

## Chapter 5 The Skeletal System

### OVERVIEW

The purpose of this chapter is to teach the anatomy, physiology, and pathology of the skeletal system.

This chapter begins with gross anatomy of the skeleton before microanatomy of bone and cartilage tissues. This gives the students more time to learn the bones, and places the microanatomy just before physiology where students learn how the microanatomy functions to achieve and maintain homeostasis in the skeletal system. Bone development over a life span is covered through Chloe as a fetus and as a developing child, her mother, and the effects of aging section. In addition, this chapter introduces a few pathology issues associated with the skeletal system.

A list of all of the bones, structures, markings, and microscopic anatomy covered in the Chapter 5 is provided at the end of this instructor's manual (IM) chapter. You can tailor the list to meet the needs of your course. Providing the customized list to students facilitates their note taking and helps them know exactly what they have to learn.

Chapter figures can be found in the Online Learning Center (OLC). Discussion points, group activities, and quizzes listed in the summary table below are explained under their individual outcomes following the table. Answer keys to the text chapter review questions, workbook concept maps, and workbook review questions are located at the end of the chapter.

A review guide is also available on the OLC. This guide lists all of the learning outcomes for the chapter and gives space for students to take notes and make sketches. This can be an important tool to encourage students to pay attention to what they are learning and to use to either take initial notes or to organize their existing notes before exams.

### COMPETENCY CORRELATION GRID

Learning Outcome	CAAHEP Competencies	ABHES Competencies
5.1 Use medical terminology related to the skeletal system.	I.C.1. Describe structural organization of the human body	3.a. Define and use entire basic structure of medical words and be able to accurately identify in the correct context, i.e., root, prefix, suffix, combinations, spelling and definitions

5.2 Distinguish between the axial skeleton and the appendicular skeleton.	I.C.2. Identify body systems	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.3 Describe five types of bones classified by shape.	I.C.2. Identify body systems	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.4 Identify bones, markings, and structures of the axial skeleton and appendicular skeleton.	I.C.2. Identify body systems	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.5 Describe the cells, fibers, and matrix of bone tissue.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.6 Compare and contrast the histology of compact and cancellous bone.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.7 Compare and contrast the histology of hyaline, elastic, and fibrocartilage connective tissues.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.8 Describe the anatomy of a long bone.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.9 Distinguish between two types of bone marrow in terms of location and function.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.10 Describe three major structural classes of joints and the types of joints in each class.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.11 Differentiate between rheumatoid arthritis and osteoarthritis.	I.C.6. Identify common pathology related to each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.12 Explain how minerals are deposited in bone.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.13 Compare and contrast endochondral and intramembranous ossification.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.14 Compare and contrast endochondral and appositional bone growth.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.

5.15 Explain how bone is remodeled by reabsorption.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.16 Explain the nutritional requirements of the skeletal system.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.17 Describe the negative-feedback mechanisms affecting bone deposition and reabsorption by identifying the relevant glands, hormones, target tissues, and hormone functions.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.18 Summarize the six functions of the skeletal system and give an example or explanation of each.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.19 Summarize the effects of aging on the skeletal system.	I.C.10. Compare body structure and function of the human body across the life span	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.20 Classify fractures using descriptive terms.	I.C.6. Identify common pathology related to each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.21 Explain how a fracture heals.	I.C.6. Identify common pathology related to each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.22 Describe a diagnostic test commonly used when diagnosing skeletal system disorders	I.C.6. Identify common pathology related to each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
5.23 Describe skeletal system disorders and relate abnormal function to the pathology.	I.C.6. Identify common pathology related to each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.

SUMMARY TABLE 5

LEARNING OUTCOME	LECTURE OUTLINE	ACTIVITIES – TALKING POINTS	ASSESSMENTS
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5.1 Use medical terminology related to the skeletal system.	I. Overview <b>Chapter figure</b> 5.1 (The Skeletal System)	<b>WkBk Word Roots &amp; Combining Forms</b>	<b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"> <li>Word Deconstruction 1-5</li> </ul>
5.2 Distinguish between the axial skeleton and the appendicular skeleton.	II. Anatomy of the skeletal system <b>Chapter Figure:</b> 5.2 (The Axial and Appendicular Skeletons)	<p><b>Talking Point:</b></p> <p>There is significantly more anatomy in this system than the last chapter. You may want to help the students organize their study of anatomy by using the Skeletal Structures List at the end of this IM chapter (list can be customized to meet the needs of your course). Organizational skills learned in this system will aid the student's study of future systems.</p> <p><b>WkBk Coloring Book:</b></p> <ul style="list-style-type: none"> <li>Axial versus Appendicular</li> <li>Figure 5.1 (Axial and Appendicular Skeleton)</li> </ul> <p><b>WkBk Concept Maps:</b></p> <ul style="list-style-type: none"> <li>Figure 5.10 (Composition of the skeletal system concept map)</li> </ul>	<b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"> <li>MS: 2</li> </ul>

<p>5.3 Describe five types of bones classified by shape.</p>	<p>A. Classification of bones</p> <ol style="list-style-type: none"> <li>1. Long bones</li> <li>2. Short bones</li> <li>3. Flat bones</li> <li>4. Irregular bones</li> <li>5. Sesamoid bones</li> </ol> <p><b>Chapter Figures:</b></p> <p>5.3 (Long bones of the hand and short bones of the wrist)</p> <p>5.4 (Flat bones-sternum and ribs)</p> <p>5.5 (Irregular bones – typical vertebra)</p> <p>5.6 (Sesamoid bone – the patella)</p>	<p><b>Talking point:</b></p> <p>The first cervical vertebrae is called the atlas. Atlas comes from Greek mythology in reference to Atlas is the mythological man that holds the earth in space. The atlas vertebrae holds the head in place.</p> <p>The second cervical vertebrae has a structure called the dens. The atlas pivots on the dens so the head rotates left and right.</p>	<p><b>WkBk Chapter Review Questions:</b></p> <ul style="list-style-type: none"> <li>• Matching: 1-5</li> <li>• Completion: 1</li> </ul>
<p>5.4 Identify bones, markings, and structures of the axial skeleton and appendicular skeletons.</p>	<p>B. Axial Skeleton</p> <ol style="list-style-type: none"> <li>1. Cranial bones</li> <li>2. Facial bones</li> </ol> <p><b>Chapter Figures:</b></p> <p>5.7 (Anterior view of the skull)</p> <p>5.8 (Lateral view of the skull)</p> <p>5.9 (Medial view of the skull)</p> <p>5.10 (Inferior view of the skull)</p> <p>5.11 (Cranial floor of the skull)</p> <p>5.12 (Superior view of the skull)</p> <p>5.13 (The ethmoid and sphenoid</p>	<p><b>WkBk Coloring Book:</b></p> <ul style="list-style-type: none"> <li>• Figure 5.1 (Axial versus appendicular skeletons)</li> <li>• Figure 5.2 (The Skull)</li> <li>• Figure 5.3 (The hand and foot)</li> </ul> <p><b>WkBk Lab Exercises and Activities:</b></p> <ul style="list-style-type: none"> <li>• Figure 5.4 (Bones of the skeleton)</li> <li>• Figures 5.5, 5.6, 5.7, 5.8, 5.9 (Right or left?)</li> </ul>	<p><b>Spot Check:</b> 1–4</p> <p><b>WkBk Chapter Review Questions:</b></p> <ul style="list-style-type: none"> <li>• MS: 1, 2</li> <li>• Completion: 2</li> </ul>

