

## CHAPTER 4

# The Integumentary System and Body Membranes

More of our time, attention, and money are spent on this system than on any other one. Every time we look into a mirror, we become aware of the integumentary system as we observe our skin, hair, nails, and the appendages that give luster and comfort to this system. The discussion of the skin begins with the structure and function of the two primary layers—the epidermis and the dermis. It continues with an examination of the appendages of the skin, which include the hair, receptors, nails, sebaceous glands, and sudoriferous glands. Your study of skin concludes with a review of one of the most serious and frequent threats to the skin—burn injury. An understanding of the integumentary system provides you with an appreciation of the danger that severe burns pose to this system.

Membranes are thin sheetlike structures that cover, protect, anchor, and lubricate body surfaces, cavities, and organs. The two major categories of membranes are epithelial and connective. Each type is located in specific areas of the body and is vulnerable to specific disease conditions. Knowledge of the location and function of these membranes prepares you for the study of their relationships to other systems and to the body as a whole.

### TOPICS FOR REVIEW

Before progressing to Chapter 5, you should have an understanding of the skin and its appendages. Your review should include the classification of burns and the method used to estimate the percentage of body surface area affected by a burn injury. A knowledge of the types of body membranes, their location, and their function is also necessary as you complete your study of this chapter.

# CLASSIFICATION OF BODY MEMBRANES

Select the correct term from the choices given and write the letter in the answer blank.

- A. Cutaneous      B. Serous      C. Mucous      D. Synovial
- \_\_\_\_\_ 1. Pleura  
\_\_\_\_\_ 2. Lines joint spaces  
\_\_\_\_\_ 3. Respiratory tract  
\_\_\_\_\_ 4. Skin  
\_\_\_\_\_ 5. Peritoneum  
\_\_\_\_\_ 6. Contains no epithelium  
\_\_\_\_\_ 7. Urinary tract  
\_\_\_\_\_ 8. Lines body surfaces that open directly to the exterior



If you have had difficulty with this section, review pages 78-80.

## THE SKIN

Match the term on the left with the proper selection on the right.

### Group A

- \_\_\_\_\_ 9. Integumentary system  
\_\_\_\_\_ 10. Epidermis  
\_\_\_\_\_ 11. Dermis  
\_\_\_\_\_ 12. Subcutaneous  
\_\_\_\_\_ 13. Cutaneous membrane

- A. Outermost layer of skin  
B. Deeper of the two layers of skin  
C. Allows for rapid absorption of injected material  
D. The skin is the primary organ  
E. Composed of dermis and epidermis

### Group B

- \_\_\_\_\_ 14. Keratin  
\_\_\_\_\_ 15. Melanin  
\_\_\_\_\_ 16. Stratum corneum  
\_\_\_\_\_ 17. Dermal papillae  
\_\_\_\_\_ 18. Cyanosis

- A. Protective protein  
B. Blue-gray color of skin resulting from a decrease in oxygen  
C. Rows of peg-like projections  
D. Brown pigment  
E. Outer layer of epidermis

Select the correct term from the choices given and write the letter in the answer blank.

- A. Epidermis      B. Dermis
- \_\_\_\_\_ 19. Tightly packed epithelial cells  
\_\_\_\_\_ 20. Nerves  
\_\_\_\_\_ 21. Fingerprints  
\_\_\_\_\_ 22. Blisters  
\_\_\_\_\_ 23. Keratin

- \_\_\_\_\_ 24. Connective tissue
- \_\_\_\_\_ 25. Follicle
- \_\_\_\_\_ 26. Sebaceous gland
- \_\_\_\_\_ 27. Sweat gland
- \_\_\_\_\_ 28. More cellular than other layer



*If you have had difficulty with this section, review pages 80-83.*

**Fill in the blanks.**

- 29. The three most important functions of the skin are \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.
- 30. \_\_\_\_\_ prevents the sun's ultraviolet rays from penetrating the interior of the body.
- 31. The hair of a newborn infant is called \_\_\_\_\_.
- 32. Hair growth begins from a small cap-shaped cluster of cells called the \_\_\_\_\_.
- 33. The nail body nearest the root has a crescent-shaped white area known as the \_\_\_\_\_ or "little moon."
- 34. The \_\_\_\_\_ muscle produces "goose pimples."
- 35. Meissner's corpuscle is generally located rather close to the skin's surface and is capable of detecting sensations of \_\_\_\_\_.
- 36. The most numerous, important, and widespread sweat glands in the body are the \_\_\_\_\_ sweat glands.
- 37. The \_\_\_\_\_ sweat glands are found primarily in the axilla and in the pigmented skin areas around the genitals.
- 38. \_\_\_\_\_ has been described as "nature's skin cream."

**Circle the correct answer.**

- 39. A first-degree burn (will or will not) blister.
- 40. A second-degree burn (will or will not) scar.
- 41. A third-degree burn (will or will not) cause immediate pain.
- 42. According to the "rule of nines" the body is divided into (9 or 11) areas of 9%.
- 43. Destruction of the subcutaneous layer occurs in (second- or third-) degree burns.



*If you have had difficulty with this section, review pages 83-90.*



### 53. WORD FIND

Can you find 15 terms from this chapter? Words may be spelled top to bottom, bottom to top, right to left, left to right, or diagonally.

