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REVIEW

ANATOMY

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- Detailed explanation of every answer

- Rationales for all answers

Royce Lee Montgomery • Kurt Ogden Gilliland

6

EDITION

Sixth edition

APPLETON & LANGE REVIEW OF
ANATOMY

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Appleton & Lange Reviews/McGraw-Hill

Medical Publishing Division

New York Chicago San Francisco Lisbon London
Madrid Mexico City Milan New Delhi San Juan Seoul
Singapore Sydney Toronto

Appleton & Lange Review of Anatomy, Sixth Edition

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1 2 3 4 5 6 7 8 9 0 VNH VNH 0 9 8 7 6 5 4 3 2

ISBN: 0-07-137727-1

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This book was set in Palatino by Circle Graphics.
The editors were Catherine W. Johnson and Lester A. Sheinis.
The production supervisor was Lisa Mendez.
The cover designer was Aimée Nordin.
The indexer was Alexandra Nickerson.
Von Hoffmann Graphics, Inc., was printer and binder.

This book was printed on acid-free paper.

Library of Congress Cataloging-in-Publication Data

Montgomery, Royce L.

Appleton & Lange review of anatomy / Royce L. Montgomery, Kurt Ogden
Gilliland.—6th ed.

p. ; cm.

Rev. ed. of: Appleton & Lange review of anatomy for the USMLE Step 1 / Royce L. Montgomery,
Gerald A. Montgomery. © 1995.

Includes bibliographical references

ISBN 0-07-137727-1 (alk. paper)

1. Human anatomy—Examinations, questions, etc. 2. Physicians—Licenses—United States—Examinations—Study guides. I. Title: Appleton & Lange review of anatomy. II. Title: Review of anatomy. III. Gilliland, Kurt Ogden. IV. Montgomery, Royce L. Appleton & Lange review of anatomy for the USMLE Step 1. V. Title.

[DNLM: 1. Anatomy—Examination Questions. QS 18.2 M788a 2003]

QM32 .M65 2002

611'.0076—dc21

2002016672

International Edition ISBN 0-07-121248-5

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Introduction

If you are planning to prepare for the United States Medical Licensing Examination (USMLE) Step 1, then this book is designed for you. Here, in one package, is a comprehensive review resource with over 600 examination type anatomy multiple-choice questions with referenced explanations of each answer.

This introduction provides specific information on the USMLE Step 1, information on question types, question-answering strategies, and various ways to use this review.

THE UNITED STATES MEDICAL LICENSING EXAMINATION STEP 1

The United States Medical Licensing Examination Step 1 is a one-day computerized examination consisting of approximately 400 questions to test your knowledge in the basic sciences. It contains multiple-choice questions organized within three dimensions. Each dimension is weighted; however, the projected percentages for these dimensions are subject to change from exam to exam. The three dimensions are: (1) System, (2) Process, and (3) Organizational Level. The application materials illustrate the percentage breakout and offer you a detailed content outline to aid you in your review.

Question Formats

The style and presentation of the questions have been fully revised to conform with the United States Medical Licensing Examinations. This will enable you to familiarize yourself with the types of questions to be expected and provide practice in recalling your knowledge in each format. Following the answer to each question, a reference to a particular and easily available text is provided for further reference and reading.

Each of the chapters contains single-best answer multiple choice questions. In some cases, a group of two or three questions may be related to a situational theme. In addition, some questions have illustrative material (e.g., line illustrations of anatomy) that require understanding and interpretation on your part. Moreover, questions may be of three levels of difficulty: rote memory, memory question that requires more understanding of the problem, and a question that requires both understanding and judgment. In view of the fact that the USMLE Step 1 is moving toward the judgment, critical-thinking type question, we have attempted to write this review with this emphasis.

One Best-Answer-Single Item Question. The majority of the questions are posed in the A type, or “one best answer single item” format. This is the most popular question format in most exams. It generally contains a brief statement, followed by five options of which only ONE is entirely correct. The options on the USMLE are lettered A, B, C, D, and E. Although the format for this question type is straightforward, the questions can be difficult because some of the distractors may be partially right. The instructions you will see for this type of question will generally appear as below:

DIRECTIONS (Question 1): Each of the numbered items or incomplete statements in this section is followed by answers or by completions of the statement. Select the ONE lettered answer or completion that is BEST in each case.