	<p>bones)</p> <p>5.14 (Sinuses)</p> <p>3. Spinal column</p> <p>a. Cervical vertebrae</p> <p>b. Thoracic vertebrae</p> <p>c. Lumbar vertebrae</p> <p>d. Sacrum and coccyx</p> <p><b>Chapter Figures:</b></p> <p>5.15 (Spinal column)</p> <p>5.16 (Adult spinal column curvatures)</p> <p>5.17 (Abnormal curvatures of the spinal column)</p> <p>5.18 (A vertebra)</p> <p>5.19 (Cervical vertebrae)</p> <p>5.20 (Thoracic and lumbar vertebrae)</p> <p>4. Sternum</p> <p>5. Ribs</p> <p><b>Chapter Figures:</b></p> <p>5.21 (Sacrum and coccyx)</p> <p>5.22 (The sternum and ribs)</p> <p>5.23 (Rib 6 attachment to T5 and T6)</p> <p>6. Hyoid bone</p> <p><b>Chapter Figures:</b></p> <p>5.24 (Hyoid bone)</p>	<p><b>WkBk Concept Maps:</b></p> <ul style="list-style-type: none"> <li>Figure 5.10 (Composition of the skeletal system)</li> </ul> <p><b>Talking point:</b></p> <p>There are 8 cranial bones.</p> <p>There are 14 facial bones.</p> <p>There are 7 associated bones (6 ossicles and 1 hyoid)</p> <p>There is 1 sternum.</p> <p>There are 24 ribs.</p> <p>There are 24 vertebrae.</p> <p>There is 1 sacrum.</p> <p>There is 1 coccyx.</p> <p>There is a total of 80 axial bones.</p> <p>There are 4 bones making up the pectoral girdle.</p> <p>There are 2 humerus bones.</p> <p>There are 2 radius bones.</p> <p>There are 2 ulna bones.</p> <p>There are 16 carpals (8 per wrist).</p> <p>There are 10 metacarpals (5 per wrist).</p> <p>There are 28 phalanges (14 per wrist).</p>	
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	<p>C. Appendicular skeleton</p> <ol style="list-style-type: none"> <li>1. Pectoral girdle</li> <li>2. Bones of the upper limb <ol style="list-style-type: none"> <li>a. Humerus</li> <li>b. Radius</li> <li>c. Ulna</li> <li>d. Carpal bones</li> <li>e. Metacarpals</li> <li>f. Phalanges</li> </ol> </li> </ol> <p><b>Chapter Figures:</b></p> <p>5.25 (Right clavicle)</p> <p>5.26 (Scapula)</p> <p>5.27 (Humerus)</p> <p>5.28 (Radius and ulna)</p> <p>5.29 (Right wrist and hand)</p> <p>5.30 (X-ray of a hand)</p> <ol style="list-style-type: none"> <li>3. Pelvic girdle</li> <li>4. Bones of the lower limb <ol style="list-style-type: none"> <li>a. Femur</li> <li>b. Patella</li> <li>c. Tibia</li> <li>d. Fibula</li> <li>e. Tarsal bones</li> <li>f. Metatarsals</li> <li>g. Phalanges</li> </ol> </li> </ol>	<p>There is a total of 64 bones making up the pectoral girdle and upper appendages.</p> <p>There are 2 bones making up the pelvic girdle.</p> <p>There are 2 femur bones.</p> <p>There are 2 tibia bones.</p> <p>There are 2 fibula bones.</p> <p>There are 2 patella.</p> <p>There are 14 tarsal bones (7 per ankle).</p> <p>There are 10 metatarsals (5 per foot)</p> <p>There are 28 phalanges of the foot (14 per foot).</p> <p>There are 62 bones making up the pelvic girdle and lower appendages.</p> <p>There is a total of 126 appendicular bones.</p> <p>There is a total of 206 bones comprising the skeleton.</p> <p>Stress: the cartilage of rib 8 merges with the cartilage of rib 7.</p> <p>The cartilage of rib 9 merges with the</p>	
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	<b>Chapter Figures:</b> 5.31 (Pelvic girdle) 5.32 (Pelvis) 5.33 (Female and male pelvises) 5.34 (Femur) 5.35 (Right tibia and fibula) 5.36 (The foot) 5.37 (Arches of the foot)	cartilage of rib 8.  The cartilage of rib 10 merges with the cartilage of rib 9.  Ribs 11 and 12 do not have any anterior cartilage and therefore no attachment to the sternum.  Stress: the pronunciation of ischium is (isk-ee-um). The “isch” is pronounced as “isk.”	
5.5 Describe the cells, fibers, and matrix of bone tissue.	D. Histology of the skeletal system 1. Bone connective tissue	<b>WkBk Concept Maps:</b> <ul style="list-style-type: none"> <li>Figure 5.10 (Composition of the skeletal system)</li> <li>Figure 5.11 (Histology of the skeletal system)</li> </ul> <b>Talking point:</b> Suggest to the students that osteons look similar to rings of a tree.	<b>Spot Check:</b> 5, 6  <b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"> <li>Completion: 4</li> </ul>
5.6 Compare and contrast the histology of compact and cancellous bone.	a. Compact bone b. Cancellous bone  <b>Chapter Figure:</b> 5.38 (Histology of bone tissue)	<b>WkBk Concept Maps:</b> <ul style="list-style-type: none"> <li>Figure 5.11 (Histology of the skeletal system)</li> </ul> <b>Talking point:</b>	



		Be sure to point out the location of the compact bone vs. cancellous bone.	
5.7 Compare and contrast the histology of hyaline, elastic, and fibrocartilage connective tissues.	<p>2. Cartilage connective tissue</p> <p>a. Hyaline cartilage connective tissue</p> <p>b. Elastic cartilage connective tissue</p> <p>c. Fibrocartilage connective tissue</p> <p><b>Chapter Figure:</b> 5.39 (Cartilage connective tissue)</p>	<p><b>WkBk Concept Maps:</b></p> <ul style="list-style-type: none"> <li>Figure 5.11 (Histology of the skeletal system)</li> </ul>	<p><b>Spot Check:</b> 5, 6</p> <p><b>WkBk Chapter Review Questions:</b></p> <ul style="list-style-type: none"> <li>MS: 3</li> <li>Completion: 3</li> </ul>
5.8 Describe the anatomy of a long bone.	<p>E. Anatomy of a long bone</p> <p><b>Chapter Figure:</b> 5.40 (Anatomy of a long bone)</p>	<p><b>WkBk Concept Maps:</b></p> <ul style="list-style-type: none"> <li>Figure 5.11 (Histology of the skeletal system)</li> </ul>	<p><b>Spot Check:</b> 7</p> <p><b>WkBk Chapter Review Questions:</b></p> <ul style="list-style-type: none"> <li>MS: 4</li> </ul>
5.9 Distinguish between two types of bone marrow in terms of location and function.	<p>A. red marrow</p> <p>B. yellow marrow</p>		<p><b>WkBk Chapter Review Questions:</b></p> <ul style="list-style-type: none"> <li>MS: 4</li> </ul>
5.10 Describe three major structural classes of joints and the types of joints in each class.	<p>F. Joints</p> <p>1. Fibrous joints</p> <p>a. sutures</p> <p>b. gomphoses</p>	<p><b>Talking Point:</b></p> <p>If a butcher shop is available in your area that processes beef, pork, or venison, you may be able to obtain a</p>	<p><b>Spot Check:</b> 8</p> <p><b>WkBk Chapter Review Questions:</b></p> <ul style="list-style-type: none"> <li>MS: 7, 8</li> </ul>

	<p>c. syndesmoses</p> <p>2. Cartilaginous joints</p> <p>a. symphysis</p> <p>b. synchondroses</p> <p>3. Synovial joints</p> <p>a. hinge</p> <p>b. ball and socket</p> <p>c. saddle</p> <p>d. gliding</p> <p>e. ellipsoid</p> <p>f. pivot</p> <p><b>Chapter Figures:</b></p> <p>5.41 (Synovial joint)</p> <p>5.42 (Knee)</p> <p><b>Table: 5.1 (Joints)</b></p>	<p>cow, pig, or deer knee at very low cost.</p> <p>These can be used as a demo of a synovial joint, or as a <b>group</b> lab specimen for dissection. Have the students feel the slippery nature of synovial fluid along with the smoothness of articular cartilage. Students gain deeper understanding of articular cartilage when they see that it can be sliced, while bone cannot.</p> <p><b>Discussion Point:</b></p> <p>(See discussion under Individual Outcome 5.10)</p> <p><b>WkBk Lab Exercises and Activities:</b></p> <ul style="list-style-type: none"> <li>• Figure 5.9 (Right or left?)</li> </ul> <p><b>WkBk Concept Maps:</b></p> <ul style="list-style-type: none"> <li>• Figure 5.15 (Joints concept map)</li> </ul>	
5.11 Differentiate between rheumatoid arthritis and osteoarthritis.	<p><b>Chapter Figures:</b></p> <p>5.43 and 5.44 (Rheumatoid arthritis)</p>		<p><b>WkBk Chapter Review Questions:</b></p> <ul style="list-style-type: none"> <li>• Critical Thinking: 2</li> </ul>
5.12 Explain how minerals are deposited in bone.	<p>III. Physiology of the skeletal system</p> <p>A. Mineral deposition</p>		<p><b>WkBk Chapter Review Questions:</b></p> <ul style="list-style-type: none"> <li>• MS: 9</li> </ul>

