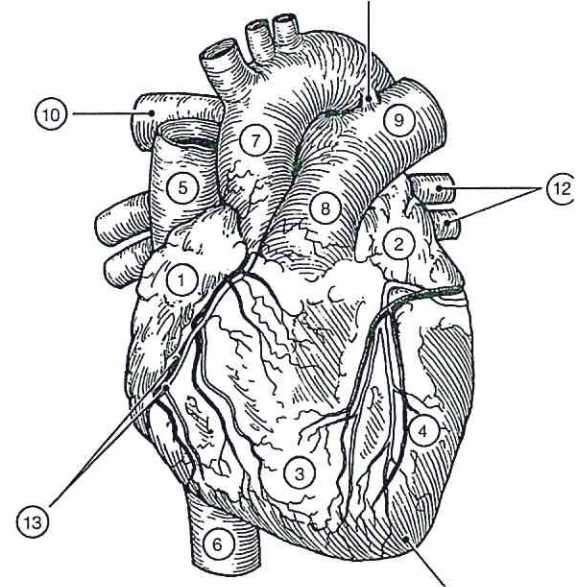


# 5 THE SKELETAL SYSTEM



The skeleton is constructed of two of the most supportive tissues found in the human body—cartilage and bone. Besides supporting and protecting the body as an internal framework, the skeleton provides a system of levers that the skeletal muscles use to move the body. In addition, the bones provide a storage depot for substances such as lipids and calcium, and blood cell formation goes on within their red marrow cavities.

The skeleton consists of bones connected at joints, or articulations, and is subdivided into two divisions. The axial skeleton includes those bones that lie around the body's center of gravity. The appendicular skeleton includes the bones of the limbs.

Topics for student review include structure and function of long bones, location and naming of specific bones in the skeleton, fracture types, and a classification of joint types in the body.

## BONES—AN OVERVIEW

1. Classify each of the following terms as a projection (*P*) or a depression or opening (*D*). Enter the appropriate letter in the answer blanks.

- |                |                |                   |
|----------------|----------------|-------------------|
| ___ 1. Condyle | ___ 4. Foramen | ___ 7. Ramus      |
| ___ 2. Crest   | ___ 5. Head    | ___ 8. Spine      |
| ___ 3. Fissure | ___ 6. Meatus  | ___ 9. Tuberosity |

2. Group each of the following bones into one of the four major bone categories. Use *L* for long bone, *S* for short bone, *F* for flat bone, and *I* for irregular bone. Enter the appropriate letter in the space provided.

- |                  |                   |                 |
|------------------|-------------------|-----------------|
| ___ 1. Calcaneus | ___ 4. Humerus    | ___ 7. Radius   |
| ___ 2. Frontal   | ___ 5. Mandible   | ___ 8. Sternum  |
| ___ 3. Femur     | ___ 6. Metacarpal | ___ 9. Vertebra |

3. Using the key choices, characterize the following statements relating to long bones. Enter the appropriate term(s) or letter(s) in the answer blanks.

*Key Choices*

- |                     |               |                         |
|---------------------|---------------|-------------------------|
| A. Diaphysis        | C. Epiphysis  | E. Yellow marrow cavity |
| B. Epiphyseal plate | D. Red marrow |                         |

- \_\_\_\_\_ 1. Site of spongy bone in the adult
- \_\_\_\_\_ 2. Site of compact bone in the adult
- \_\_\_\_\_ 3. Site of hematopoiesis in the adult
- \_\_\_\_\_ 4. Scientific name for bone shaft
- \_\_\_\_\_ 5. Site of fat storage in the adult
- \_\_\_\_\_ 6. Site of longitudinal growth in a child

4. Complete the following statements concerning bone formation and destruction, using the terms provided in the key. Insert the key letter or corresponding term in the answer blanks.