An example of this question type is:

1. An obese 21-year-old woman complains of increased growth of coarse hair on her lip, chin,

chest, and abdomen. She also notes menstrual irregularity with periods of amenorrhea. The most likely cause is

- (A) polycystic ovary disease
- (B) an ovarian tumor
- (C) an adrenal tumor
- (D) Cushing's disease
- (E) familial hirsutism

In the question above, the key word is "most." Although ovarian tumors, adrenal tumors, and Cushing's disease are causes of hirsutism (described in the stem of the question), polycystic ovary disease is a much more common cause. Familial hirsutism is not associated with the menstrual irregularities mentioned. Thus, the most likely cause of the manifestations described can only be "(A) polycystic ovary disease."

STRATEGIES FOR ANSWERING ONE BEST ANSWER-SINGLE ITEM QUESTIONS

1. Remember that only one choice can be the correct answer.
2. Read the question carefully to be sure that you understand what is being asked. Pay attention to key words like "most."
3. Quickly read each choice for familiarity. (This important step is often not done by test takers.)
4. Go back and consider each choice individually.
5. If a choice is partially correct, tentatively consider it to be incorrect. (This step will help you eliminate choices and increase your odds of choosing the correct answer.)
6. Consider the remaining choices and select the one you think is the answer. At this point, you may want to quickly scan the stem to be sure you understand the question and your answer.
7. If you do not know the answer, make an educated guess. Your score is based on the number of correct answers, not the number you get incorrect. **Do not leave any questions unanswered.**
8. The actual examination is timed for an average of 60 seconds per question. It is important to be thorough to understand the question, but it is equally important for you to keep moving.

Answers, Explanations, and References

In each of the sections of this book, the question sections are followed by a section containing the answers, explanations, and references to the questions. This section (1) tells you the answer to each question; (2) gives you an explanation/review of why the answer is correct and background information on the subject matter; and (3) tells you where you can find more in-depth information on the subject matter in other books and/or journals. We encourage you to use this section as a basis for further study and understanding.

If you choose the correct answer to a question, you can then read the explanation (1) for reinforcement and (2) to add to your knowledge about the subject matter (remember that the explanations usually tell not only why the answer is correct, but also why the other choices are incorrect). If you choose the wrong answer to a question, you can read the explanation for a learning/reviewing discussion of the material in the question. Furthermore, you can note the reference cited (e.g., "Joklik et al, pp 103–114"), look up the full source in the bibliography at the end of the section (e.g., "Joklik WK, Willett HP, Amos DB. *Zinsser's Microbiology*. 20th ed. Norwalk, Conn: Appleton & Lange; 1992"), and refer to the pages cited for a more in-depth discussion.

SPECIFIC INFORMATION ON THE STEP 1 EXAMINATION

The official source of all information with respect to the United States Medical Licensing Examination Step 1 is the National Board of Medical Examiners (NBME), 3930 Chestnut Street, Philadelphia, PA 19104. Established in 1915, the NBME is a voluntary, nonprofit, independent organization whose sole function is the design, implementation, distribution, and processing of a vast bank of question items, certifying examinations, and evaluative services in the professional medical field.

Please contact the NBME or visit the USMLE web site (www.usmle.org) for information on exam registration and scoring.

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The Back

Questions

DIRECTIONS (Questions 1 through 40): Each of the numbered items or incomplete statements in this section is followed by answers or by completions of the statements. Select the ONE lettered answer or completion that is BEST in each case.