5.13 Compare and contrast endochondral and intramembranous ossification.	<p>B. Bone development</p> <ol style="list-style-type: none"> <li>1. Intramembranous ossification</li> <li>2. Endochondral ossification</li> </ol> <p><b>Chapter Figures:</b></p> <p>5.46 (Intramembranous ossification of the skull)</p> <p>5.47 (Endochondral ossification of a long bone)</p>	<p><b>WkBk Concept Maps:</b></p> <ul style="list-style-type: none"> <li>• Figure 5.12 (Bone development)</li> </ul> <p><b>Talking point:</b></p> <p>Type in your browser, “youtube endochondral.” You should be able to find a you tube video showing endochondral and intramembranous ossification.</p>	<b>Spot Check:</b> 9
5.14 Compare and contrast endochondral and appositional bone growth.	<p>C. Bone growth</p> <ol style="list-style-type: none"> <li>1. Endochondral growth</li> <li>2. Appositional growth</li> </ol> <p><b>Chapter Figures:</b></p> <p>5.49 (X-ray of a child’s hand)</p> <p>5.50 (Appositional bone growth)</p> <p><b>Table 5.2</b> (Types of ossification)</p>	<p><b>Discussion Point:</b></p> <p>(See discussion under Individual Outcome 5.14)</p> <p><b>WkBk Concept Maps:</b></p> <ul style="list-style-type: none"> <li>• Figure 5.13 (Bone growth and remodeling)</li> </ul>	<p><b>Spot Check:</b> 10</p> <p><b>WkBk Chapter Review Questions:</b></p> <ul style="list-style-type: none"> <li>• Critical Thinking: 3</li> </ul>
5.15 Explain how bone is remodeled by reabsorption.	<p>D. Bone remodeling</p> <p><b>Chapter Figure:</b> 5.51 (Calcium supplements)</p>	<p><b>Talking point:</b></p> <p>This would be a good time to discuss osteoclasts and the hormone, Parathormone (PTH), to show the relationship of different systems.</p>	<p><b>WkBk Chapter Review Questions:</b></p> <ul style="list-style-type: none"> <li>• Completion: 5</li> </ul>

5.16 Explain the nutritional requirements of the skeletal system.	E. Nutritional requirements of the skeletal system  <b>Chapter Figure:</b> 5.52 (Sources of calcium in the diet)		<b>Spot Check:</b> 10 <b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"><li>• Critical Thinking: 1</li></ul>
5.17 Describe the negative-feedback mechanisms affecting bone deposition and reabsorption by identifying the relevant glands, hormones, target tissues, and hormone functions.	F. Hormonal regulation of bone deposition and reabsorption  <b>Chapter Figures:</b> 5.53 (Parathyroid glands) 5.54 (Homeostasis of calcium)	<b>WkBk Concept Maps:</b> <ul style="list-style-type: none"><li>• Figure 5.14 (Hormonal regulation of bone)</li></ul>	<b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"><li>• MS: 9</li><li>• Matching: 6-10</li></ul>
5.18 Summarize the six functions of the skeletal system and give an example or explanation of each.	G. Functions of the skeletal system <ol style="list-style-type: none"><li>1. Support</li><li>2. Movement</li><li>3. Protection</li><li>4. Acid-base balance</li><li>5. Electrolyte balance</li><li>6. Blood formation</li></ol>	<b>Talking point:</b> This would be a good time to get the students engaged by having them discuss what they think is the most important of the 6 functions and why. There is not a right or wrong answer.	
5.19 Summarize the effects of aging on the skeletal system.	IV. Effects of aging on the skeletal system	<b>Talking point:</b> Discuss why osteoporosis occurs in females more than males.	<b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"><li>• MS: 5</li><li>• Critical Thinking: 1</li></ul>
5.20 Classify fractures using descriptive terms.	V. Fractures A. Types of fractures <ol style="list-style-type: none"><li>1. closed</li><li>2. open</li></ol>	<b>WkBk Concept Maps:</b> <ul style="list-style-type: none"><li>• Figure 5.16 (Fractures and how they heal)</li></ul>	<b>Spot Check:</b> 11 <b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"><li>• MS:10</li></ul>

	3. complete 4. displaced 5. nondisplaced 6. hairline 7. greenstick 8. depressed 9. transverse 10. oblique 11. spiral 12. epiphyseal 13. comminuted 14. compression  <b>Chapter Figure:</b> 5.55 (X-rays of fractures)	<b>Talking point:</b> Obtain x-rays from a local hospital to show the various fractures. Real x-rays have more meaning than text book pictures.	
5.21 Explain how a fracture heals.	B. Fracture healing  <b>Chapter Figures:</b> 5.56 (Open reduction of an ankle fracture) 5.57 (The healing of a bone fracture)	<b>WkBk Concept Maps:</b> <ul style="list-style-type: none"> <li>Figure 5.16 (Fractures and how they heal)</li> </ul>	<b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"> <li>MS: 6</li> </ul>
5.22 Describe a diagnostic test commonly used when diagnosing skeletal system	VI. Diagnostic test for skeletal system disorders.	<b>WkBk Case Study:</b> 1, 2, and 3	

disorders.	<b>Table 5.4</b> (Common diagnostic tests for skeletal system disorders)		
5.23 Describe skeletal system disorders and relate abnormal function to the pathology.	<p>VII. Skeletal system disorders</p> <ul style="list-style-type: none"> <li>A. Osteoporosis</li> <li>B. Osteomyelitis</li> <li>C. Cancers Affecting the Skeletal System</li> <li>D. Gout</li> <li>E. Cleft Palate</li> <li>F. Mastoiditis</li> </ul> <p><b>Chapter Figures:</b></p> <p>5.58 (Osteoporosis)</p> <p>5.59 (Gout)</p> <p>5.60 (Cleft palate)</p> <p>5.61 (Mastoiditis)</p> <p><b>Table 5.5</b> (Summary of diseases and disorders of the skeletal system)</p>		<p><b><i>WkBk Chapter Review Questions:</i></b></p> <ul style="list-style-type: none"> <li>• Critical Thinking: 2, 3</li> </ul>

## INDIVIDUAL OUTCOMES

### OUTCOME 5.4

**Spot Check 1:** Name three flat bones of the axial skeleton.

*Answer: Any three of the following: parietal, frontal, occipital, temporal, sternum, ribs.*

**Spot Check 2:** Name two irregular bones of the axial skeleton.

*Answer: Any two of the following: facial bones, ethmoid bone, sphenoid bone, vertebrae, sacrum, coccyx.*

**Spot Check 3:** What bones make up the acetabulum?

*Answer: Ilium, ischium, pubis.*

**Spot Check 4:** Where does the pelvic girdle join the axial skeleton?

*Answer: At the sacroiliac joint.*

### OUTCOME 5.5

**Spot Check 5:** How does the matrix of compact bone differ from that of cancellous bone? How are the matrices of the three types of cartilage similar?

*Answer: The matrix of compact bone is arranged in osteons, where the matrix of cancellous bone is arranged in trabeculae. The matrix of all three types of cartilage is the same—proteoglycans and water with fibers.*

**Spot Check 6:** How do the matrices of bone and cartilage differ in terms of how cells are fed and have their wastes removed?

*Answer: The matrix of bone is hard and does not allow for diffusion, so bone cells require a blood supply to supply nutrients and remove wastes. Cartilage matrix does allow for diffusion to supply nutrients and remove wastes, so no direct blood supply is necessary.*

### OUTCOME 5.7

**Spot Check 5:** How does the matrix of compact bone differ from that of cancellous bone? How are the matrices of the three types of cartilage similar?

*Answer: The matrix of compact bone is arranged in osteons, where the matrix of cancellous bone is arranged in trabeculae. The matrix of all three types of cartilage is the same—proteoglycans and water with fibers.*

**Spot Check 6:** How do the matrices of bone and cartilage differ in terms of how cells are fed and have their wastes removed?

