PreTest®
Self-Assessment
and Review

Third Edition

Anatomy

Ernest W. April

- 500 board-type multiple-choice questions
- Comprehensive explanations
- Thorough, up-to-date references and bibliography

Anatomy:
PreTest® Self-Assessment and Review

Third Edition

Edited by
Ernest W. April, Ph.D.
Associate Professor of Anatomy and Cell Biology
College of Physicians & Surgeons
of Columbia University
New York, New York

McGraw-Hill Book Company
Health Professions Division
PreTest Series

New York St. Louis San Francisco
Auckland Bogotá Guatemala Hamburg
Johannesburg Lisbon London Madrid
Mexico Montreal New Delhi Panama
Paris Saõ Paulo Singapore Sydney
Tokyo Toronto

Library of Congress Cataloging in Publication Data
Main entry under title:

Anatomy : PreTest self-assessment and review.

Bibliography: p.
1. Anatomy, Human—Examinations, questions, etc.
2. Anatomy—Examinations, questions, etc. I. April,
Ernest W. [DNLM: 1. Anatomy—Examination questions.
QS 18 A537]
QM32.A65 1983 611'.0076 83-730

ISBN 0-07-051931-5

Editors: *John H. Gilchrist, Ernest Kohlmetz*
Project Editor: *Mary E. Baker*
Editorial Assistant: *Donna Altieri*
Production: *Rosemary J. Pascale, Judith M. Raccio*
Design: *Robert Tutsky, Mary Jane Zuk*
Printer: *Hull Printing Company*

1 2 3 4 5 6 7 8 9 HUHU 8 7 6 5 4 3

Anatomy

Introduction

Anatomy: PreTest® Self-Assessment and Review provides medical students, as well as physicians, with a comprehensive and convenient instrument for self-assessment and review within the field of anatomy. The 500 questions parallel the format and degree of difficulty of the questions contained in Part I of the National Board of Medical Examiners examinations, the Federation Licensing Examination (FLEX), the Visa Qualifying Examination, and the ECFMG examination.

Each question in the book is accompanied by an answer, an explanation, and specific page references to current textbooks. A bibliography, listing all the sources used, follows the last chapter.

Perhaps the most effective way to use this book is to allow yourself one minute to answer each question in a given chapter; as you proceed, indicate your answer beside each question. By following this suggestion, you will be approximating the time limits imposed by the board examinations previously mentioned.

When you finish answering the questions in a chapter, you should then spend as much time as you need verifying your answers and carefully reading the explanations. Although you should pay special attention to the explanations for the questions you answered incorrectly, you should read **every** explanation. The author of this book has designed the explanations to reinforce and supplement the information tested by the questions. If, after reading the explanations for a given chapter, you feel you need still more information about the material covered, you should consult and study the references indicated.

This book meets the criteria established by the AMA's Department of Continuing Medical Education for up to 22 hours of credit in category 5D for the Physician's Recognition Award. It should provide an experience that is instructive as well as evaluative; we also hope that you enjoy it. We would be very happy to receive your comments.

Contents

Embryology

DIRECTIONS: Each question below contains five suggested answers. Choose the **one best** response to each question.

1. Reduction of the chromosome number from diploid to haploid occurs during

(A) mitotic divisions
(B) the first maturation (meiotic) division of the primary germ cell
(C) the second maturation (meiotic) division of the secondary germ cell
(D) the second maturation (meiotic) division of the first polar body
(E) fertilization

2. Oogonia reach their maximum number at which of the following stages of human development?

(A) Five months of fetal life
(B) Birth
(C) Puberty (12 to 14 years of age)
(D) Adolescence (16 to 20 years of age)
(E) Early adulthood (21 to 26 years of age)

3. At the time of ovulation in the human female, all the following are true EXCEPT that

(A) the first meiotic division has just occurred
(B) expulsion of the first polar body has just occurred
(C) the secondary oocyte is arrested in the second maturation division
(D) the zona pellucida has broken down
(E) fertilization is possible

4. A 26-year-old man contracted viral influenza with an unremitting fever of 39.5°C (103°F) for 3 days. Since spermatogenesis cannot occur above a scrotal temperature of 35.5°C (96°F), he was left with no viable sperm on his recovery. The time required for spermatogenesis, spermiogenesis, and passage of viable sperm to the epididymis is approximately

(A) 3 days
(B) 1 week
(C) 5 weeks
(D) 2 months
(E) 4 months

5. By the eighth day of development, the blastocyst is incompletely embedded in the endometrium. At the embryonic pole, the trophoblast forms a disk composed of two cell layers. The layer of trophoblast containing actively dividing cells is which of the following?