1. The vertebral column does all of the following EXCEPT
 - (A) protect the spinal cord and spinal nerves
 - (B) support the weight of the body
 - (C) provide a pivot for the head
 - (D) play an important role in posture and locomotion
 - (E) form the main part of the appendicular skeleton
2. Which of the following is NOT a distinctive characteristic of a typical cervical vertebra?
 - (A) The body is small and wider from side to side than anteroposteriorly.
 - (B) The vertebral foramen is large and triangular.
 - (C) The transverse processes contain transverse foramina.
 - (D) The articular processes contain superior facets directed inferoanteriorly.
 - (E) The spinous processes are short and bifid.
3. Which of the following is NOT a distinctive characteristic of a typical thoracic vertebra?
 - (A) The body is heart-shaped.
 - (B) The vertebral foramen is triangular and larger than in cervical and lumbar vertebrae.
 - (C) The transverse processes are long and strong and extend posterolaterally.
 - (D) The articular processes contain superior facets directed posteriorly and slightly laterally.
 - (E) The spinous processes are long and slope posteroinferiorly.
4. Which of the following is a distinctive characteristic of a typical lumbar vertebra?
 - (A) The body is massive and kidney-shaped when viewed superiorly.
 - (B) The vertebral foramen is circular and smaller than those of cervical and lumbar vertebrae.
 - (C) The transverse processes are long and slender and contain mammillary processes.
 - (D) The articular processes contain accessory processes.
 - (E) The spinous processes are long and slope posteroinferiorly.
5. Which of the following is true regarding the intervertebral disc between the C1 and C2 vertebrae?
 - (A) Its annulus fibrosus is composed of concentric lamellae of fibrocartilage.
 - (B) It does not contain a nucleus pulposus as other intervertebral discs do.
 - (C) It is thicker than other intervertebral discs.
 - (D) It acts like a shock absorber in response to axial forces.
 - (E) There is no intervertebral disc between the C1 and C2 vertebrae.

6. All of the following are true regarding the posterior longitudinal ligament EXCEPT
 - (A) It is narrower and weaker than the anterior longitudinal ligament.
 - (B) It runs within the vertebral canal and connects the vertebral bodies to each other.
 - (C) It is provided with pain nerve endings.
 - (D) It helps prevent hyperextension of the vertebral column.
 - (E) It is attached to the intervertebral discs and the posterior edges of the vertebral bodies.
 7. Spinal arteries supplying the vertebrae are branches of the
 - (A) vertebral and ascending cervical arteries in the neck
 - (B) posterior intercostal arteries in the lumbar region
 - (C) subcostal and lumbar arteries in the pelvis
 - (D) iliolumbar and lateral and medial sacral arteries in the thorax
 - (E) aorta
 8. Which of the following back muscles is innervated by dorsal rami?
 - (A) latissimus dorsi
 - (B) levator scapulae
 - (C) rhomboid major
 - (D) rhomboid minor
 - (E) longissimus
 9. Which of the following is NOT a deep (or intrinsic) muscle of the back?
 - (A) serratus posterior inferior
 - (B) levatores costarum
 - (C) iliocostalis
 - (D) multifidus
 - (E) splenius capitis
 10. The splenius capitis and cervicis
 - (A) extend the head and neck
 - (B) flex the head and neck
 - (C) elevate ribs, assisting inspiration
 - (D) stabilize the atlas and axis
 - (E) move the upper limb
 11. The erector spinae muscles
 - (A) flex the vertebral column
 - (B) flex the head
 - (C) control flexion of the back
 - (D) prevent lateral bending of the vertebral column
 - (E) assist with elevation
 12. Which of the following is not a member of the minor deep layer of the back?
 - (A) levatores costarum
 - (B) cervical intertransversarii
 - (C) spinalis
 - (D) interspinales
 - (E) thoracic intertransversarii
 13. The transversospinalis muscles do all of the following EXCEPT
 - (A) extend the head
 - (B) extend the thoracic and cervical regions of the vertebral column
 - (C) elevate ribs, assisting inspiration
 - (D) stabilize vertebrae
 - (E) assist with rotation of the vertebral column
 14. Which of the following muscles does NOT attach to transverse processes of vertebrae?
 - (A) semispinalis
 - (B) multifidus
 - (C) rotatores
 - (D) intertransversarii
 - (E) spinalis
 15. Which of the following muscles does NOT laterally bend the cervical intervertebral joints?
 - (A) longus colli
 - (B) iliocostalis cervicis
 - (C) longissimus capitis and cervicis
 - (D) splenius capitis
 - (E) splenius cervicis
 16. Which of the following muscles are likely to be organs of proprioception instead of producers of motion?
-