*Answer: The matrix of bone is hard and does not allow for diffusion, so bone cells require a blood supply to supply nutrients and remove wastes. Cartilage matrix does allow for diffusion to supply nutrients and remove wastes, so no direct blood supply is necessary.*

### OUTCOME 5.8

**Spot Check 7:** If the shaft of the humerus were broken, would the bone bleed? Explain.

*Answer: Yes. The shaft (diaphysis) of the humerus is compact bone arranged in osteons. The central canal of each osteon contains blood vessels and a nerve. If the diaphysis is broken, the blood vessels of each osteon would also be broken.*



Quiz: 1



## IM Ch 5

- |  |                         |
|--|-------------------------|
| 1. Identify this bone.   | <i>humerus</i>          |
| 2. Does it belong to the right or left side of the body?           | <i>right</i>            |
| 3. Classify this bone.   | <i>long</i>             |
| 4. What is the term for the shaft of this bone?                    | <i>diaphysis</i>        |
| 5. What is the term for the clubby ends of this bone?              | <i>epiphyses</i>        |
| 6. What is the name for the covering of the shaft of this bone?    | <i>periosteum</i>       |
| 7. What type of bone can be found in the shaft of this bone?       | <i>compact bone</i>     |
| 8. What is the term for the cavity within the shaft of this bone?  | <i>medullary cavity</i> |
| 9. What lines the cavity within the shaft of this bone?            | <i>endosteum</i>        |
| 10. What can be found within the cavity of the shaft of this bone? | <i>yellow marrow.</i>   |

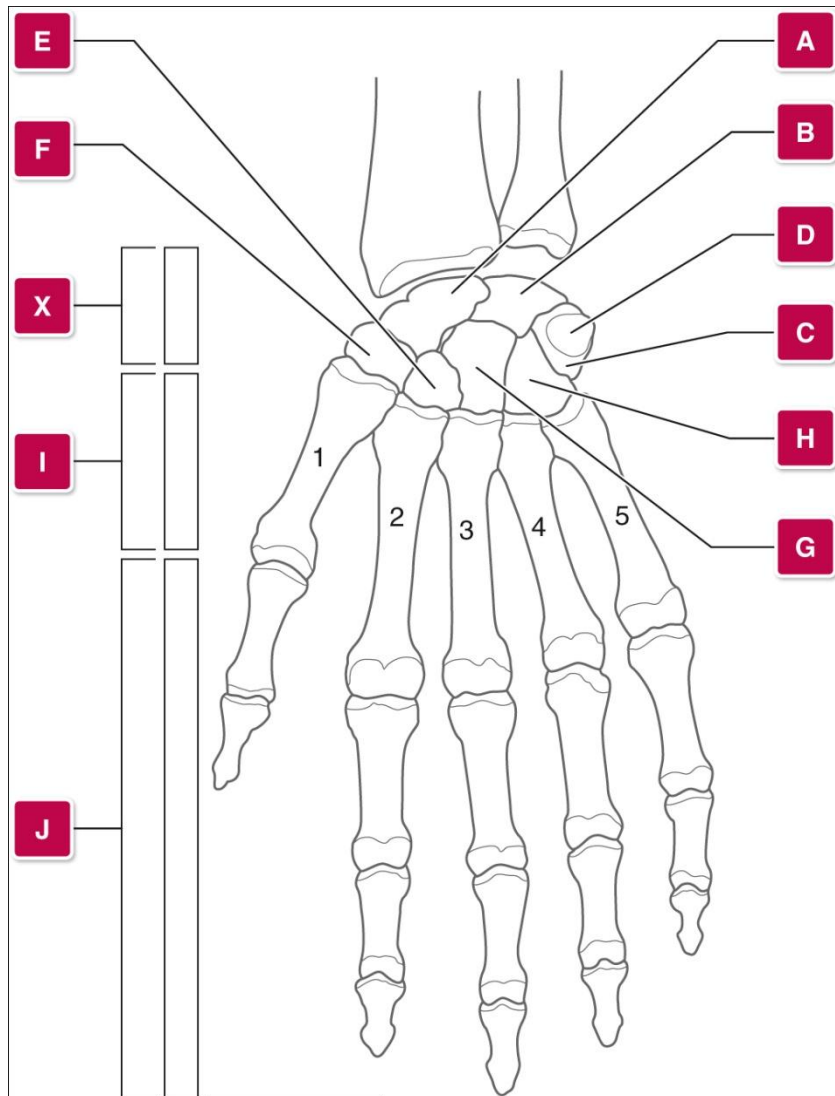
**OUTCOME 5.10**

**Spot Check 8:** What kind (class and type) of joint is formed by an interosseus ligament?

*Answer Class: Fibrous joint, Type: Syndesmosis.*

**Discussion Point:** In terms of anatomy, why is it easier to dislocate a shoulder than a hip? *they are both ball and socket joints, but the glenoid cavity of the shoulder is far more shallow than the acetabulum of the hip.*

Quiz



## IM Ch 5

This is an anterior view of a hand and wrist. Consider just the hand and wrist to answer the following questions.

1. How many bones are located in the hand and wrist (exclude arm bones)? *27: 14 phalanges, 5 metacarpals, and 8 carpals*
2. Identify the collective name for the bones marked 'X' in this image. *carpals*
3. Identify the collective name for the bones marked 'T' in this image. *metacarpals*
4. Identify the collective name for the bones marked 'J' in this image. *phalanges*
5. What class(es) of bone(s) can be found in the hand and wrist? *long and short bones*
6. What class(es) of joint(s) can be found in the wrist? *synovial*
7. What type(s) of joint(s) can be found in the wrist? *gliding and ellipsoid*
8. What class(es) of joint(s) can be found in the hand of a child? *synovial and cartilaginous*
9. Are all of the joints in a child's hand and wrist movable? *no. The fibrous synchondroses in the long bones of a child's hand are immovable.*
10. Is there a difference in the class(es) of joints between an adult's and a child's hand? *yes. An adult's long bones have finished endochondral growth so the adult no longer has synchondroses*

## OUTCOME 5.11

### Discussion Point: 1

Ask how many students know someone with arthritis. Without disclosing personal information this discussion can expand to include: Who gets arthritis? What is the likelihood that a healthcare professional will have to deal with an arthritis patient? What are the symptoms? What are the types? What are the treatments? How are treatments marketed? What is the cost?

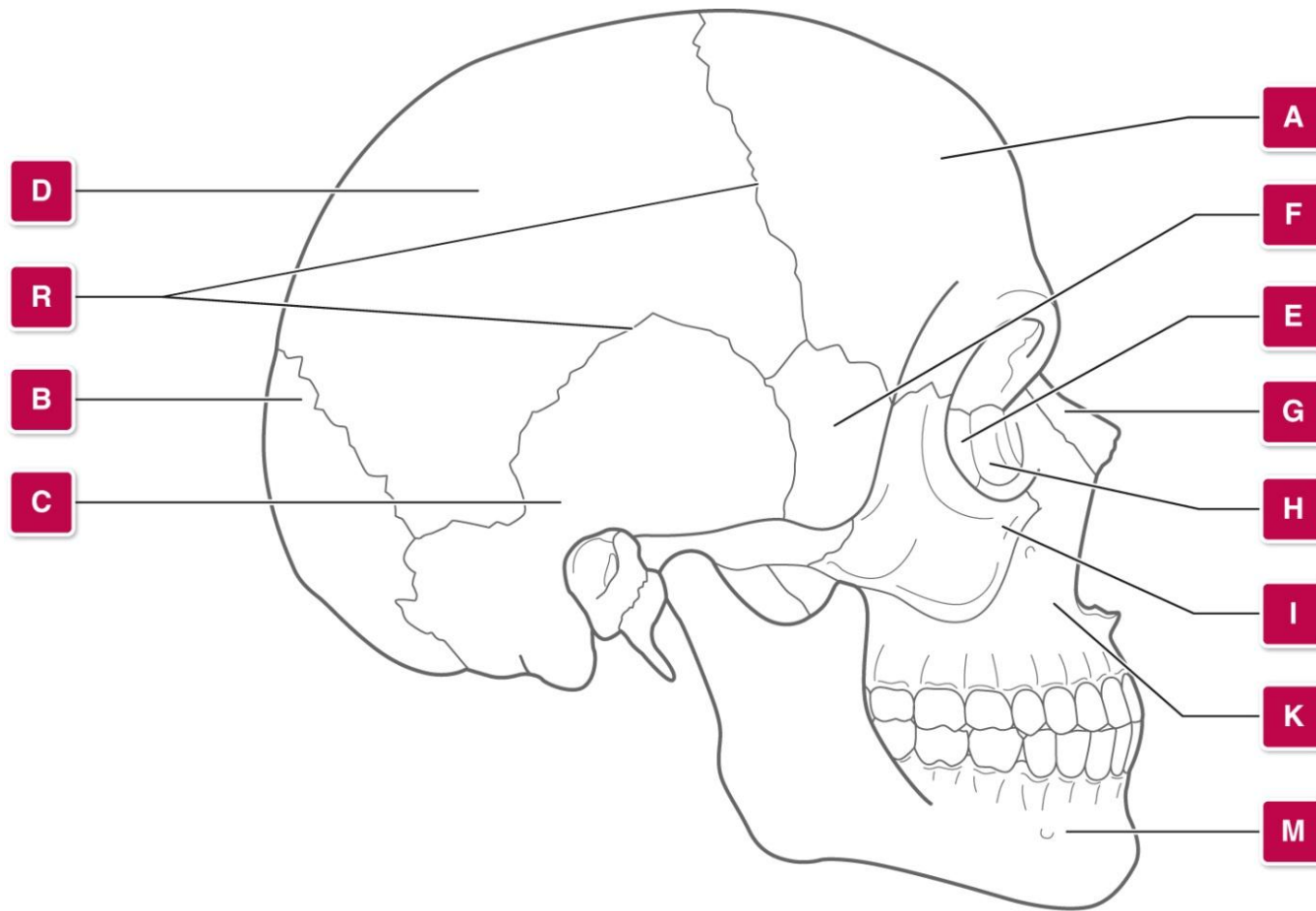
**Group Assignment:** If the class is not knowledgeable on the topic of arthritis, each of the previous questions could be given to a group of students to research and report back to the class.