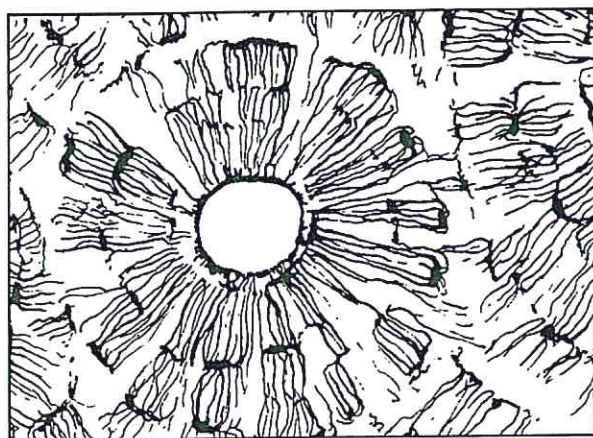
*Key Choices*

- |               |                |                |                          |
|---------------|----------------|----------------|--------------------------|
| A. Atrophy    | C. Gravity     | E. Osteoclasts | G. Parathyroid hormone   |
| B. Calcitonin | D. Osteoblasts | F. Osteocytes  | H. Stress and/or tension |

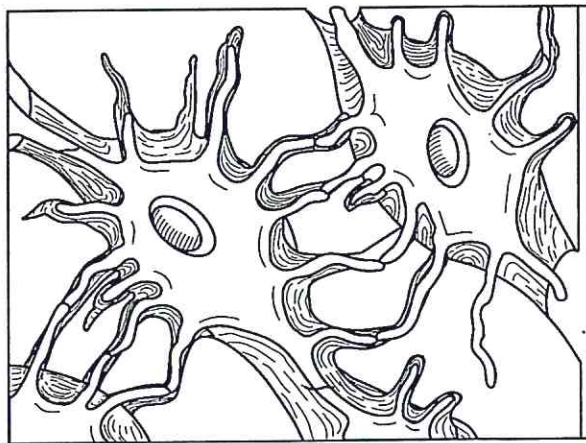
- \_\_\_\_\_ 1. When blood calcium levels begin to drop below homeostatic levels, (1) is released, causing calcium to be released from bones.
- \_\_\_\_\_ 2. Mature bone cells, called (2), maintain bone in a viable state.
- \_\_\_\_\_ 3. Disuse such as that caused by paralysis or severe lack of exercise results in muscle and bone (3).
- \_\_\_\_\_ 4. Large tubercles and/or increased deposit of bony matrix occur at sites of (4).
- \_\_\_\_\_ 5. Immature, or matrix-depositing, bone cells are referred to as (5).
- \_\_\_\_\_ 6. (6) causes blood calcium to be deposited in bones as calcium salts.
- \_\_\_\_\_ 7. Bone cells that liquefy bone matrix and release calcium to the blood are called (7).
- \_\_\_\_\_ 8. Our astronauts must do isometric exercises when in space because bones atrophy under conditions of weightlessness or lack of (8).

5. Five descriptions of bone structure are provided in Column A. First identify the structure by choosing the appropriate term from Column B and placing the corresponding answer in the answer blank. Then consider Figure 5-1A, a diagrammatic view of a cross section of bone, and Figure 5-1B, a higher magnification view of compact bone tissue. Select different colors for the structures and bone areas in Column B, and use them to color the coding circles and corresponding structures on the figure diagrams. Because the concentric lamellae would be difficult to color without confusing other elements, identify one lamella by using a bracket and label.

| <b>Column A</b>  | <b>Column B</b>                                    |
|--|--|
| _____ 1. Layers of calcified matrix                            | A. Central (Haversian) canal <input type="radio"/> |
| _____ 2. "Residences" of osteocytes                            | B. Concentric lamellae                             |
| _____ 3. Longitudinal canal, carrying blood vessels and nerves | C. Lacunae <input type="radio"/>                   |
| _____ 4. Nonliving, structural part of bone                    | D. Canaliculi <input type="radio"/>                |
| _____ 5. Tiny canals, connecting lacunae                       | E. Bone matrix <input type="radio"/>               |
|  | F. Osteocyte <input type="radio"/>                 |



