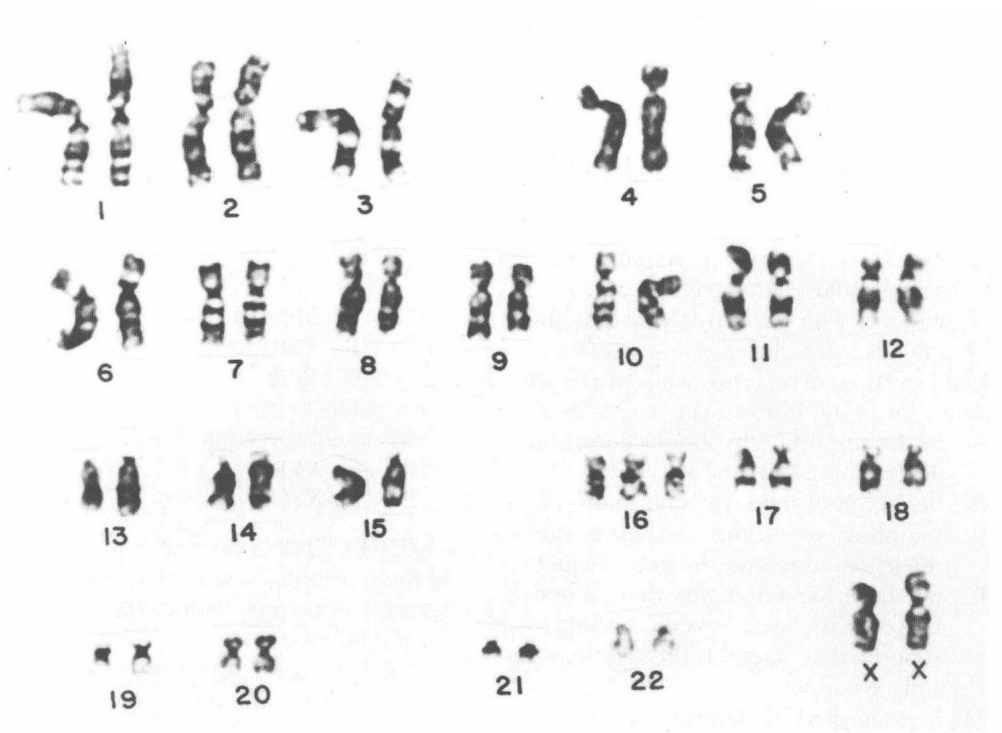

FIGURE 2-5.

D. should be 41%-50%
E. should be greater than 50%

9. A sonogram is obtained because the uterine fundus of a patient thought to be 24 weeks pregnant measures 21 cm. In addition to what appears to be cerebral ventriculomegaly, there is oligohydramnios, and a hydropic appearing placenta. This sonogram should suggest that the karyotype of the fetus is
   A. 45, X
   B. 47, XX, 21
   C. 47, XYY
   D. 45, X /46,XY
   E. 69, XXX
10. A couple, both of whom have neurofibromatosis, seek genetic counseling. You should tell this couple that
   A. 100% of the offsprings will either have the disease or be a carrier
   B. 75% of the offsprings will have the disease
   C. 50% of the offsprings will be homozygous for the gene
   D. 25% of the males will have the more severe form of the disease
   E. the abnormal gene is found on the Y chromosome
11. An Israeli couple seeks information about Tay-Sachs disease. A comment that you might make includes:
   A. it is an X-linked autosomal recessive condition
   B. it is most common in Jews of African descent
   C. a carrier can be detected by determining the concentration of serum hexosaminidase A
   D. death usually occurs in the fourth decade
   E. the best time to determine carrier state is during pregnancy
12. A true statement about the karyotype depicted in Figure 2-5 includes:
   A. it is associated with severe mental retardation
   B. it is usually but not always lethal
   C. it is the most common karyotype associated with a stillborn
   D. it is noted in about one third of trisomic abortus material
   E. affected individuals have a 50% chance of having a congenital heart defect
13. A 23 year-old gravida 3 para 0-0-3-0 is married to a 27 year-old gentleman who has never fathered a pregnancy that went to term. This couple seeks your advice. Before you recommend that each have a karyotype, you would explain that
   A. if either of them has a 21-21 translocation, it is incompatible with a normal gestation