## OUTCOME 5.13

**Spot Check 9:** What type of ossification would form a humerus in Chloe as a fetus?

*Answer: Endochondral ossification*

Quiz



## IM Ch 5

- |   |   |
|---|---|
| 1. Identify bone 'D'.                                 | <i>parietal bone</i>  |
| 2. Classify bone 'D'.                                 | <i>flat bone</i>  |
| 3. What type of development did bone 'D' undergo?     | <i>intramembranous ossification</i>                           |
| 4. Identify joints marked 'R'.                        | <i>sutures</i>  |
| 5. What class of joint is 'R'?                        | <i>fibrous</i>  |
| 6. What type(s) of bone make up bone 'D'?             | <i>compact bone and cancellous bone</i>                       |
| 7. What type of bone marrow can be found in bone 'D'? | <i>red bone marrow</i>  |
| 8. Of What is the matrix of bone 'D' composed?        | <i>hydroxyapatite (calcium phosphate) and collagen fibers</i> |

### OUTCOME 5.14

**Spot Check 10:** What specifically can be done to ensure strong, healthy bones in adulthood? Explain.

*Answer: Discussion, answers may vary. They should include exercise to put stress on the bones and a diet rich in calcium and vitamin D to ensure appositional bone growth.*

**Discussion Point:** Have the students compare tubercles of the humerus to trochanters of the femur. What accounts for their size difference? *Stress on the bone encourages appositional growth. The femur is weight bearing so it would have more stress on it during development than the humerus of the arm.*



**OUTCOME 5.16**

**Spot Check 10:** What specifically can be done to ensure strong, healthy bones in adulthood? Explain.

*Answer: Discussion, answers may vary. They should include exercise to put stress on the bones and a diet rich in calcium and vitamin D to ensure appositional bone growth.*

**OUTCOME 5.20**

**Spot Check 11:** What terms would be used to describe a fracture that broke the shaft of a humerus at an angle into two separate pieces, with one of the pieces sticking out of the skin?