S U D O R I F E R O U S V K R  
E J U Q U E S T E C N O H Y U  
I S J L M E L A N O C Y T E H  
R I M U E N O T I R E P H S B  
O M K N V A S T R L A N U G O  
T R G U F G A U C E G O V W D  
A E A L P R D I O N T F D R N  
L D V A D M L C P D H S L Z F  
J I N Y N L R L A M E N I R E  
P P H Q O N E U X R R F E L G  
E E Z F J U M Y O U U O C C B  
D Z P E R J Y U V F C I I E O  
G J S I W J S K C D T N O Z C  
C O S M Z M F I B U G U X O J  
X Y P M E I W E C V S U G B I

Apocrine	Epidermis	Mucus
Blister	Follicle	Peritoneum
Cuticle	Lanugo	Pleurisy
Dehydration	Lunula	Serous
Depilatories	Melanocyte	Sudoriferous

### DID YOU KNOW?

- Because the dead cells of the epidermis are constantly being worn and washed away, we get a new outer layer of skin every 27 days.
- Your hair will grow 590 miles during your lifetime.
- Your fingernails will grow 84 feet during your lifetime.

# CHECK YOUR KNOWLEDGE

## Multiple Choice

Circle the correct answer.

1. What is the type of serous membrane that covers organs found in all body cavities called?
  - A. Visceral
  - B. Pleural
  - C. Parietal
  - D. Synovial
2. Which of the following statements about synovial membranes is *true*?
  - A. They are classified as epithelial.
  - B. They line joints.
  - C. They contain a parietal layer.
  - D. All of the above
3. Which of the following statements about hair follicles is *true*?
  - A. Arrector pili muscles are associated with them.
  - B. Sudoriferous glands empty into them.
  - C. They arise directly from the epidermis layer of the skin.
  - D. All of the above
4. Which of the following statements about apocrine glands is *true*?
  - A. They can be classified as sudoriferous.
  - B. They are found primarily in the armpit and genital regions.
  - C. They secrete a thick substance that has a strong odor associated with it.
  - D. All of the above
5. Which of the following, if any, is *not* found in the dermis layer of the skin?
  - A. Nerves
  - B. Melanin
  - C. Blood vessels
  - D. All of the above are found in the dermis
6. What characterizes second-degree burns?
  - A. Blisters
  - B. Swelling
  - C. Severe pain
  - D. All of the above
7. Blackheads can result from the blockage of which of the following glands?
  - A. Lacrimal
  - B. Sebaceous
  - C. Ceruminous
  - D. Sudoriferous
8. Keratin is found in which layer of the skin?
  - A. Dermis
  - B. Epidermis
  - C. Subcutaneous
  - D. Serous
9. What is the fold of skin that hides the root of a nail called?
  - A. Lunula
  - B. Body

- C. Cuticle
  - D. Papillae
10. Which of the following is *not* an important function of the skin?
- A. Sense organ activity
  - B. Absorption
  - C. Protection
  - D. Temperature regulation

## Matching

Select the most appropriate answer from column B for each item in column A. There is only one correct answer for each item.

Column A	Column B
_____ 11. Melanin	A. Fingerprint
_____ 12. Epithelial membrane	B. Pressure
_____ 13. Pacinian corpuscle	C. Brown pigment
_____ 14. Sebaceous	D. Pleura
_____ 15. Waterproofing	E. Synovial membrane
_____ 16. Hair	F. Perspiration
_____ 17. Lunula	G. Oil
_____ 18. Connective tissue membrane	H. Follicle
_____ 19. Dermal papillae	I. Keratin
_____ 20. Sudoriferous	J. Little moon

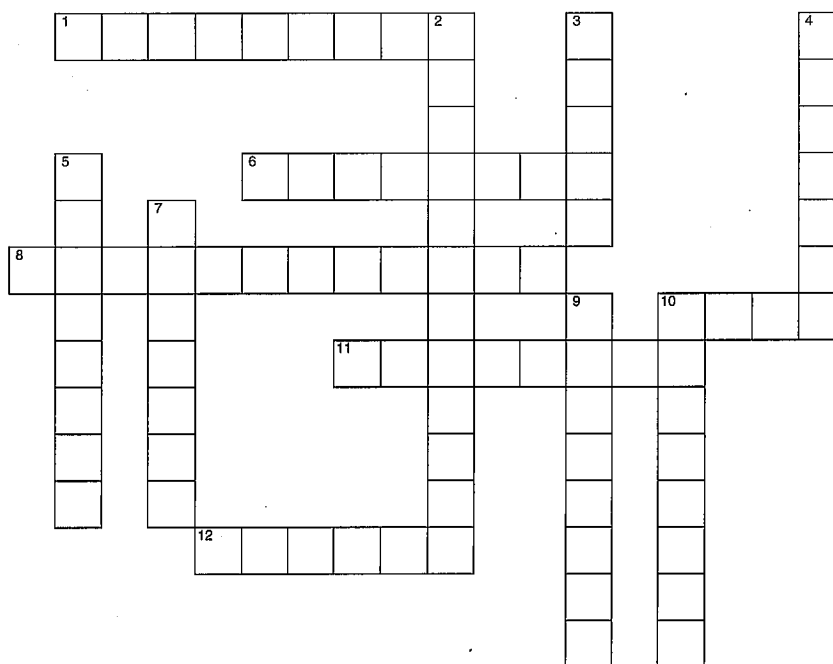
## Completion

Complete the phrases below with the following terms.