A



B

Figure 5-1

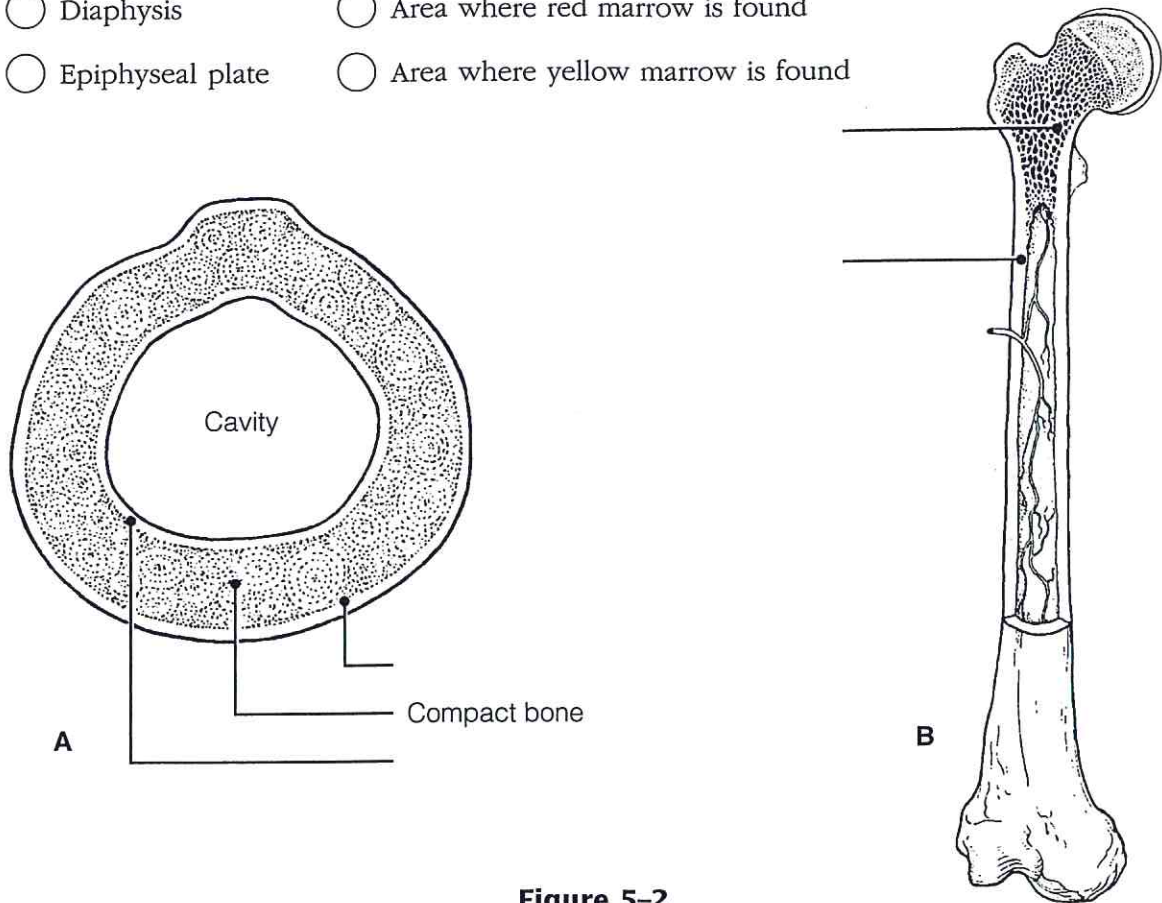
6. Circle the term that does not belong in each of the following groupings.

- |                      |                     |               |                   |
|----------------------|---------------------|---------------|-------------------|
| 1. Hematopoiesis     | Red marrow          | Yellow marrow | Spongy bone       |
| 2. Lamellae          | Canaliculi          | Circulation   | Osteoblasts       |
| 3. Osteon            | Marrow cavity       | Central canal | Canaliculi        |
| 4. Epiphysis surface | Articular cartilage | Periosteum    | Hyaline cartilage |

7. Figure 5-2A is a midlevel, cross-sectional view of the diaphysis of the femur. Label the membrane that lines the cavity and the membrane that covers the outside surface.

Figure 5-2B is a drawing of a longitudinal section of the femur. Color the bone tissue gold. Do *not* color the articular cartilage; leave it white. Select different colors for the bone regions listed at the coding circles below. Color the coding circles and the corresponding regions on the drawing. Complete Figure 5-2B by labeling compact bone and spongy bone.

- Diaphysis                       Area where red marrow is found  
 Epiphyseal plate               Area where yellow marrow is found



**Figure 5-2**

8. The following events apply to the endochondral ossification process as it occurs in the primary ossification center. Put these events in their proper order by assigning each a number (1-6).
- \_\_\_\_\_ 1. Cavity formation occurs within the hyaline cartilage.
  - \_\_\_\_\_ 2. Collar of bone is laid down around the hyaline cartilage model just beneath the periosteum.
  - \_\_\_\_\_ 3. Periosteal bud invades the marrow cavity.
  - \_\_\_\_\_ 4. Perichondrium becomes vascularized to a greater degree and becomes a periosteum.
  - \_\_\_\_\_ 5. Osteoblasts lay down bone around the cartilage spicules in the bone's interior.
  - \_\_\_\_\_ 6. Osteoclasts remove the cancellous bone from the shaft interior, leaving a marrow cavity that then houses fat.