*Answer: Complete, open, oblique fracture of the humerus.*

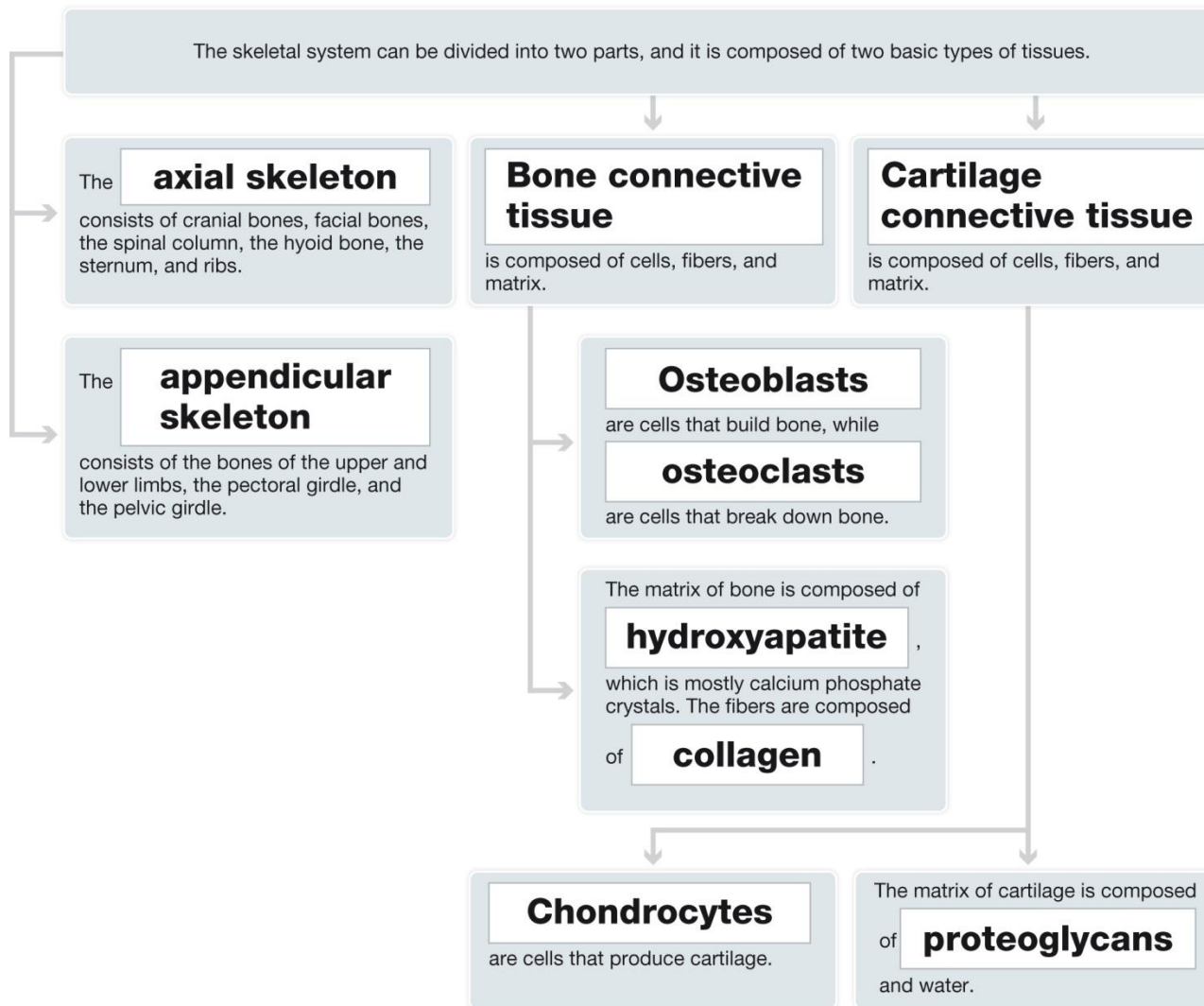
## ANSWER KEYS

### Chapter Review Questions

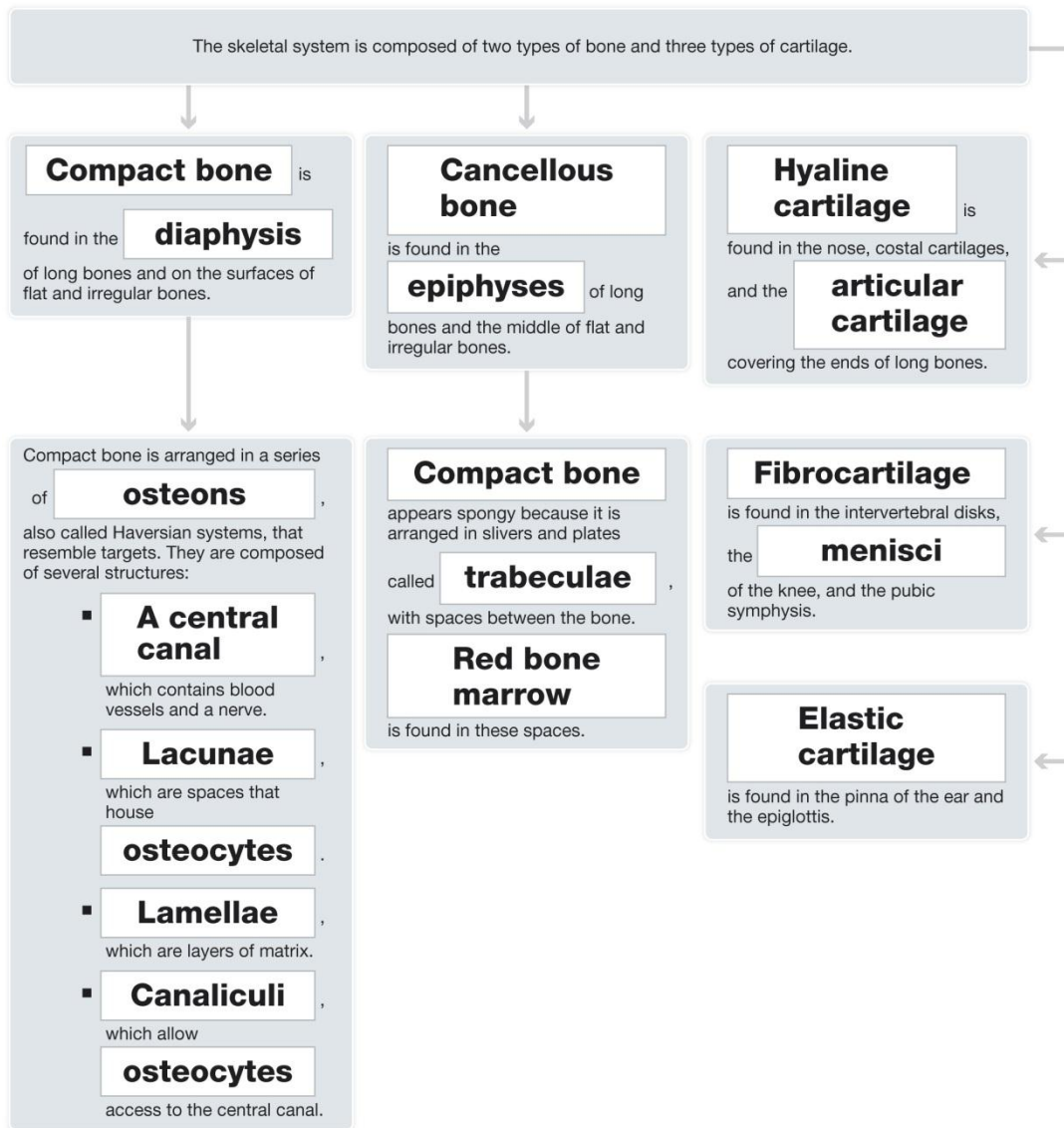
1. A
2. C
3. B
4. B
5. C
6. B
7. C
8. D
9. D
10. B
11. B
12. A
13. B
14. C
15. A
16. C
17. D
18. C
19. B
20. C
21. C
22. D
23. C