B. recurrent abortions occur in one out of every 500 couples attempting pregnancy
C. each has an equal chance of having an abnormal karyotype
D. the percentage of men with chromosomal abnormalities in this group is 5%
E. the most frequent parental chromosomal abnormality seen in a group of patients who have had recurrent abortions is a sex chromosome trisomy

14. Identification of a fetus who carries the genes for cystic fibrosis can
A. be accomplished by amniocentesis and determining the fetal karyotype
B. be accomplished by chorionic villus sampling and using restriction endonucleases to isolate the gene sequence
C. not be achieved at this time although there have been several preliminary reports that suggest this is theoretically possible
D. be identified by determining the NaCl content of the amniotic fluid between 16 and 20 weeks of gestation
E. be accomplished by performing a Southern Blot directly on material obtained from a chorionic villus biopsy

DIRECTIONS for questions 15 - 21: For each numbered item, select the one heading most closely associated with it. Each lettered heading may be used once, more than once, or not at all.

Questions 15-16.
(A) nondisjunctional event identified in abortus material
(B) nondisjunctional event not identified in living or abortus material
(C) Patau syndrome
(D) Edwards syndrome
(E) Down syndrome

15. Trisomy 13
16. Trisomy 17

17-18. **Partial Deletions of Chromosome**
(A) 4
(B) 5
(C) 18
(D) Short arm X
(E) Long arm X

17. Wolf syndrome
18. Cri-du-chat syndrome

19-21. Match the specific chromosomal abnormality with its frequency of occurrence in chromosomally abnormal abortus material.
(A) 50%
(B) 20%
(C) 15%
(D) 5%
(E) 1%

19. Turner's syndrome
20. Triploidy
21. Trisomy

DIRECTIONS For each numbered item 22 - 24, indicate whether it is associated with
A only (A)
B only (B)
C both (A) and (B)
D neither (A) nor (B)

(A) Meiosis
(B) Mitosis
(C) Both
(D) Neither

22. nondisjunction
23. 47, XYY
24. 46, XY/45, X

DIRECTIONS for questions 25 - 31: For each of the questions below, ONE or MORE of the responses is correct. Select the best answer based on the following
A if 1, 2, and 3 are correct
B if only 1 and 2 are correct
C if only 2 and 3 are correct
D if only 1 is correct
E if only 3 is correct

25. A 35-year-old primigravida had an amniocentesis 3 weeks ago. The karyotype is reproduced in Figure 2-6. A description of the phenotype should state that the
1. sex is male
2. adult is usually tall
3. adult is severely mentally handicapped

26. A family is suspected of carrying an X-linked recessive abnormality. One female member exhibits the trait. If this were an X-linked recessive, the possible explanations are that this is
1. a function of the Lyon hypothesis
2. a female who is homozygous
3. an example of complete penetrance

27. An 18-year-old paraplegic seeks genetic counseling during the 21st week of her pregnancy. She is the only member of her family who has this condition, which is due to a meningomyelocele repaired at birth. There is no history of a neural tube defect (NTD) on the husband's side of the family. You should advise this patient
1. to take folate
2. there is a 2% risk of recurrence
3. to have an amniocentesis for determination of amniotic fluid alpha-fetoprotein

28. A woman who has had three spontaneous abortions is found to have the karyotype

FIGURE 2-6.

shown in Figure 2-7. Rational options available to this couple include:
1. amniocentesis and selective abortion
2. ovum donation and embryo transplant
3. donor insemination

29. A chromosome break may result in
1. a point mutation
2. partial deletion
3. a balanced translocation

30. When triploidy is associated with a partial mole, the
1. likelihood of the subsequent development of a choriocarcinoma is increased over that seen after delivery of a complete mole
2. fetal chromosomes are of paternal origin
3. follow up should include monitoring of the β-Hcg

31. An oncogene may
1. be the result of a point mutation
2. alter normal cell-cell interactions controlling growth
3. alter the cell's skeleton

ANSWERS

1. **A,** Pages 27, 40. Usually, if 50% of the protein produced by the gene pair is enough to give the usual phenotype, the condition is dominant. In this case, no generation is spared, the condition is equally represented between males and females, and all affected individuals have at least one affected parent. Male-to-male transmission rules out X-linked dominant inheritance.
2. **B,** Pages 28, 40. Since there is full penetrance, an autosomal dominant is unlikely. Both sexes are affected, making X-linked inheritance extremely unlikely. The parents are consanguineous and must be presumed carriers. Two of seven children are affected. With an autosomal recessive trait, one would expect 25% of the children to be affected on the basis of segregation.
3. **D,** Page 32. The karyotype is 47, XXX. Fifty percent of these women are fertile. While most of the offspring produced are