(A) Cytotrophoblast
(B) Syncytiotrophoblast
(C) Embryoblast
(D) Amnioblast
(E) Endodermal layer

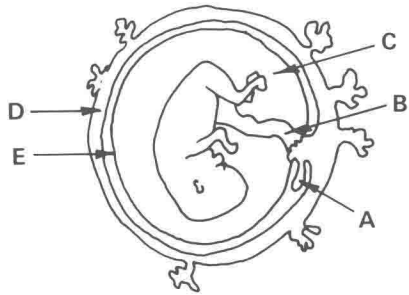
6. In the developing human embryo, most of the internal organs begin to form in the

(A) first month
(B) second month
(C) fourth month
(D) sixth month
(E) ninth month

7. Derivatives of the mesodermal cell layer of the embryo include all the following structures EXCEPT the

(A) peritoneal serosa
(B) tonsillar parenchyma
(C) gonads
(D) spleen
(E) adrenal cortex

8. In the diagram below of a human fetus in its second month of development, all the structures have been correctly labeled EXCEPT the



(A) yolk sac
(B) umbilical cord
(C) extraembryonic coelom
(D) chorion
(E) amnion

9. The chambers of the heart form by differential growth of the endocardial tube and fusion with existing vessels. The crista terminalis represents the line of fusion between the

(A) septum primum and septum secundum
(B) bulbus cordis and primitive right ventricle
(C) primitive right atrium and sinus venosus
(D) right and left atria
(E) two horns of the sinus venosus

10. During the third to sixth month of gestation, the structure **primarily** responsible for erythropoiesis is the

(A) yolk sac
(B) liver
(C) spleen
(D) bone marrow
(E) thymus

11. The branchial system is formed by four mesodermal branchial arches separated externally by four pharyngeal clefts and internally by five pharyngeal pouches. The external auditory canal is formed by which of the following structures?

(A) First pharyngeal cleft
(B) Third pharyngeal cleft
(C) First pharyngeal pouch
(D) Second branchial arch
(E) Cervical sinus

12. The skeletal and connective tissue structures of the lower portion of the face and anterior neck are derived from neural crest cells in the branchial arches. All the following structures derive from the second branchial arch EXCEPT the

(A) malleus
(B) stapes
(C) styloid process of the temporal bone
(D) stylohyoid ligament
(E) lesser horn of the hyoid bone

13. The primitive aortic arches, embedded in the branchial arches, run from the aortic sac to terminate in the dorsal aortae. The common carotid arteries develop from which of the following aortic arches?

(A) First
(B) Second
(C) Third
(D) Fourth
(E) Sixth

14. A patent ductus arteriosus in the newborn represents a persistence of which of the following primitive aortic arches?

(A) First
(B) Second
(C) Third
(D) Fourth
(E) Sixth

15. Numerous epithelial glandular structures develop from the pharyngeal pouches. Congenital absence of the thymus gland has a high coincidence of variance with absence of the

(A) palatine tonsil
(B) superior (IV) parathyroid glands
(C) inferior (III) parathyroid glands
(D) thyroid gland
(E) parafollicular cells

16. The definitive kidney develops in a succession of stages from the cervical to the caudal region. Bowman's capsule, which contains a primitive glomerulus, first develops in association with the

(A) nephrogenic cord
(B) pronephros
(C) mesonephros
(D) metanephros
(E) ureteric bud

17. The metanephric kidney begins to develop during the fifth week. All the following statements concerning the ureteric bud are true EXCEPT that it