## WORKBOOK CONCEPT MAPS:

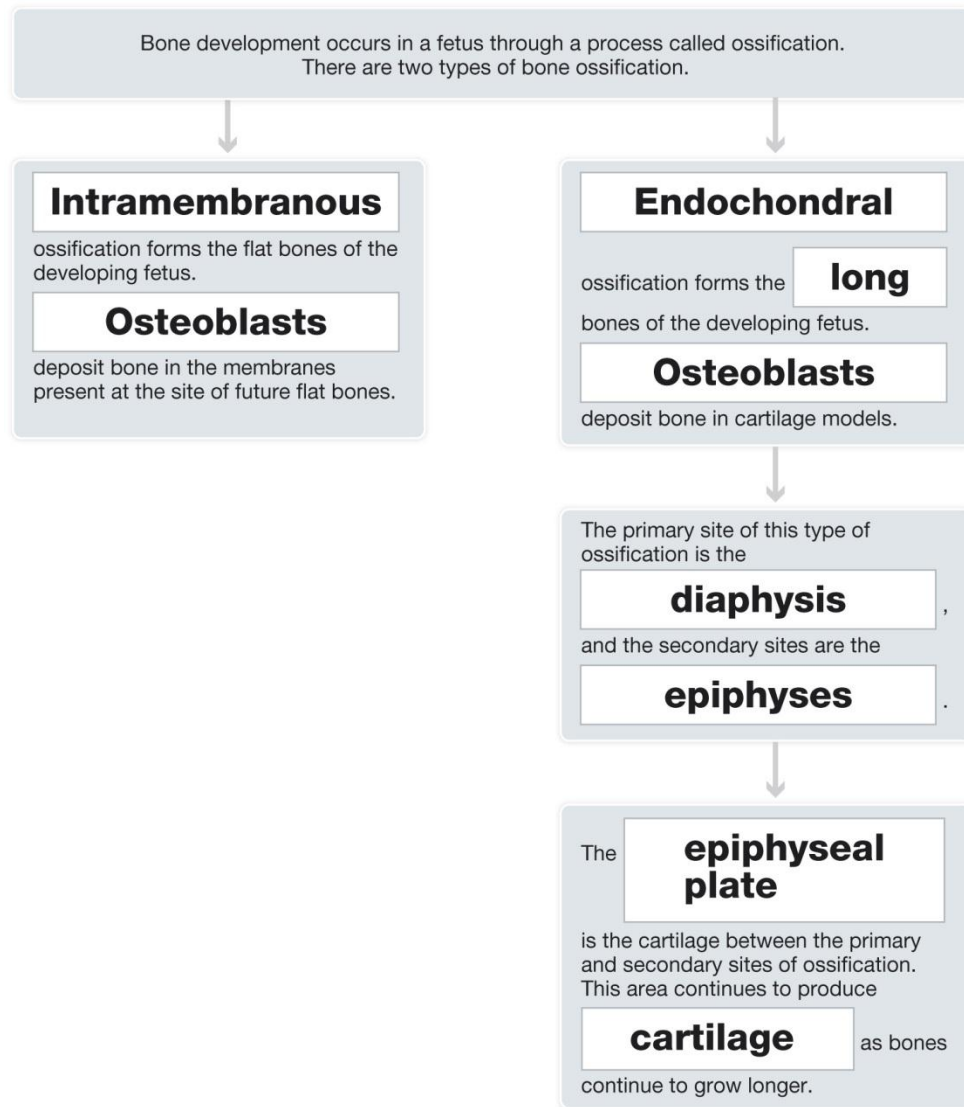
## Composition of the skeletal system

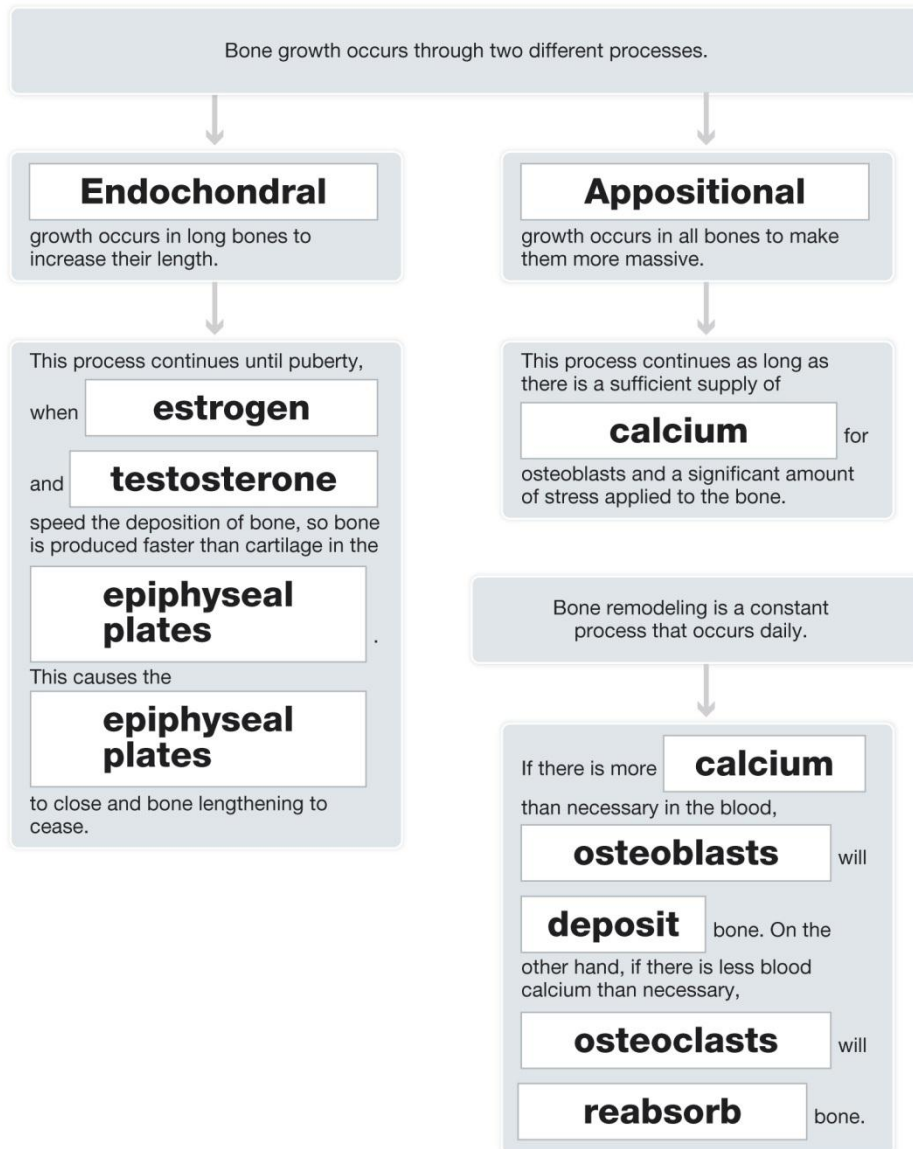


## Histology of the skeletal system

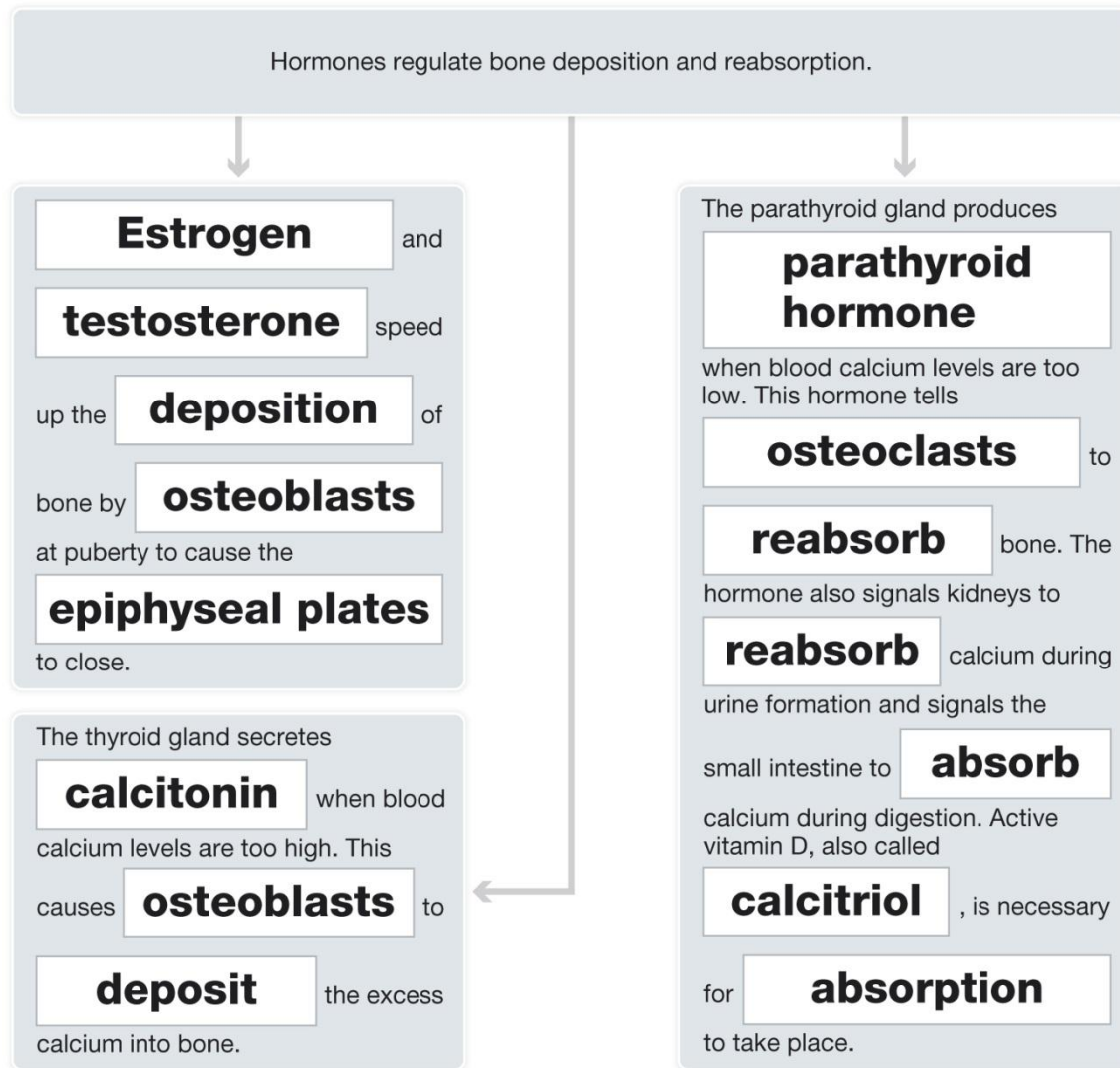


## Bone development



**Bone growth and remodeling**

## Hormonal regulation of bone

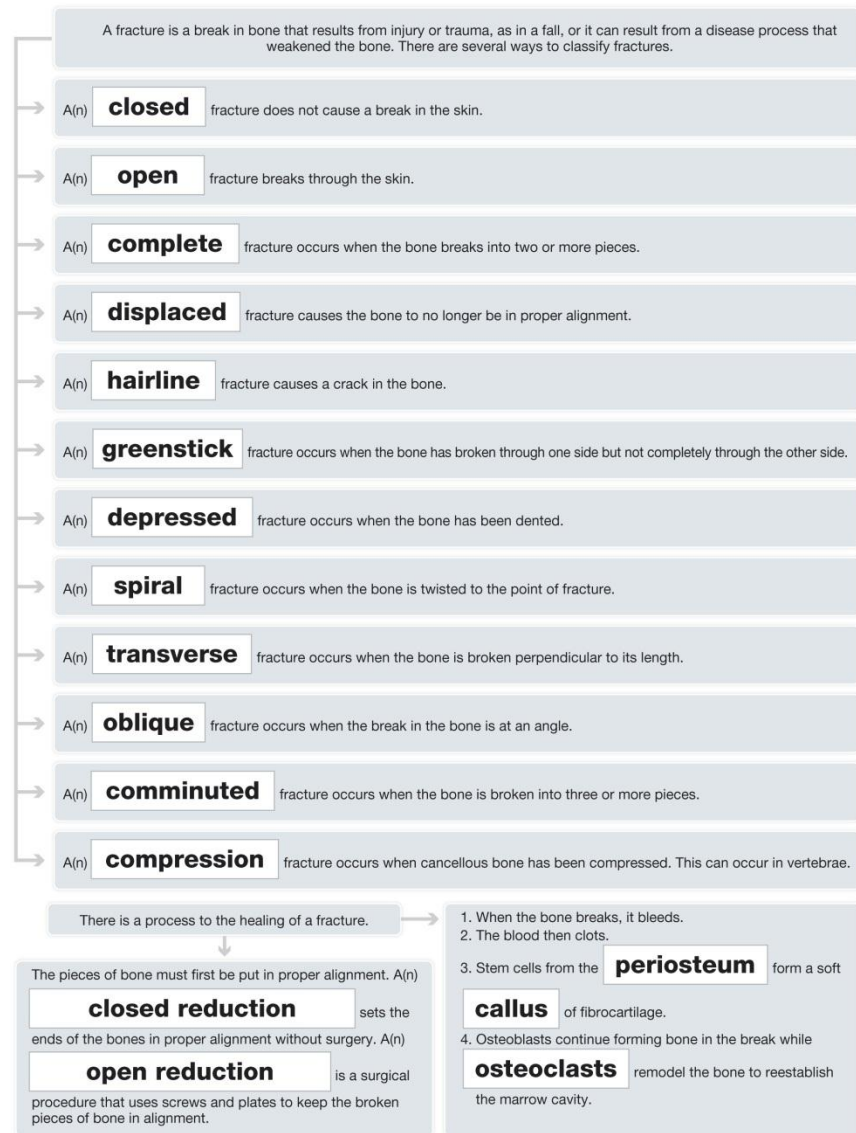


## Joints





## Fractures and how they heal



## Workbook Chapter Review Questions

### Word Deconstruction:

In the text book, you built words to fit a definition using combining forms, prefixes, and suffixes. Here you are to break down the term into its parts (prefixes, roots, and suffixes) and give a definition. Prefixes and suffixes can be found inside the back cover of the textbook.