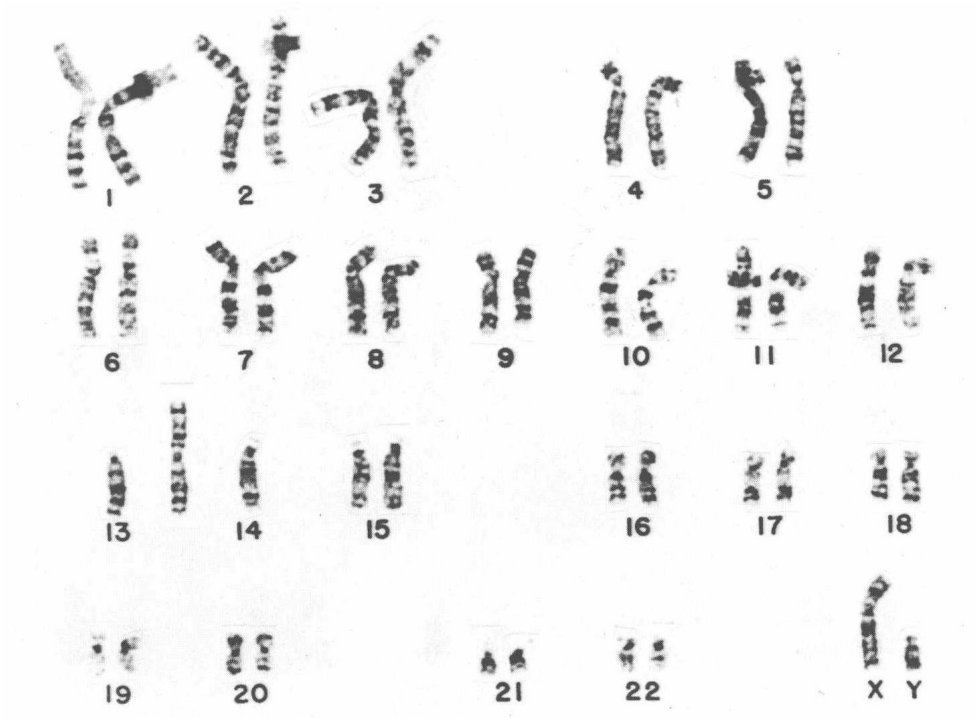

FIGURE 2-7.

normal, there is a slight increase of an offspring being produced with nondisjunctional events involving both the sex chromosomes and the autosomes.

4. **B,** Page 35. Of those abortuses with chromosome abnormalities, roughly 50% have autosomal trisomy. A trisomy of chromosome 16 has been noted in about one third of the cases, but since this has never been seen in living individuals, it must be considered universally lethal. In women who have produced a conception which is trisomic, the risk of a subsequent trisomic event is 1-2% being somewhat less for women under 35 and higher for women over 35.
5. **E,** Pages 23, 33, 34. In Robertsonian translocation (central fusion), two acrocentric chromosomes, such as 14 and 21, are involved. An isochromosome is the result of a transverse split rather than a longitudinal split of a metacentric chromosome during meiosis. The daughter chromosome has either two long or two short arms. With a reciprocal translocation, chromatin material is exchanged, but the chromosomal number does not change. When a chromosome breaks and turns on its axis, as is the case in this question, there is an inversion. In this example, the centromere was not involved, so the inversion is called paracentric. When the centromere is included, it is a pericentric inversion.
6. **C,** Pages 30, 33, 41. One would expect that 25% would be normal, 25% carriers, 25% unbalanced and affected, and 25% monosomic. If this involved the 21 chromosome, one would be dealing with Down syndrome. Since monosomy is lethal, the theoretical live-born risk is 33% normal, 33% carriers, and 33% Down syndrome.
7. **C,** Pages 30, 33, 41. The numbers in the above question, #6, do not turn out to be the case—the observed live-born risk of Down syndrome is 10%-15% if the mother has the translocation, and 1%-2% if the father is the carrier.
8. **E,** Pages 35, 41. It has been estimated that about 15% of ova penetrated by sperm fail to divide. Another 15% fail to implant, and 25% to 30% are aborted spontaneously at previllous stages. Of the roughly 40% of fertilized ova that survive the first missed menstrual period, as many as 25% are aborted spontaneously, so that only about 30% to 35% of all ova penetrated by sperm actually result in live-born infants. This information is being re-

fined as we gain more information with in vitro fertilization.