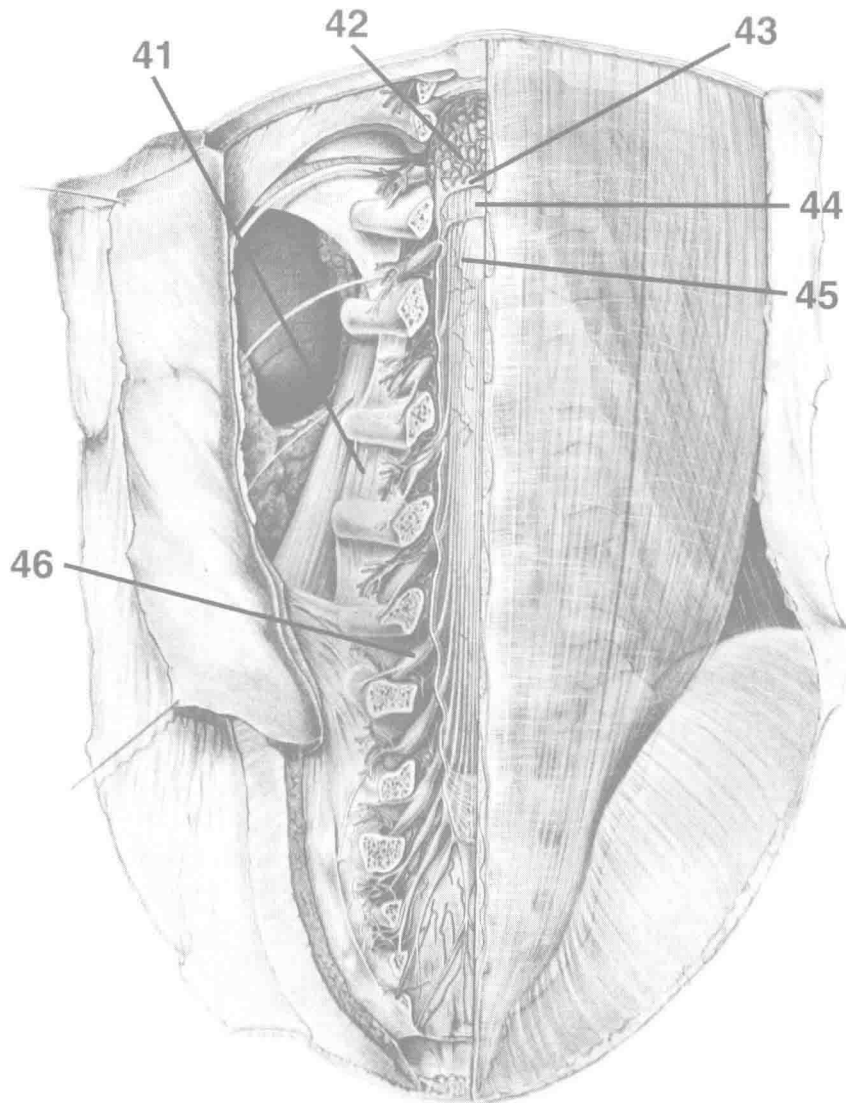
- (A) iliocostalis
(B) spinalis
(C) rotatores
(D) splenius capitis
(E) longissimus
17. Which of the following statements is true regarding the suboccipital and deep neck muscles?
- (A) The rectus capitis posterior major arises from the spinous process of C2 and inserts into the lateral part of the inferior nuchal line.
(B) The obliquus capitis inferior arises from the posterior tubercle of the posterior arch of C1 and inserts into the medial part of the inferior nuchal line.
(C) The obliquus capitis superior arises from the spinous process of C2 and inserts into the transverse process of C1.
(D) The rectus capitis posterior minor arises from the transverse process of C1 and inserts into the occipital bone between the nuchal lines.
(E) The suboccipital muscles are innervated by the ventral rami of C1.
18. ALL of the following extend the atlanto-occipital joint EXCEPT
- (A) rectus capitis posterior major and minor
(B) semispinalis capitis
(C) longus capitis
(D) splenius capitis
(E) longissimus capitis
19. The suboccipital triangle is composed of
- (A) a superolateral and superomedial border (the superior oblique and rectus capitis posterior major)
(B) an inferolateral border (semispinalis capitis)
(C) a floor (C2)
(D) a roof (trapezius)
(E) greater and lesser occipital nerves
20. ALL of the following are innervated by dorsal rami EXCEPT
- (A) muscles of the suboccipital triangle
(B) skin over the neck and occipital bone (innervated by greater occipital nerve)
(C) intrinsic muscles of the back
(D) skin of the neck and scalp (innervated by lesser occipital nerve)
(E) skin of the central part of the back
21. Which of the following statements is correct?
- (A) The spinal cord is enlarged in the thoracic region for innervation of the upper limbs.
(B) The spinal cord is enlarged in the lumbosacral region for innervation of the lower limbs.
(C) In embryos, the spinal cord occupies only the superior two-thirds of the vertebral canal.
(D) In adults, the spinal cord occupies the full length of the vertebral canal.
(E) The cauda equina is composed of ventral but not dorsal roots.
22. Which of the following is NOT true in adults?
- (A) The tapering end of the spinal cord may terminate as high as T12 or as low as L3.
(B) The first cervical nerves lack dorsal roots in 50% of people.
(C) The coccygeal nerve may be absent.
(D) The terminal filum is the vestigial remnant of the caudal part of the spinal cord that was in the tail of the embryo.
(E) The spinal cord has a lumbar enlargement for the lower limb but no equivalent enlargement for the smaller upper limb.
23. Which of the following is contained in the extradural (epidural) space?
- (A) fat (loose connective tissue)
(B) external vertebral venous plexus
(C) CSF
(D) denticulate ligaments
(E) radicular, medullary, and spinal arteries