FOR EXAMPLE: Dermatitis: dermat/ it is-inflammation of the skin

1. Osteoarthropathy: oste/ arthro/ pathy, disease of the bones and joints
2. Arthroscopic: arthro/ scopic, examining a joint with an endoscope
3. Orthopedic: ortho/ ped/ ic, the medical specialty pertaining to bones
4. Osteodystrophy: oste/ dys/ trophy, painful development of the bones
5. Chondrodynia: chondro/ dynia, pain in the cartilage

### Multiple Select:

Select the correct choices for each statement. The choices may be all correct, all incorrect, or any combination of correct and incorrect.

1. Which of the following statements is (are) true concerning thoracic vertebrae?
  - a. A thoracic vertebra protects the neck.
  - b. A thoracic vertebra has extra foramen.
  - c. The thoracic vertebrae lack intervertebral disks.
  - d. *A thoracic vertebra has facets for the attachment of ribs.*
  - e. *A thoracic vertebra has a spine and transverse processes for the attachment of ligaments and tendons.*

2. Which of the following structures belong(s) to the appendicular skeleton?

a. Intervertebral disks.

***b. Long bones.***

c. Sutures.

***d. Clavicle.***

***e. Ossa coxae.***

3. Which of the following statements is (are) true about cartilage?

***a. Hyaline cartilage can be found in articular cartilage.***

***b. Fibrocartilage can be found in the pubic symphysis.***

c. Fibrocartilage connective tissue has fibers running in all directions.

d. Elastic cartilage can be found in a syndesmosis.

e. Costal cartilage is composed of elastic cartilage connective tissue.

4. Which of the following statements is (are) true about bone marrow?

a. Red bone marrow produces red blood cells, but not white blood cells.

***b. Red bone marrow can be found in flat bones.***

***c. Red and yellow bone marrow can be found in a long bone such as the tibia.***

d. Yellow marrow is found in cancellous bone.

*e. Yellow marrow is fatty tissue.*

5. Which of the following is (are) the result of aging on the skeletal system?

a. The development of rheumatoid arthritis.

**b. Increased reabsorption.**

*c. Osteoclasts that are more efficient.*

d. Increase in bone deposition.

e. Decrease in bone mass and increase in bone density.

6. Which of the following statements is (are) true about fractures?

*a. A callus is usually visible on an x-ray after the fracture has healed.*

b. A closed reduction attaches the broken ends of the bones together with screws and plates.

*c. Osteoblasts deposit bone in the fibrocartilage of the break.*

*d. Cells of the periosteum are important to heal the break.*

e. Osteoclasts from the endosteum reestablish an epiphysis.

7. Which of the following statements is (are) true about the knee?

a. The knee is a cartilaginous joint because it has a meniscus.

**b. The knee has bursae, which are fluid-filled extensions of the synovial membrane.**

**c. The knee contains a sesamoid bone.**

d. The knee is stabilized laterally by cruciate ligaments.

**e. The knee is an example of a hinge joint.**

8. Which of the following statements is (are) true concerning joint classification?

*a. Fibrous joints can be found in the skull.*

*b. A cartilaginous joint can be found in the pelvis.*

c. Gomphoses are found in the appendicular skeleton.

*d. Synovial joints provide a wide range of motion.*

*e. Synchondroses decrease with age.*

9. Which of the following statements is (are) true concerning feedback mechanisms in the skeletal system?

a. A positive-feedback mechanism occurs when the blood calcium level is too high and osteoclasts deposit bone to lower the blood calcium level.

***b. A positive-feedback mechanism is seen during deposition when crystals form on a seed crystal.***

c. A negative-feedback mechanism occurs when the blood calcium level is too low and osteoblasts reabsorb bone to raise the blood calcium level.

***d. Negative-feedback mechanisms are used to maintain an electrolyte balance of calcium in the blood.***

e. Hormones from the thyroid gland and parathyroid gland use positive-feedback mechanisms to regulate bone deposition and reabsorption.

10. Which of the following statements is (are) possible concerning a fracture of the tibia?

- a. An epiphyseal fracture is possible at the proximal end of the tibia of a child.*
- b. A displaced transverse fracture of the shaft of the tibia would break the endosteum and compact bone.*
- c. An open fracture of the tibia would cause a break in the periosteum.*
- d. It is possible to have a depressed fracture of the diaphysis of the tibia.
- e. A comminuted fracture of the tibia is likely to need an open reduction.*

**Matching:**

Match the bone to its class as defined by shape.

- |                                 |                   |
|---------------------------------|-------------------|
| <u>  c  </u> 1. Patella         | a. Long bone      |
| <u>  e  </u> 2. Lumbar vertebra | b. Short bone     |
| <u>  b  </u> 3. Calcaneus       | c. Sesamoid bone  |
| <u>  d  </u> 4. Floating rib    | d. Flat bone      |
| <u>  a  </u> 5. Ulna            | e. Irregular bone |

**Matching:**

Match the following hormones or chemicals to their target tissues in the skeletal system. Some questions may have more than one answer. Some choices may be used more than once.

- |                                      |                    |
|--------------------------------------|--------------------|
| <u>d</u> 6. Calcitriol               | a. Kidneys         |
| <u>b,c</u> 7. Calcitonin             | b. Osteoclasts     |
| <u>b,c</u> 8. Estrogen               | c. Osteoblasts     |
| <u>b,c</u> 9. Testosterone           | d. Small intestine |
| <u>a,b,d</u> 10. Parathyroid hormone |                    |

**Completion:**

Fill in the blanks to complete the following statements.

1. The number of bones may vary between two individuals because one individual may have additional sesmoid bones growing in tendons at a joint.
2. The ilium, the ischium, and the pubis form the acetabulum.
3. Chondrocytes are housed in lacunae.
4. Hydroxyapetite is mainly calcium phosphate crystals.
5. Osteoclasts produce hydrochloric acid to reabsorb bone.

**Critical Thinking:**

1. Describe the best environment, lifestyle, and nutrition that would lead to a healthy skeletal system in old age. Justify your choices.

A diet that includes calcium and phosphorus for bone deposition, and protein for collagen fiber production in bone, and ample exercise to apply stress on the bone for appositional bone growth.

2. Predict which skeletal system disorder would result from the following situations: (a) a lactose-intolerant, pregnant woman with no prenatal care, (b) an individual who has played professional sports for 15 years, (c) an open fracture of the tibia, and (d) a woman (age 27) with premature onset of menopause.  
a) osteomalacia, b) osteoarthritis, c) osteomyelitis if bacteria infect the wound, d) osteoporosis.
3. Achondroplastic dwarfism results when all of the epiphyseal plates close prematurely. Pituitary dwarfism results when there is insufficient pituitary growth hormone to make all of the bones grow normally. Given this information, how would the proportions of an achondroplastic dwarf differ from those of a pituitary dwarf? (Hint: What bones have epiphyseal plates?)  
A pituitary dwarf would be in perfect proportion just much smaller. An achondroplastic dwarf would likely have a normal size head and torso, but shorter arms, legs, hands, fingers, feet and toes because only long bones would be affected.

#### Case Study:

1. X-rays use electromagnetic radiation that sends photons through the body, allowing the visualization of dense structures such as bone. This procedure can be used to determine bone fractures.
2. A closed reduction sets the edges of the fracture in proper alignment by manipulating the bone without surgery. An open reduction sets the bones in proper alignment through surgery. Plates, pins, and screws may be used in an open reduction to ensure the bone fragments stay in proper alignment. It is important to immobilize the break once either type of reduction is performed to give the body the best chance of healing the fracture properly.
3. As long bones grow throughout childhood, osteoblasts are continuing to deposit bone in the epiphyseal plates of long bones while the chondrocytes continue to expand the plates with cartilage. This will occur until the child reaches puberty. At puberty, the hormone estrogen or testosterone will speed up the osteocytes, which will deposit more bone than the chondrocytes can produce cartilage. The osteocytes will eventually close the



epiphyseal plates and endochondral growth will have stopped. All that will remain of the growth plate is an epiphyseal line indicating where the epiphyseal plate was located. A fracture that occurs at the epiphyseal plate before the child reaches puberty can potentially affect the growth of the long bone.