- |                         |                   |
|-------------------------|-------------------|
| A. Skin                 | F. Third-degree   |
| B. Eccrine sweat glands | G. Pleurisy       |
| C. Peritonitis          | H. Sebaceous      |
| D. Mucous               | I. Hair follicles |
| E. Epidermis            | J. Receptors      |
21. The \_\_\_\_\_ glands secrete oil or sebum for hair and skin.
  22. The first line of defense for the body is the \_\_\_\_\_.
  23. The \_\_\_\_\_ glands work throughout the body, helping to regulate body heat.
  24. The \_\_\_\_\_ burn may involve not only the epidermis and dermis but also muscle tissue.
  25. Hair growth requires epidermal, tube-like structures called \_\_\_\_\_.
  26. The outermost and thinnest primary layer of skin is called the \_\_\_\_\_.
  27. A condition that involves the inflammation of the serous membranes that line the chest cavity and cover the lungs is called \_\_\_\_\_.
  28. The \_\_\_\_\_ membrane lines body surfaces that open directly to the exterior of the body and produces mucus.
  29. Specialized nerve endings that make it possible for skin to act as a sense organ are called \_\_\_\_\_.
  30. \_\_\_\_\_ is a condition in which the serous membranes, which line the abdominal cavity and abdominal organs, are inflamed.

# SKIN/BODY MEMBRANES

Fill in the crossword puzzle.



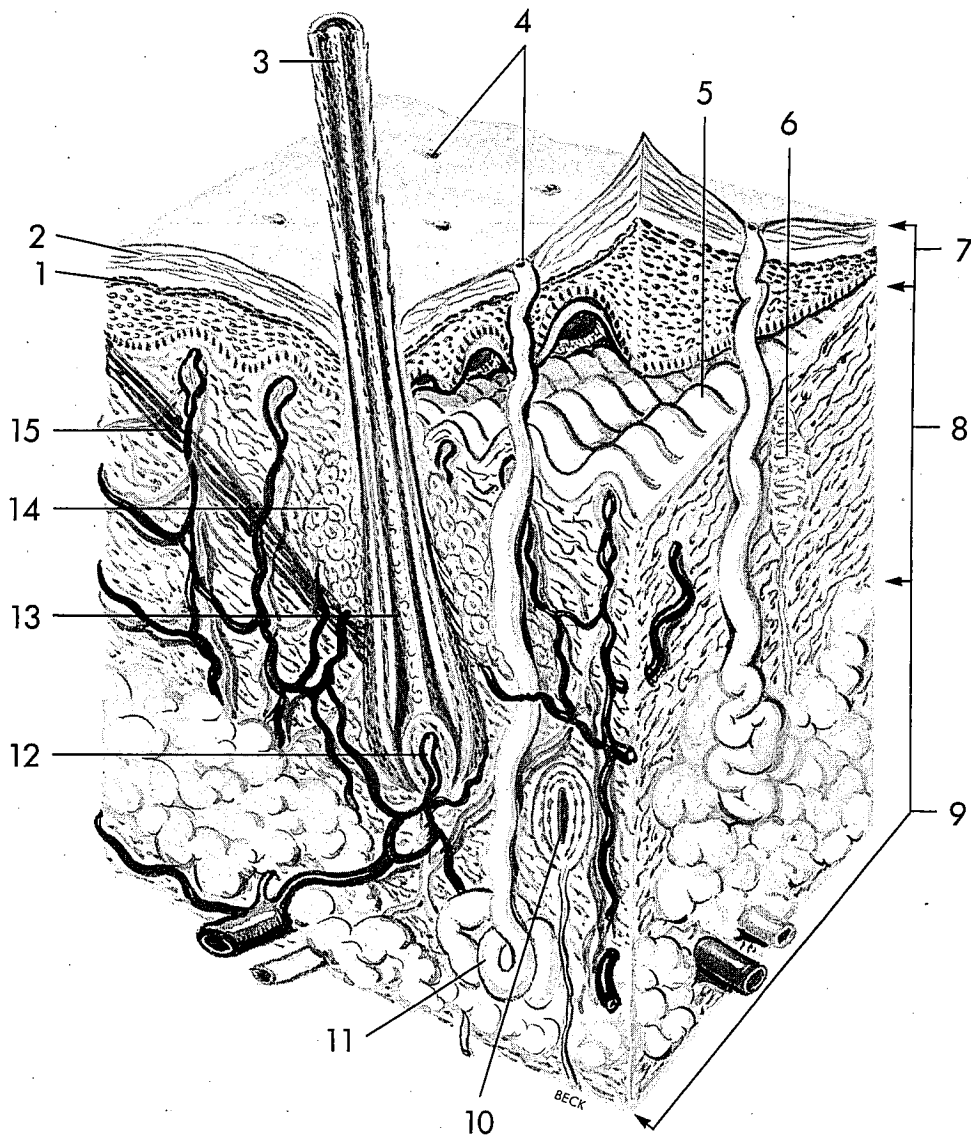
## Across

1. Oil gland
6. Bluish gray color of skin due to decreased oxygen
8. "Goose pimples" (two words)
10. Cutaneous
11. Inflammation of the serous membrane that lines the chest and covers the lungs
12. Deeper of the two primary skin layers