24. All of the following are contained in the subarachnoid (leptomeningeal) space EXCEPT
- (A) CSF
 - (B) arachnoid trabeculae
 - (C) segmental medullary arteries
 - (D) spinal arteries
 - (E) internal vertebral plexus
25. Which of the following does NOT give rise to arteries supplying the spinal cord?
- (A) ascending cervical artery
 - (B) deep cervical artery
 - (C) intercostal arteries
 - (D) lumbar arteries
 - (E) thoracoacromial artery
26. Which of the following is true?
- (A) There are paired anterior spinal arteries.
 - (B) There are paired posterior spinal arteries.
 - (C) The sulcal (central) arteries are formed by the union of branches of the vertebral arteries.
 - (D) Each anterior spinal artery is a branch of either the posteroinferior cerebellar artery or the vertebral artery.
 - (E) There is usually one anterior and one posterior spinal vein
27. Which of the following is true?
- (A) There are usually two anterior and two posterior spinal veins.
 - (B) Veins of the spinal cord are distributed in a similar fashion to that of spinal arteries.
 - (C) Spinal veins are unique in that they do not communicate with each other.
 - (D) Spinal veins are arranged laterally.
 - (E) Spinal veins are drained by sulcal and meningeal vein.
28. All of the following are contained in typical spinal nerves EXCEPT
- (A) sensory fibers from tendons and joints
 - (B) motor fibers to muscles
 - (C) parasympathetic fibers to glands
 - (D) sensory fibers from blood vessels and glands
 - (E) motor fibers to smooth muscle
29. Which of the following is not true regarding the parasympathetic nervous system?
- (A) The cell body of the presynaptic neuron is located in the gray matter of the CNS.
 - (B) The cell body of the postsynaptic neuron is located in an autonomic ganglion outside the CNS.
 - (C) The postsynaptic neuron emits norepinephrine.
 - (D) Its neurons are craniosacral in origin.
 - (E) It promotes quiet and orderly processes of the body.
30. Postsynaptic sympathetic fibers that ultimately innervate the body wall and limbs do which of the following?
- (A) pass from the sympathetic trunks to adjacent ventral rami through gray rami communicantes
 - (B) pass from the sympathetic trunks to adjacent ventral rami through white rami communicantes
 - (C) pass from the sympathetic trunks to adjacent dorsal rami through gray rami communicantes
 - (D) pass from the sympathetic trunks to adjacent dorsal rami through white rami communicantes
 - (E) pass from the sympathetic trunks to splanchnic nerves
31. Postsynaptic sympathetic fibers do ALL of the following EXCEPT
- (A) constrict the pupil of the eye
 - (B) stimulate contraction of blood vessels
 - (C) stimulate contraction of erector pili muscles
 - (D) cause sudomotion
 - (E) cause goose bumps