## AXIAL SKELETON

### Skull

9. Using the key choices, identify the bones indicated by the following descriptions. Enter the appropriate term or letter in the answer blanks.

- |       |  |  |
|-------|--|--|
| _____ | 1. Forehead bone   | <i>Key Choices</i>                           |
| _____ | 2. Cheekbone   | A. Ethmoid                                   |
| _____ | 3. Lower jaw   | B. Frontal                                   |
| _____ | 4. Bridge of nose  | C. Hyoid                                     |
| _____ | 5. Posterior part of hard palate   | D. Lacrimals                                 |
| _____ | 6. Much of the lateral and superior cranium                              | E. Mandible                                  |
| _____ | 7. Most posterior part of cranium  | F. Maxillae                                  |
| _____ | 8. Single, irregular, bat-shaped bone, forming part of the cranial floor | G. Nasals                                    |
| _____ | 9. Tiny bones, bearing tear ducts  | H. Occipital                                 |
| _____ | 10. Anterior part of hard palate   | I. Palatines                                 |
| _____ | 11. Superior and middle nasal conchae formed from its projections        | J. Parietals                                 |
| _____ | 12. Site of mastoid process  | K. Sphenoid                                  |
| _____ | 13. Site of sella turcica  | L. Temporals                                 |
| _____ | 14. Site of cribriform plate   | M. Vomer                                     |
| _____ | 15. Site of mental foramen   | N. Zygomatic                                 |
| _____ | 16. Site of styloid process  |  |
| _____ | 17. _____  | 18. Four bones, containing paranasal sinuses |
| _____ | 19. _____  | 20. _____                                    |
| _____ | 21. Its condyles articulate with the atlas                               |  |
| _____ | 22. Foramen magnum contained here  |  |
| _____ | 23. Middle ear found here  |  |
| _____ | 24. Nasal septum   |  |
| _____ | 25. Bears an upward protrusion, the "cock's comb," or crista galli       |  |
| _____ | 26. Site of external acoustic meatus                                     |  |

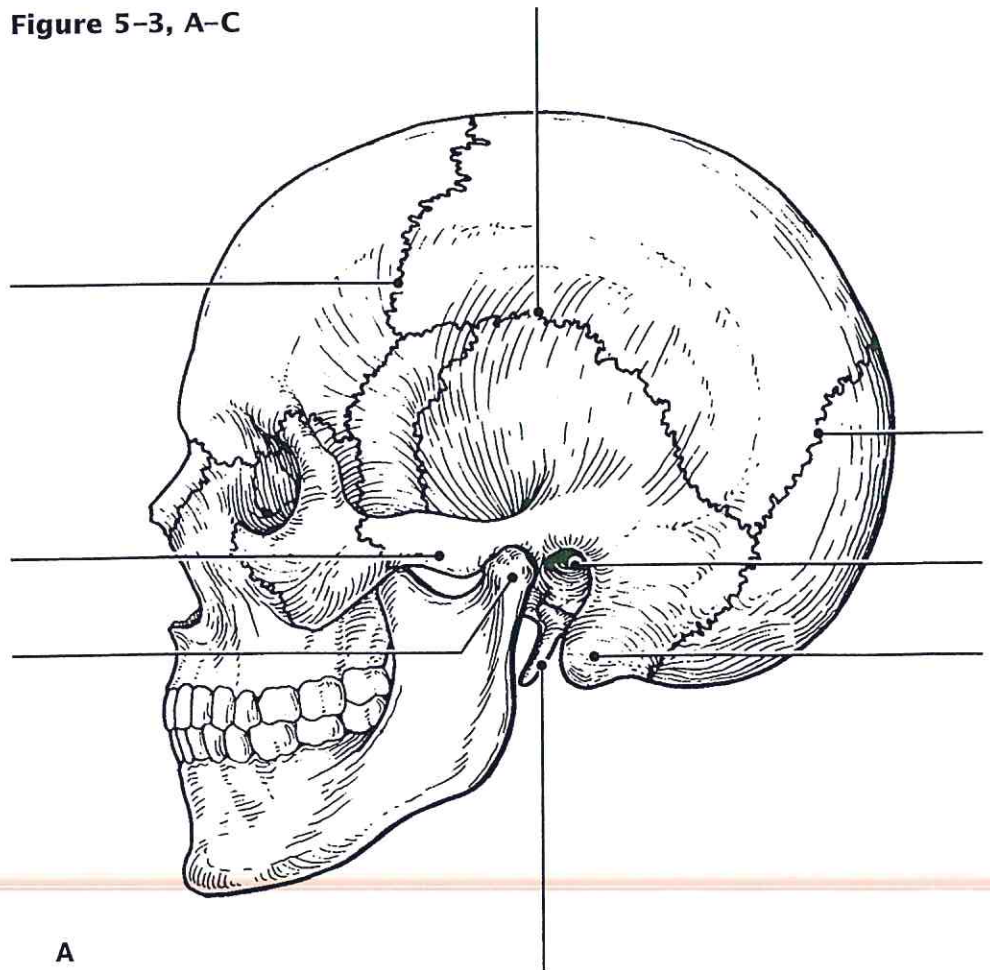
10. For each statement that is true, insert *T* in the answer blank. For false statements, correct the underlined words by inserting the correct words in the answer blanks.