(A) forms as an outgrowth of the mesonephric (wolffian) duct
(B) forms the renal pelvis and calyces
(C) forms the penile urethra
(D) induces the metanephric blastema to form the metanephric kidney
(E) is of mesodermal origin

18. Differentiation of external female genitalia during the third month of development is dependent on

(A) ovarian estrogen stimulation
(B) adrenal estrogen stimulation
(C) growth hormone stimulation
(D) progesterone stimulation by the ovary
(E) lack of testicular androgen stimulation

19. The median umbilical ligament on the anterior abdominal wall is derived from the obliteration of the

(A) urachus
(B) umbilical artery
(C) umbilical vein
(D) ductus venosus
(E) wolffian duct in the female fetus or müllerian duct in the male

20. An ileal (Meckel's) diverticulum, a common anomaly of the intestinal tract, represents a partial persistence of the

(A) urachus
(B) allantoic stalk
(C) amnion
(D) vitelline duct
(E) appendix

DIRECTIONS: Each question below contains four suggested answers of which **one** or **more** is correct. Choose the answer:

A	if	**1, 2, and 3**	are correct
B	if	**1 and 3**	are correct
C	if	**2 and 4**	are correct
D	if	**4**	is correct
E	if	**1, 2, 3, and 4**	are correct

21. A pleuripotential cell that passes the checkpoint in G_1 and enters the S phase of the cell cycle will

(1) complete the cell cycle by undergoing mitosis and cytokinesis
(2) produce enzymes necessary for DNA replication
(3) continue to cycle through mitoses until it receives a signal from the microenvironment to enter the prolonged interphase of G_0
(4) produce secretory products

22. One example of cellular differentiation is offered by myoblasts, which cease mitosis before they form myotubes and produce contractile proteins. Correct statements concerning differentiation include which of the following?

(1) Gene replication does not occur at the same time as gene transcription
(2) The cell must move out of the cell cycle into the G_0 phase before it is able to express specific, genetically determined properties
(3) There are no known signals that may move a mature, highly differentiated cell, such as muscle or nerve, into the S phase
(4) Tissue regeneration involves movement of a differentiated cell into the cell cycle

23. By the fourth day of development, fluid accumulation by the morula results in a separation of the cells into trophoblast and embryoblast, or inner cell mass. From the eighth to the twelfth day of development, the role of the trophoblast includes

(1) enclosure of the inner cell mass and blastocyst cavity
(2) production of hormones
(3) invasion of the endometrial epithelium
(4) production of two distinct cell populations by differentiation

24. By the eighth day of development, the cells of the inner cell mass (embryoblast) differentiate into two distinct layers—epiblast and hypoblast. Correct statements about the epiblast layer include which of the following?

(1) It splits away from the trophoblast by cavitation to form the amnionic cavity
(2) It forms the prochordal plate, an important organizer of the head
(3) It gives rise to ectodermal and mesodermal structures
(4) It consists of cuboidal cells adjacent to the blastocyst cavity

SUMMARY OF DIRECTIONS

A	B	C	D	E
1, 2, 3 only	1, 3 only	2, 4 only	4 only	All are correct

25. The primitive streak, which develops during the second week, provides orientation to a developing embryo. It is true of cells of the primitive streak that they

(1) originate from the epiblast
(2) migrate cranially to form the notochord
(3) migrate laterally to form intraembryonic mesoderm
(4) give rise to the neural crest cells

26. Nerve growth factor (NGF) may be responsible for the normal development of neural crest derivatives. An embryo deficient in NGF could generate developmental anomalies that may be associated with the

(1) autonomic ganglia
(2) chromaffin cells of the adrenal medulla
(3) neurilemma (Schwann cells)
(4) melanocytes

27. By the process of induction, certain embryonic tissues alter the microenvironment of adjacent cells and tissues. Examples of induction during embryogenesis include the development of the

(1) lens by the optic vesicle
(2) gonad by the mesonephros
(3) neural plate and brain by the notochord
(4) breast by the underlying muscle tissue