32. Which of the following is NOT true?
- (A) Variations in vertebrae are affected by race, sex, genetic factors, and environmental factors.
 - (B) An increased number of vertebrae occurs more often in males, and a reduced number occurs more often in females.
 - (C) The number of cervical vertebrae can be 6, 7, or 8.
 - (D) Some people have more than five lumbar vertebrae and therefore fewer thoracic vertebrae.
 - (E) The sacrum is typically composed of five fused vertebrae.
33. Which of the following statements about kyphosis is true?
- (A) Kyphosis may result from developmental anomalies as well as from osteoporosis.
 - (B) The vertebral column curves anteriorly.
 - (C) Kyphosis results in an increase in the lateral diameter of the thorax.
 - (D) Women may develop a temporary kyphosis during pregnancy.
 - (E) It is also known as “swayback” or “hollow back.”
34. Lordosis is characterized by which of the following?
- (A) an abnormal increase in thoracic curvature
 - (B) an anterior rotation of the pelvis
 - (C) an abnormal lateral curvature
 - (D) rotation of the vertebrae
 - (E) lateral curvature of the spine
35. Scoliosis may be caused by which of the following?
- (A) asymmetrical weakness of intrinsic back muscles
 - (B) difference in length of the upper limbs
 - (C) dehydrated intervertebral discs
 - (D) ipsilateral weakness in gluteal muscles
 - (E) sciatic nerve lesion
36. Which of the following is NOT true in respect to caudal epidural anesthesia?
- (A) A local anesthetic is injected into the sacral hiatus or the posterior sacral foramina.
 - (B) The anesthetic acts on S2-4 and the coccygeal nerves.
 - (C) The height to which the anesthetic travels is primarily limited by the amount of fat in the epidural space.
 - (D) Sensation is lost inferior to the epidural block.
 - (E) The sacral hiatus is located between the sacral cornua and inferior to the 4th sacral spinous process or median sacral crest.
37. Which of the following is NOT a vertebral problem?
- (A) sacralization of L5
 - (B) lumbarization of S1
 - (C) lumbarization of T12
 - (D) lumbar spinal stenosis
 - (E) hemisacralization of L5
38. Which of the following statements is true?
- (A) In spina bifida cystica, the laminae of L5 and possibly S1 do not fuse properly.
 - (B) In spina bifida occulta, one or more vertebral arches do not develop, allowing meninges and even the spinal cord to herniate.
 - (C) Paralysis of the limbs and problems with bladder/bowel control may be associated with meningocele.
 - (D) Some cases of spina bifida result from an improper closure of the neural tube during the 8th week of embryonic development.
 - (E) A meningocele is a spina bifida associated with brain herniation.

39. Which of the following are derivatives of the epimere?
- (A) erector spinae muscles
 - (B) prevertebral muscles
 - (C) quadratus lumborum
 - (D) striated muscles of the anus
 - (E) sternalis
40. Shortly after week four of development, dorsal primary rami begin to innervate which of the following?
- (A) ventral axial skeletal musculature
 - (B) vertebral joints
 - (C) skin of the upper limb
 - (D) sweat glands of the lateral back region
 - (E) erector pili muscles

DIRECTIONS (Questions 41 through 46): Identify the anatomical features indicated on the art below.