- \_\_\_\_\_ 1. When a bone forms from a fibrous membrane, the process is called endochondral ossification.
- \_\_\_\_\_ 2. When trapped in lacunae, osteoblasts change into osteocytes.
- \_\_\_\_\_ 3. Large numbers of osteocytes are found in the inner periosteum layer.
- \_\_\_\_\_ 4. Primary ossification centers appear in the epiphyses of a long bone.
- \_\_\_\_\_ 5. Epiphyseal plates are made of spongy bone.
- \_\_\_\_\_ 6. In appositional growth, bone reabsorption occurs on the periosteal surface.
- \_\_\_\_\_ 7. "Maturation" of newly formed (noncalcified) bone matrix takes about 10 days.

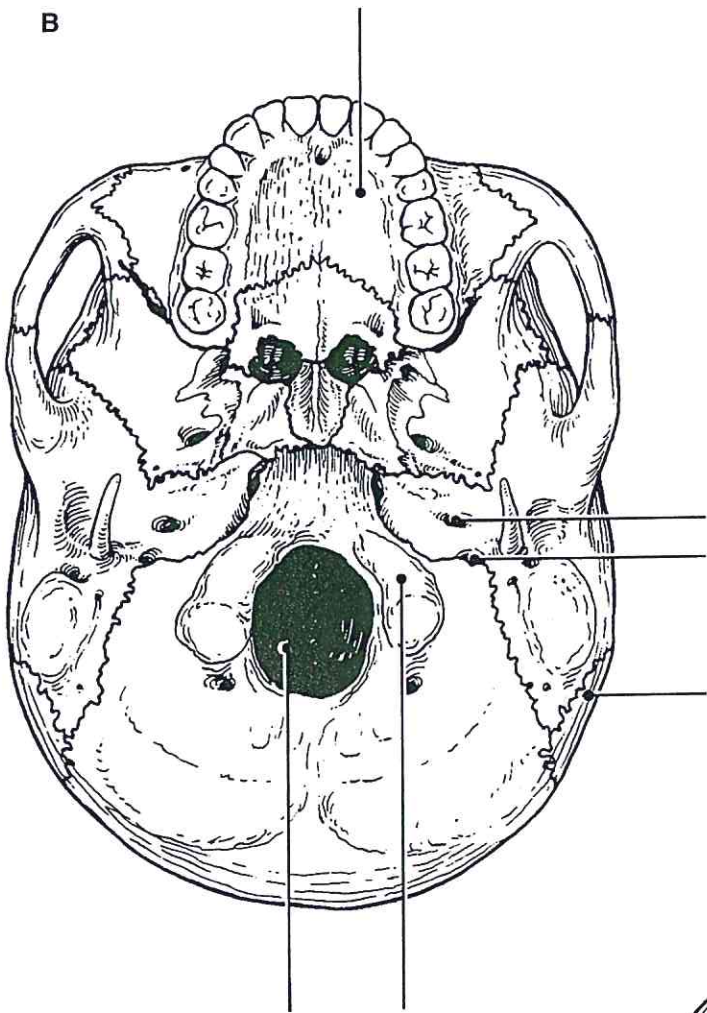
11. Figure 5-3, A-C shows lateral, anterior, and inferior views of the skull. Select different colors for the bones listed below and color the coding circles and corresponding bones in the figure. Complete the figure by labeling the bone markings indicated by leader lines.