## Down

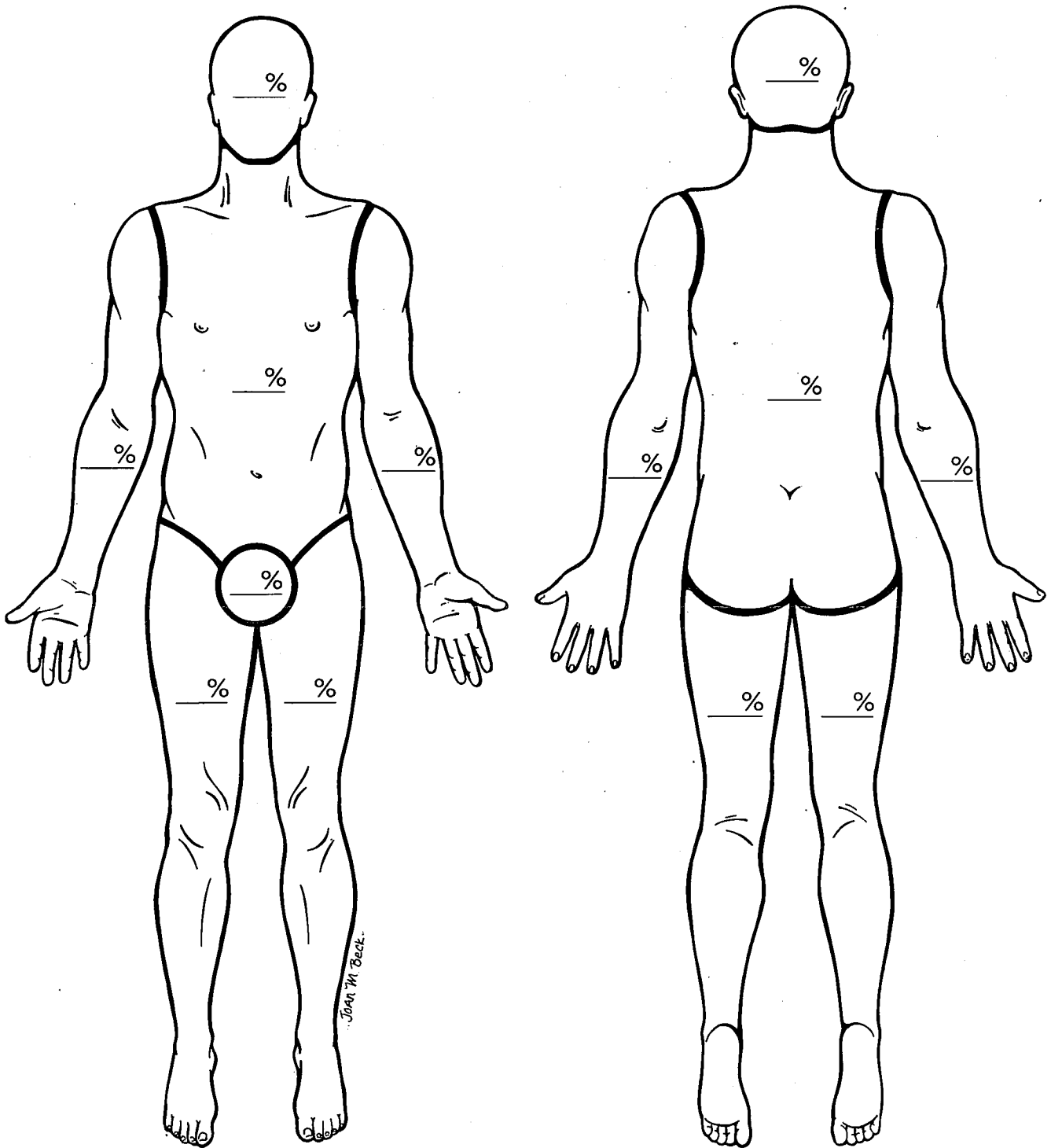
2. Sweat gland
3. Cushion-like sac found between moving body parts
4. Brown pigment
5. Forms the lining of serous body cavities
7. Tough waterproof substance that protects body from excess fluid loss
9. Covers the surface of organs found in serous body cavities
10. Membrane that lines joint spaces

# Longitudinal Section of the Skin



- |          |           |
|----------|-----------|
| 1. _____ | 9. _____  |
| 2. _____ | 10. _____ |
| 3. _____ | 11. _____ |
| 4. _____ | 12. _____ |
| 5. _____ | 13. _____ |
| 6. _____ | 14. _____ |
| 7. _____ | 15. _____ |
| 8. _____ |           |

# "Rule of Nines" for Estimating Skin Surface Burned



How strange we would look without our skeleton! It is the skeleton that provides us with the rigid, supportive framework that gives shape to our bodies. But this is just the beginning, since it also protects the organs beneath it, maintains the homeostasis of blood calcium, produces blood cells, and assists the muscular system in providing movement for us.