Answers and Explanations

1. (E) The vertebral column forms the main part of the axial skeleton (*Moore, p 432*).
2. (D) The articular processes contain superior facets directed superoposteriorly (*Moore, p 439*).
3. (B) The vertebral foramen is circular and smaller than the foramina of cervical and lumbar vertebrae (*Moore, p 441*).
4. (A) The body is massive and kidney-shaped when viewed superiorly. The vertebral foramen is triangular and larger than the foramina in thoracic vertebrae and smaller than those in cervical vertebrae. The transverse processes are long and slender and contain accessory processes. The articular processes contain mammillary processes. The spinous processes are short, thick, and broad (*Moore, p 442*).
5. (E) There is no intervertebral disc between the C1 and C2 vertebrae (*Moore, p 451*).
6. (D) The posterior longitudinal ligament helps prevent hyperflexion of the vertebral column (*Moore, p 451*).
7. (A) Spinal arteries supplying the vertebrae are branches of the vertebral and ascending cervical arteries in the neck, posterior intercostal arteries in the thorax, subcostal and lumbar arteries in the lumbar region, and iliolumbar and lateral and medial sacral arteries in the pelvis (*Moore, p 467*).
8. (E) The longissimus, a deep or intrinsic back muscle, is innervated by dorsal rami. All superficial or extrinsic back muscles except the trapezius, which is innervated by the accessory nerve, are innervated by ventral rami (*Moore, p 467*).
9. (A) The serratus posterior inferior is an intermediate extrinsic back muscle (*Moore, p 467*).
10. (A) The splenius capitis and cervicis, when acting together, extend the head and neck (*Moore, p 468*).
11. (C) The erector spinae muscles extend the vertebral column and head when acting bilaterally, control flexion of the back by gradually lengthening their fibers, and bend the vertebral column laterally when acting unilaterally (*Moore, p 470*).
12. (C) The spinalis is a member of the erector spinae muscles, which comprise the intermediate muscle layer of the back (*Moore, p 470*).
13. (C) The transversospinalis muscles do not elevate the ribs to assist inspiration (*Moore, p 470*).
14. (E) The spinalis inserts on spinous processes—not transverse processes. The semispinalis, multifidus, rotatores, and intertransversarii all attach to transverse processes of vertebrae (*Moore, p 470*).
15. (A) The longus colli flexes the cervical intervertebral joints but does not bend them laterally (*Moore, p 473*).
16. (C) Because of their small size and lack of mechanical advantage, it has been proposed that the rotatores are likely to be organs of proprioception instead of producers of motion (*Moore, p 474*).

17. (A) The rectus capitis posterior major arises from the spinous processes of C2 and inserts into the lateral part of the inferior nuchal line. The rectus capitis posterior minor arises from the posterior tubercle of the posterior arch of C1 and inserts into the medial part of the inferior nuchal line. The obliquus capitis inferior arises from the spinous processes of C2 and inserts into the transverse process of C1. The obliquus capitis superior arises from the transverse process of C1 and inserts into the occipital bone between the nuchal lines. The suboccipital muscles are innervated by the dorsal rami of C1 (Moore, pp 475–476).
18. (C) The longus capitis flexes but does not extend the atlanto-occipital joint (Moore, p 476).
19. (A) The suboccipital triangle is the deep triangular area between the rectus capitis posterior major and the superior and inferior oblique muscles. The boundaries and course of the suboccipital triangle include the rectus capitis posterior major, the superior oblique, and the inferior oblique. The floor is formed by the atlanto-occipital membrane and posterior arch of C1. The roof is formed by the semispinalis capitis. The suboccipital triangle contains the vertebral artery and suboccipital nerve (Moore, pp 476–477).
20. (D) The lesser occipital nerve, which is composed of ventral rami of C2 and C3, innervates the skin of the neck and scalp (Moore, p 477).
21. (B) The spinal cord is enlarged in the lumbosacral region for innervation of the lower limbs (Moore, p 477).
22. (E) The spinal cord is enlarged in two regions for innervation of the limbs. The tapering end of the spinal cord may terminate as high as T12 or as low as L3. The first cervical nerves lack dorsal roots in 50% of people. The coccygeal nerve may be absent. The terminal filum is the vestigial remnant of the caudal part of the spinal cord that was in the tail of the embryo (Moore, pp 477–479).
23. Fat (loose connective tissue) is contained in the extradural (epidural) space (Moore, p 480).
24. (E) CSF, arachnoid trabeculae, segmental medullary arteries, radicular arteries, and spinal arteries are located in the subarachnoid (leptomeningeal) space. The internal vertebral venous plexus is located in the extradural (epidural) space (Moore, p 480).
25. (E) The vertebral, ascending cervical, deep cervical, intercostal, lumbar, and lateral sacral arteries give rise to arteries supplying the spinal cord (Moore, p 486).
26. (B) There are paired posterior spinal arteries (Moore, p 486).
27. (B) Veins of the spinal cord are distributed in a similar fashion to that of spinal arteries (Moore, p 486).
28. (C) Typical spinal nerves do not contain parasympathetic fibers (Moore, p 44–45).
29. (C) The postsynaptic neurons of the parasympathetic nervous system emit acetylcholine (Moore, p 45).
30. (A) Postsynaptic sympathetic fibers that ultimately innervate the body wall and limbs pass from the sympathetic trunks to adjacent ventral rami through gray rami communicantes (Moore, p 47).
31. (A) Postsynaptic sympathetic fibers dilate but do not constrict the pupil of the eye (Moore, p 47).
32. (C) The number of cervical vertebrae is constant at seven (Moore, p 434).
33. (A) Kyphosis (humpback or hunchback) may result from developmental anomalies as well as from osteoporosis. It is characterized by an abnormal increase in the thoracic curvature with the vertebrae curving posteriorly, resulting in an increase in the anteroposterior diameter of the thorax. Women may develop a temporary lordosis—not kyphosis—during pregnancy (Moore, p 434).
34. (B) Lordosis is characterized by an abnormal rotation of the pelvis (Moore, p 434).