- Frontal
- Parietal
- Mandible
- Maxilla
- Sphenoid
- Ethmoid
- Temporal
- Zygomatic
- Palatine
- Occipital
- Nasal
- Lacrimal
- Vomer

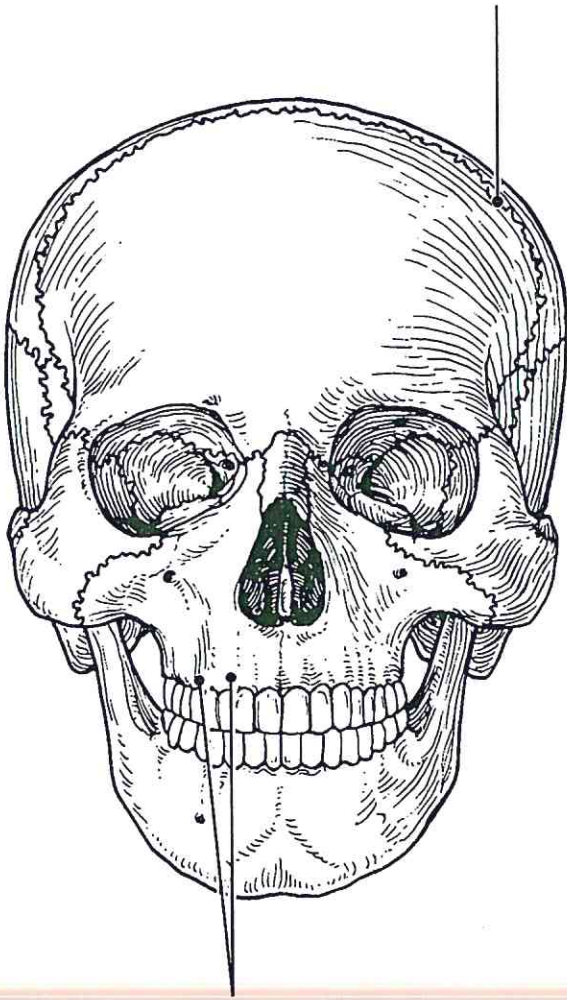
**Figure 5-3, A-C**



B



C



12. An anterior view of the skull, showing the positions of the sinuses, is provided in Figure 5-4. First select different colors for each of the sinuses and use them to color the coding circles and the corresponding structures on the figure. Then briefly answer the following questions concerning the sinuses.

Sphenoid sinus

Ethmoid sinuses

Frontal sinus

Maxillary sinus

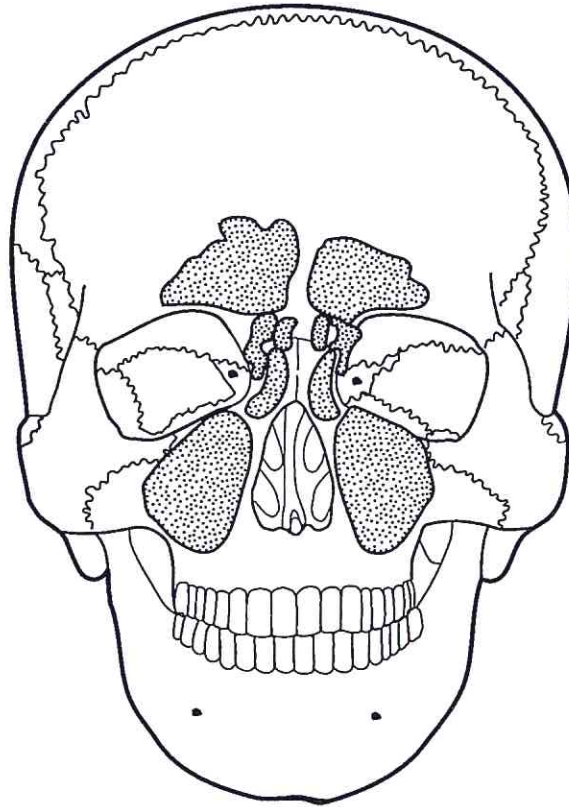


Figure 5-4

1. What *are* sinuses? \_\_\_\_\_

2. What purpose do they serve in the skull? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. Why are they so susceptible to infection? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_