28. The face is formed during the fifth week from several mesodermal prominences that border on a slight depression, the stomodeum or primitive mouth. The stomodeum is bounded by the

(1) paired mandibular prominences
(2) paired maxillary prominences
(3) lateral and medial nasal prominences
(4) unpaired frontal prominence

29. Development of the primary palate and its fusion with the lateral maxillary processes separates the stomodeum from the primitive nasal fossa. By this stage (the forty-fifth day of development), the secondary palate has appeared within the stomodeal cavity, forming the hard and soft palates and separating the oral and nasal cavities. The secondary palate is formed by fusion of the

(1) epithelial wall
(2) nasal septum
(3) nasal placodes
(4) palatine shelves

30. Correct statements concerning the ductus venosus include which of the following?

(1) It forms a direct channel through the liver from the umbilical vein to the inferior vena cava
(2) It persists in the adult as the hepatic portal vein
(3) It allows oxygenated blood to bypass the liver
(4) It develops from the subcardinal venous system

31. Because the collapsed lungs have a high vascular resistance, the ductus arteriosus is an important shunt in the fetal circulation. Correct statements concerning the ductus arteriosus include which of the following?

(1) Functional closure of the ductus occurs soon after the lungs first expand
(2) There may be a slight reversal of blood flow through the ductus during the postnatal period
(3) Anatomic obliteration of the ductus usually takes several weeks
(4) The ductus forms the ligamentum venosum in the adult

32. Both the location and arrangement of the coronary sinus can be explained embryologically. The coronary sinus develops from the

(1) right umbilical vein
(2) superior portion of the sinus venosus
(3) right vitelline vein
(4) left horn of the sinus venosus

33. The superior vena cava is formed later than the inferior vena cava. The definitive superior vena cava is incorporated from portions of the

(1) posterior cardinal vein
(2) anterior cardinal vein
(3) supracardinal vein
(4) common cardinal vein

34. Normally, the endocardial cushions of the atrioventricular canal participate in

(1) division of the atrium into right and left chambers
(2) closure of the ostium primum between the left and right atria
(3) formation of the membranous interventricular septum
(4) formation of the semilunar valves

35. Normally, the truncus and conus of the developing heart are separated by the fusion and descent of the two spiral ridges. Failure of these ridges to fuse or descend would result in an

(1) aorta that arises from the pulmonary trunk
(2) interventricular septum that is defective
(3) atretic pulmonary artery
(4) undivided truncus that receives mixed venous and arterial blood

36. The truncoconal septum takes a spiral, descending course in the normally developing heart. If the course were straight downward without the spiral, the

(1) aorta would originate from the right ventricle
(2) pulmonary veins would enter the right atrium
(3) pulmonary artery would originate from the left ventricle
(4) vena cava would enter the left atrium

SUMMARY OF DIRECTIONS

A	B	C	D	E
1, 2, 3 only	**1, 3 only**	**2, 4 only**	**4 only**	**All are correct**

37. During the fifth week of development, the body cavities are divided into pleural, pericardial, and peritoneal cavities. The diaphragm, which is instrumental in the divisional process, is derived from the

(1) septum transversum
(2) esophageal mesentery
(3) pleuroperitoneal membranes
(4) cervical myotomes

38. Endodermal cells of the distal portion of the primitive foregut give rise to

(1) liver parenchyma
(2) Kupffer cells lining the hepatic sinusoids
(3) bile duct epithelium
(4) blood islands of the early hematopoietic system

39. In the fifth week of development, the pancreas develops from a **dorsal** bud immediately cranial to the hepatic diverticulum and from a **ventral** bud caudal to, and opposite, the hepatic diverticulum. The dorsal bud contributes which of the following pancreatic structures?