After reviewing the microscopic structures of bone and cartilage, you will understand how skeletal tissues are formed, their differences, and their importance in the human body. Your microscopic investigation will make the study of this system easier as you logically progress from this view to macroscopic bone formation and growth and as you visualize the structure of the long bones.

The skeleton is divided into two main divisions: the axial skeleton and the appendicular skeleton. All of the 206 bones of the human body may be classified into one of these two categories. And, although we can divide the bones neatly by this system, we are still aware that subtle differences exist between men's and women's skeletons. These structural differences provide us with insight into the differences in function between men and women.

Finally, three types of joints exist in the body: synarthroses, amphiarthroses, and diarthroses. It is important to have a knowledge of these joints and to understand how movement is facilitated by these various articulations.

## **TOPICS FOR REVIEW**

Before progressing to Chapter 6, you should familiarize yourself with the functions of the skeletal system, the structure and function of bone and cartilage, bone formation and growth, and the types of joints found in the body. Additionally, your understanding of the skeletal system should enable you to identify the two major subdivisions of the skeleton, the bones found in each area, and any differences that exist between men's and women's skeletons.


# FUNCTIONS OF THE SKELETAL SYSTEM

## TYPES OF BONES

### STRUCTURE OF LONG BONES

Fill in the blanks.

1. There are \_\_\_\_\_ types of bones.
2. The \_\_\_\_\_ is the hollow area inside the diaphysis of a bone.
3. The thin layer of cartilage covering each epiphysis is the \_\_\_\_\_.
4. The \_\_\_\_\_ lines the medullary cavity of long bones.
5. \_\_\_\_\_ is the process of blood cell formation.
6. Blood cell formation is a vital process carried on in \_\_\_\_\_.
7. The \_\_\_\_\_ is the strong fibrous membrane that covers long bones everywhere except at joint surfaces.
8. Osteoporosis occurs most frequently in \_\_\_\_\_.
9. Bones serve as a safety-deposit box for \_\_\_\_\_, a vital substance required for normal nerve and muscle function.
10. As muscles contract and shorten, they pull on bones and thereby \_\_\_\_\_ them.

 If you have had difficulty with this section, review pages 98 and 103.

## MICROSCOPIC STRUCTURE OF BONE AND CARTILAGE

Match the term on the left with the proper selection on the right.

Group A


- \_\_\_\_\_ 11. Trabeculae
- \_\_\_\_\_ 12. Compact
- \_\_\_\_\_ 13. Spongy
- \_\_\_\_\_ 14. Periosteum
- \_\_\_\_\_ 15. Cartilage

Group B

- \_\_\_\_\_ 16. Osteocytes
- \_\_\_\_\_ 17. Canaliculi
- \_\_\_\_\_ 18. Lamellae
- \_\_\_\_\_ 19. Chondrocytes
- \_\_\_\_\_ 20. Haversian system

- A. Outer covering of bone
- B. Dense bone tissue
- C. Fibers embedded in a firm gel
- D. Needle-like threads of spongy bone
- E. Ends of long bones


- A. Connect lacunae
- B. Cartilage cells
- C. Structural unit of compact bone
- D. Bone cells
- E. Ring of bone

 If you have had difficulty with this section, review pages 99-101.

# BONE FORMATION AND GROWTH

If the statement is true, write "T" in the answer blank. If the statement is false, correct the statement by circling the incorrect term and writing the correct term in the answer blank.

- \_\_\_\_\_ 21. When the skeleton forms in a baby before birth, it consists of cartilage and fibrous structures.
- \_\_\_\_\_ 22. Diaphyses are the ends of bones.
- \_\_\_\_\_ 23. Bone-forming cells are known as osteoclasts.
- \_\_\_\_\_ 24. It is the combined action of osteoblasts and osteoclasts that sculpts bones into their adult shapes.
- \_\_\_\_\_ 25. The stresses placed on certain bones during exercise decrease the rate of bone deposition.
- \_\_\_\_\_ 26. The epiphyseal plate can be seen in both external and cutaway views of an adult long bone.
- \_\_\_\_\_ 27. The shaft of a long bone is known as the articulation.
- \_\_\_\_\_ 28. Cartilage in the newborn becomes bone when it is replaced with calcified bone matrix that is deposited by osteoblasts.
- \_\_\_\_\_ 29. When epiphyseal cartilage becomes bone, growth begins.
- \_\_\_\_\_ 30. The epiphyseal cartilage is visible, if present, on x-ray films.

 If you have had difficulty with this section, review pages 101-103.

# DIVISIONS OF SKELETON

Circle the correct answer.

31. Which one of the following is *not* a part of the axial skeleton?
- A. Scapula
  - B. Cranial bones
  - C. Vertebra
  - D. Ribs
  - E. Sternum
32. Which one of the following is *not* a cranial bone?
- A. Frontal
  - B. Parietal
  - C. Occipital
  - D. Lacrimal
  - E. Sphenoid
33. Which of the following statements is *not* true?
- A. A baby is born with a straight spine.
  - B. In an adult, the sacral and thoracic curves are convex.
  - C. The normal curves of the adult spine provide greater strength than does a straight spine.
  - D. A curved structure has more strength than a straight one of the same size and materials.