35. (A) Scoliosis may be caused by asymmetrical weakness of intrinsic back muscles (myopathic scoliosis), difference in length of the lower limbs, failure of one half of a vertebra to develop, or occasionally habitual standing or sitting in an improper position (habit scoliosis) (Moore, p 435).
36. (C) The height to which the anesthetic travels is primarily limited by the amount injected and by the position of the patient (Moore, p 435).
37. (C) Part or all of L5 may fuse with the sacrum (hemisacralization or sacralization). In addition, S1 may separate from the sacrum and fuse with L5. Lumbar stenosis occurs when an intervertebral disc bulges and narrows the vertebral canal in the lumbar region, compressing the spinal nerve roots. T12 is not known to fuse with L1 (Moore, pp 446–447).
38. (C) Paralysis of the limbs and problems with bladder/bowel control may be present in severe cases of meningocele, which is associated with spina bifida cystica, a condition in which one or more vertebral arches do not develop. In spina bifida occulta, the laminae of L5 and possibly S1 do not fuse properly. Some cases of spina bifida result from an improper closure of the neural tube during the 4th week of embryonic development (Moore, pp 448–449).
39. (A) Myoblasts of the epimeres form the extensor muscles of the vertebral column (Sadler, p 190).
40. (A) Dorsal primary rami innervate dorsal axial musculature, vertebral joints, and the skin of the back (Sadler, p 421).
41. intertransverse ligament
42. internal vertebral venous plexus
43. dura mater
44. arachnoid layer
45. conus medullaris
46. dorsal root ganglion

The Upper Limb

Questions

DIRECTIONS (Questions 1 through 83): Each of the numbered items or incomplete statements in this section is followed by answers or by completions of the statement. Select the ONE lettered answer or completion that is BEST in each case.

- Which of the following is NOT true regarding the clavicle?
 - Its medial end is enlarged where it attaches to the sternum.
 - Its lateral end is flat where it articulates with the humerus.
 - The medial two-thirds of the shaft are convex anteriorly.
 - The clavicle transmits shock from the upper limb to the axial skeleton.
 - The clavicle is a "long bone" that has no medullary cavity.
- The trapezius attaches to which of the following regions of the clavicle?
 - lateral one-third of the clavicle
 - conoid tubercle
 - subclavian groove
 - trapezoid line
 - quadrangular tubercle
- Which of the following is true in respect to the scapula?
 - The spine of the scapula continues laterally as the coracoid process.
 - The lateral surface of the scapula forms the glenoid cavity.
 - The acromion is superior to the glenoid cavity and projects anterolaterally.
 - The scapula is fastened securely to the thoracic cage at the scapulothoracic joint.
 - The acromioclavicular joint represents the true shoulder joint.
- Which of the following is NOT included in the condyle of the humerus?
 - radial, coronoid, and olecranon fossae
 - epicondyles
 - trochlea
 - capitulum
 - greater tubercle
- Which of the following is NOT true in respect to the ulna and radius?
 - The brachialis attaches to the tuberosity of the ulna.
 - The ulnar styloid process is much larger than the radial styloid process and extends farther distally.
 - The head of the ulna lies distally, whereas the head of the radius articulates with the humerus.
 - The ulna is medial to the radius in the anatomical position.
 - The bodies of these bones are firmly bound together by the interosseous membrane.