(1) Body of the pancreas
(2) Upper half of the head of the pancreas
(3) Secondary pancreatic duct (of Santorini)
(4) Distal portion of the main pancreatic duct

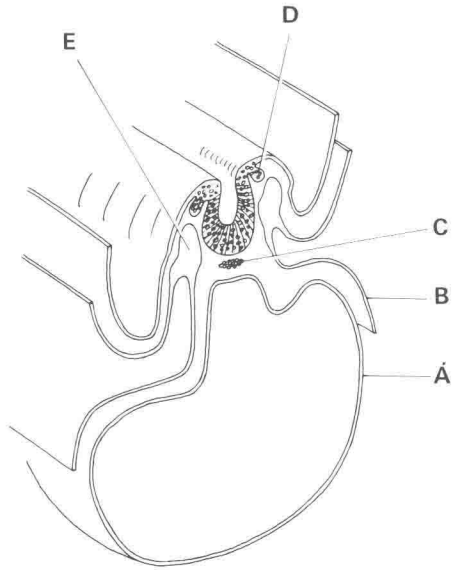
40. Components of the rhombencephalon (hindbrain) in the developing brain include the

(1) hypoglossal nucleus (CN XII)
(2) cerebellum
(3) trigeminal nucleus (CN V)
(4) otic placode

DIRECTIONS: The groups of questions below consist of lettered choices followed by several numbered items. For each numbered item select the **one** lettered choice with which it is **most** closely associated. Each lettered choice may be used once, more than once, or not at all.

Questions 41-45

For each anatomic description that follows, select from the diagram below the labeled structure that is most appropriate.



Embryo—Third Week of Development

41. Gives rise to dorsal root ganglia
42. Contributes to the neural arch of the vertebral column
43. Represents a unique characteristic of vertebrates
44. Forms the muscle layers of the gastrointestinal tract
45. Is rudimentary and not normally represented in the adult

Questions 46-50

Adult structures arise from embryologic anlages. For each adult structure that follows, select the most appropriate anlage.

(A) Paramesonephric (müllerian) duct
(B) Mesonephric (wolffian) duct
(C) Genital tubercle
(D) Urogenital sinus
(E) Mesonephric tubules

46. Penile urethra
47. Ampulla of the oviducts
48. Seminal vesicles
49. Prostate gland
50. Ureters in the female

Embryology Answers

1. **The answer is B.** *(Langman, ed 4. pp 3-5. Moore, ed 2. pp 12-16.)* Prior to the first meiotic division, there is replication of deoxyribonucleic acid (DNA) by the primary germ cells. Thus, at the beginning of the division, there is double the DNA content and each chromosome is bivalent. During the first meiotic division, each secondary germ cell receives one half (23) of the bivalent pairs and is thus haploid. However, since each chromosome is bivalent, the amount of DNA is equivalent to a somatic cell, but only half the chromosomes are represented. During the second meiotic division, replication does not occur, and each daughter cell receives 23 monovalent chromosomes. Therefore, the DNA content is halved. Fertilization restores the normal diploid number of chromosomes and the full complement of DNA.

2. **The answer is A.** *(Langman, ed 4. pp 6-9. Moore, ed 2. pp 13-16.)* Differentiation into oogonia begins once the primordial germ cells have arrived in the gonad of a genetic female. After undergoing a number of mitotic divisions, these fetal cells form a cluster in the cortical part of the ovary. Some of these oogonia differentiate into the larger primary oocytes, which by the third month of development are found in the deeper layers of the gonad. The primary oocytes begin meiosis to produce secondary oocytes. At the same time, the number of oogonia continues to increase to about 6,000,000 in the fifth month. At this time most of the surviving oogonia and some of the oocytes become atretic. However, the surviving secondary oocytes (400,000 to 1,000,000) become surrounded by epithelial cells, forming the primordial follicles by the seventh month. During childhood there is continued atresia so that by puberty only about 40,000 secondary oocytes remain.

3. **The answer is D.** *(Langman, ed 4. pp 8-11, 18-25. Moore, ed 2. pp 13, 24-27.)* At the time of ovulation, the zona pellucida is intact, and it is maintained around the viable secondary oocyte for approximately 5 days. Prior to ovulation, the first meiotic division occurs, with reduction of the chromosomal number to the haploid condition and expulsion of the first polar body. The resulting secondary oocyte immediately proceeds as far as the spindle stage of the second