34. True ribs:
- A. Attach to the cartilage of other ribs
  - B. Do not attach to the sternum
  - C. Attach directly to the sternum without cartilage
  - D. Attach directly to the sternum by means of cartilage
35. The bone that runs along the lateral side of your forearm is the:
- A. Humerus
  - B. Ulna
  - C. Radius
  - D. Tibia
36. The shinbone is also known as the:
- A. Fibula
  - B. Femur
  - C. Tibia
  - D. Ulna
37. The bones in the palm of the hand are called:
- A. Metatarsals
  - B. Tarsals
  - C. Carpals
  - D. Metacarpals
38. Which one of the following is *not* a bone of the upper extremity?
- A. Radius
  - B. Clavicle
  - C. Humerus
  - D. Ilium
39. The heel bone is known as the:
- A. Calcaneus
  - B. Talus
  - C. Metatarsal
  - D. Phalanges
40. The mastoid process is part of the \_\_\_\_\_ bone.
- A. Parietal
  - B. Temporal
  - C. Occipital
  - D. Frontal
41. When a baby learns to walk, the \_\_\_\_\_ area of the spine becomes concave.
- A. Lumbar
  - B. Thoracic
  - C. Cervical
  - D. Coccyx
42. Which bone is the "funny" bone?
- A. Radius
  - B. Ulna
  - C. Humerus
  - D. Carpal
43. There are \_\_\_\_\_ pairs of true ribs.
- A. 14
  - B. 7

## 96. WORD FIND

Can you find 14 terms from this chapter? Words may be spelled top to bottom, bottom to top, right to left, left to right, or diagonally.

A R T I C U L A T I O N N U T  
M M L T N I N G U I H J N C G  
P R P E R I O S T E U M A N B  
H V P G U A T B M E O P R F G  
I N V R N O B O F S M H X E R  
A G J O A J P E T O E O H T Q  
R U R B X O E E C A S G I S B  
T S S Y I M O Q N U O O L X Q  
H J I E A B P U N Q L E Q K S  
R I S I L U C I L A N A C X R  
O I N A M A S Q M A Q K E C T  
S T S A L C O E T S O U I D G  
E T S Y F W L N M P U F N U F  
S B H Q H L O U S A R X I T V  
R P M P A F M G X K D S L G A

Amphiarthroses	Fontanels	Osteoclasts
Articulation	Hemopoiesis	Periosteum
Axial	Lacunae	Sinus
Canaliculi	Lamella	Trabeculae
Compact	Osteoblasts	

## DID YOU KNOW?

- The bones of the hands and feet make up more than half of the 206 total bones of the body.
- Approximately 25 million Americans have osteoporosis; four out of five of them are women.
- The bones of the middle ear are mature at birth.

80. (Ligaments or tendons) grow out of periosteum and attach two bones together.
81. The (articular cartilage or epiphyseal cartilage) absorbs jolts.
82. Gliding joints are the (least movable or most movable) of the diarthrotic joints.
83. The knee is the (largest or smallest) joint.
84. Hinge joints allow motion in (2 or 4) directions.
85. The saddle joint at the base of each of our thumbs allows for greater (strength or mobility).
86. When you rotate your head, you are using a (gliding or pivot) joint.

▶ If you have had difficulty with this section, review pages 120-126.

## UNSCRAMBLE THE BONES

87. ETVERRBAE  
 ○ □ □ □ □ ○ □ □ □ □

88. BPSUI  
 ○ □ □ □ ○ □ □

89. SCALUPA  
 □ ○ □ □ □ □ □ ○ □ □

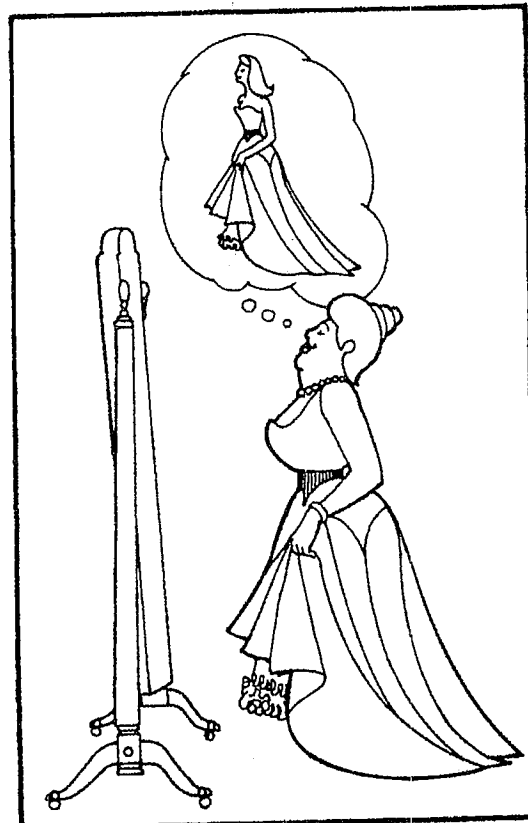
90. IMDBALNE  
 □ □ □ □ ○ □ □ □ □ □ □ ○

91. APNHGAELS  
 □ □ □ □ ○ □ □ □ □ □ □ ○ □ □ □

Take the circled letters, unscramble them, and fill in the statement.