9. **E,** Pages 35-36, 38. Given these findings, one should predict that the karyotype is a polyploidy such as triploidy. The latter is associated with a partial hydatidiform mole. This patient should be followed as if she had a complete hydatidiform mole.
10. **B,** Pages 27-28. Each parent carries this autosomal dominant gene. It is highly unlikely that either is homozygous for the gene. The gene is not on the X or Y chromosome, but is on chromosome 17. The sex ratio for heterozygotes, therefore, is one male to one female. The gametes will be as pictured in Figure 2-8. Twenty-five percent will be normal (nn), 75% will be abnormal (NN or nN), 50% will have neurofibromatosis (nN), and 25% will be homozygous for this dominant gene and will have the lethal form (NN).
11. **C,** Page 28. Tay-Sachs disease is an autosomal recessive condition that is found most often in Jews of Eastern European origin. The carrier state can be detected by measuring serum hexosaminidase A. Death usually occurs by age 3 or 4. Although the carrier state can be determined during pregnancy, it is faster and cheaper to analyze blood for hexosaminidase A when the serum estrogens are at non pregnant levels.
12. **D,** Page 35. Figure 2-5 depicted a 47, XX +16 karyotype. A trisomy of chromosome 16 has been noted in about one third of trisomic abortus material. Since this has never been seen in living individuals, it must be considered universally lethal.
13. **A,** Pages 38, 40. The diagnosis of a chromosome abnormality in couples with chronic pregnancy wastage is important to rule out an abnormality incompatible with normal gestation, such as homologous translocations between identical members of the same group of chromosomes like 21-

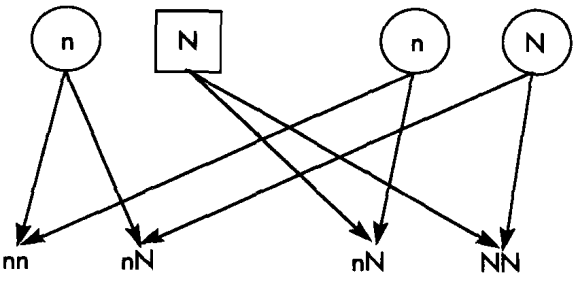

FIGURE 2-8.

21. Roughly one in every 200 couples suffers from multiple abortions. Simpson discovered that the prevalence of chromosome abnormalities in women with chronic spontaneous abortion problems was about twice that of males (4.8% vs. 2.4%). It is important when counseling a couple to try to prevent either one from placing the blame on themselves or their partner. Although occasional sex chromosome abnormalities such as 47, XXX and 47, XYY, as well as a variety of mosaic representations, are seen among such couples, the majority demonstrate either balanced reciprocal translocations or Robertsonian fusion.
14. **B,** Pages 25, 27. Cystic fibrosis is the result of an abnormal gene, not a chromosomal abnormality. Identification of an affected individual or carrier may be accomplished by specifically identifying the mutant gene. The key to the localization of genetic information on the DNA molecule has been the discovery of a group of over 200 bacterial enzymes, restriction endonucleases, that recognize and cut specific nucleotide sequences in the double stranded DNA molecule. In the cases of cystic fibrosis, this has been achieved so that this determination should be offered to patients who are carriers. Although the "sweat test" was one of the first tests used to make the diagnosis in children, it could not be applied to amniotic fluid. There is usually not enough DNA from a chorionic villus biopsy to determine a nucleotide sequence by Southern Blot. Therefore, one has to use a cell culture or amplification of the DNA molecule (Polymerase chain reaction).

15-16. 15, **C;** 16, **B;** Pages 30, 41. Trisomy 13 and trisomy 15 are usually considered together. Trisomy 13 is known as Patau syndrome and is incompatible with extended life. Trisomy 18 is Edwards syndrome, also incompatible with extended life, while trisomy 21 is the more common and familiar Down syndrome. Nondisjunctional events resulting in a trisomy have been described in every autosome except 1 and 17.

17-18. 17, **A;** 18, **B;** Page 34. Wolf syndrome is due to the loss of a portion of the short arm of chromosome 4, and Cri-du-chat syndrome to the loss of the short arm of chromosome 5.

19-21. 19, **B;** 20, **C;** 21, **A;** Pages 34, 35, 41. Half of the abortuses with chromosomal abnor-