**What the fat lady wore to the ball.**

92. □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □



## APPLYING WHAT YOU KNOW

93. Mrs. Perine had advanced cancer of the bone. As the disease progressed, Mrs. Perine required several blood transfusions throughout her therapy. One day she asked the doctor to explain the necessity for the transfusions. What explanation might the doctor give to Mrs. Perine?

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94. Dr. Kennedy, an orthopedic surgeon, called the admissions office of the hospital to advise that within the next hour he would be admitting a patient with an epiphyseal fracture. Without any other information, the patient is assigned to the pediatric ward. What prompted this assignment?

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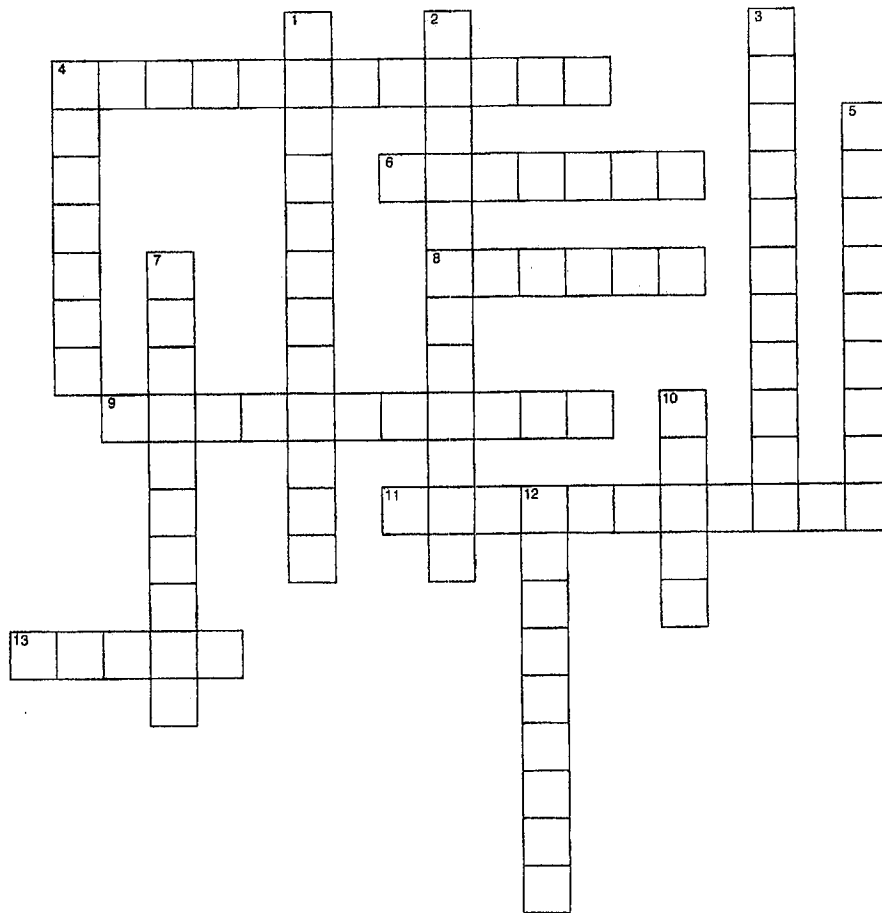
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95. Mrs. Van Skiver, who is 60 years old, noticed when she went in for her physical examination that she was half an inch shorter than she had been on her last visit. Dr. Veazey suggested that Mrs. Van Skiver begin a regimen of dietary supplements of calcium and vitamin D, and he also gave Mrs. Van Skiver a prescription for sex hormone therapy. What bone disease did Dr. Veazey suspect?

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# SKELETAL SYSTEM

Fill in the crossword puzzle.



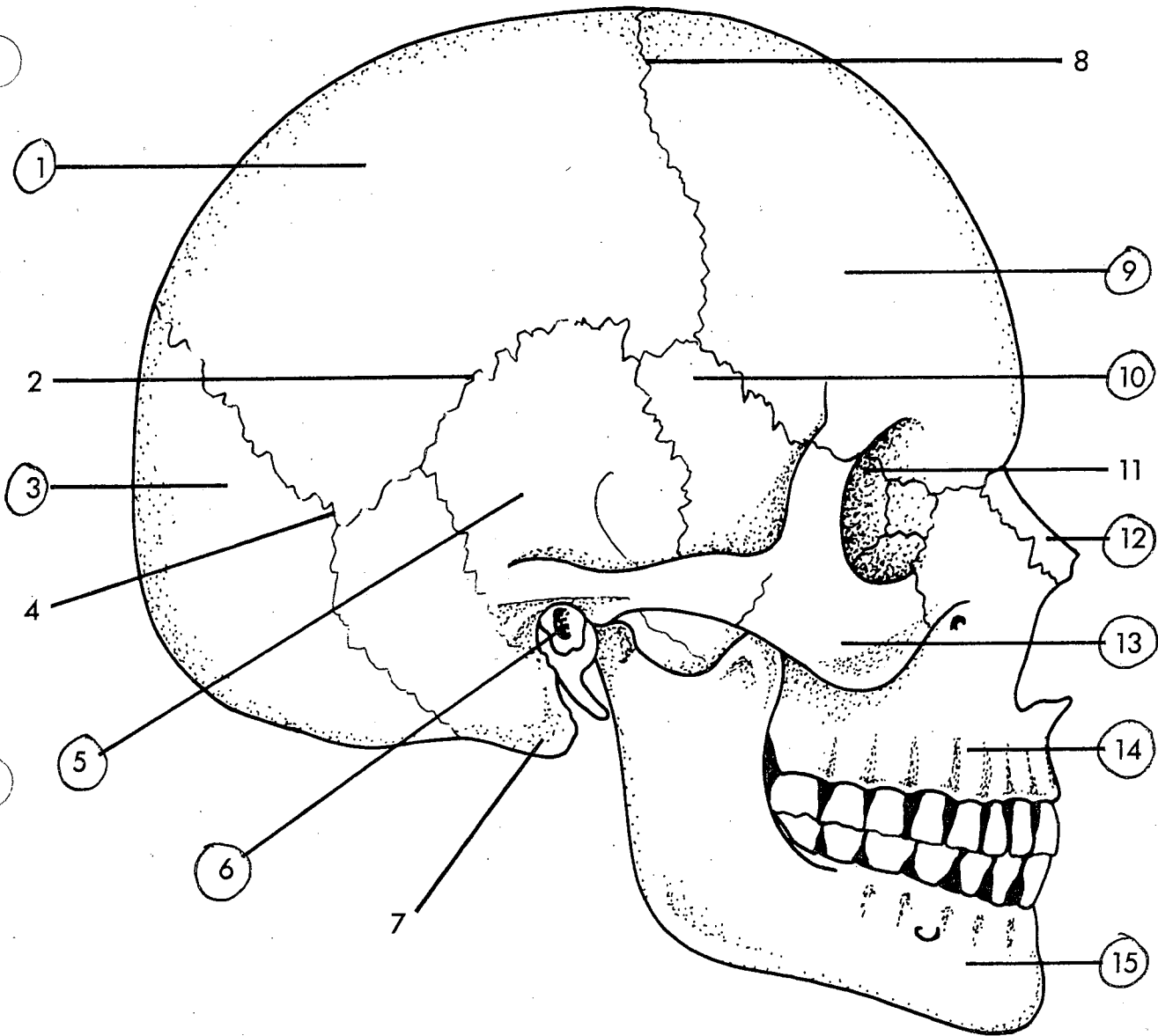
## Across

- 4. Cartilage cells
- 6. Spaces in bones where osteocytes are found
- 8. Chest
- 9. Freely movable joints
- 11. Process of blood cell formation
- 13. Space inside cranial bone

## Down

- 1. Joint
- 2. Suture joints
- 3. Bone-absorbing cells
- 4. Type of bone
- 5. Ends of long bones
- 7. Covers long bone except at its joint surfaces
- 10. Division of skeleton
- 12. Bone cell

# Skull Viewed from the Right Side

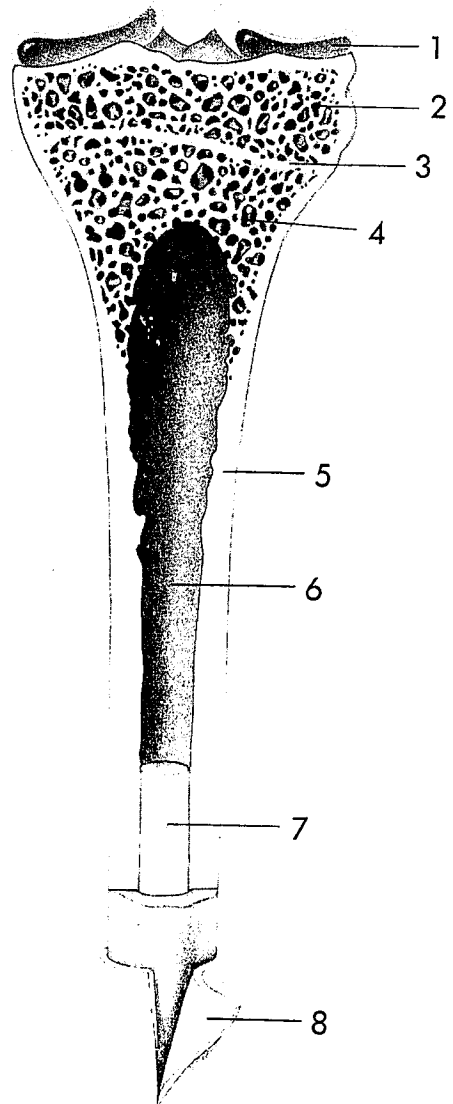


1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_

9. \_\_\_\_\_
10. \_\_\_\_\_
11. \_\_\_\_\_
12. \_\_\_\_\_
13. \_\_\_\_\_
14. \_\_\_\_\_
15. \_\_\_\_\_

# Longitudinal Section of Long Bone

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_



*John M. Beck*