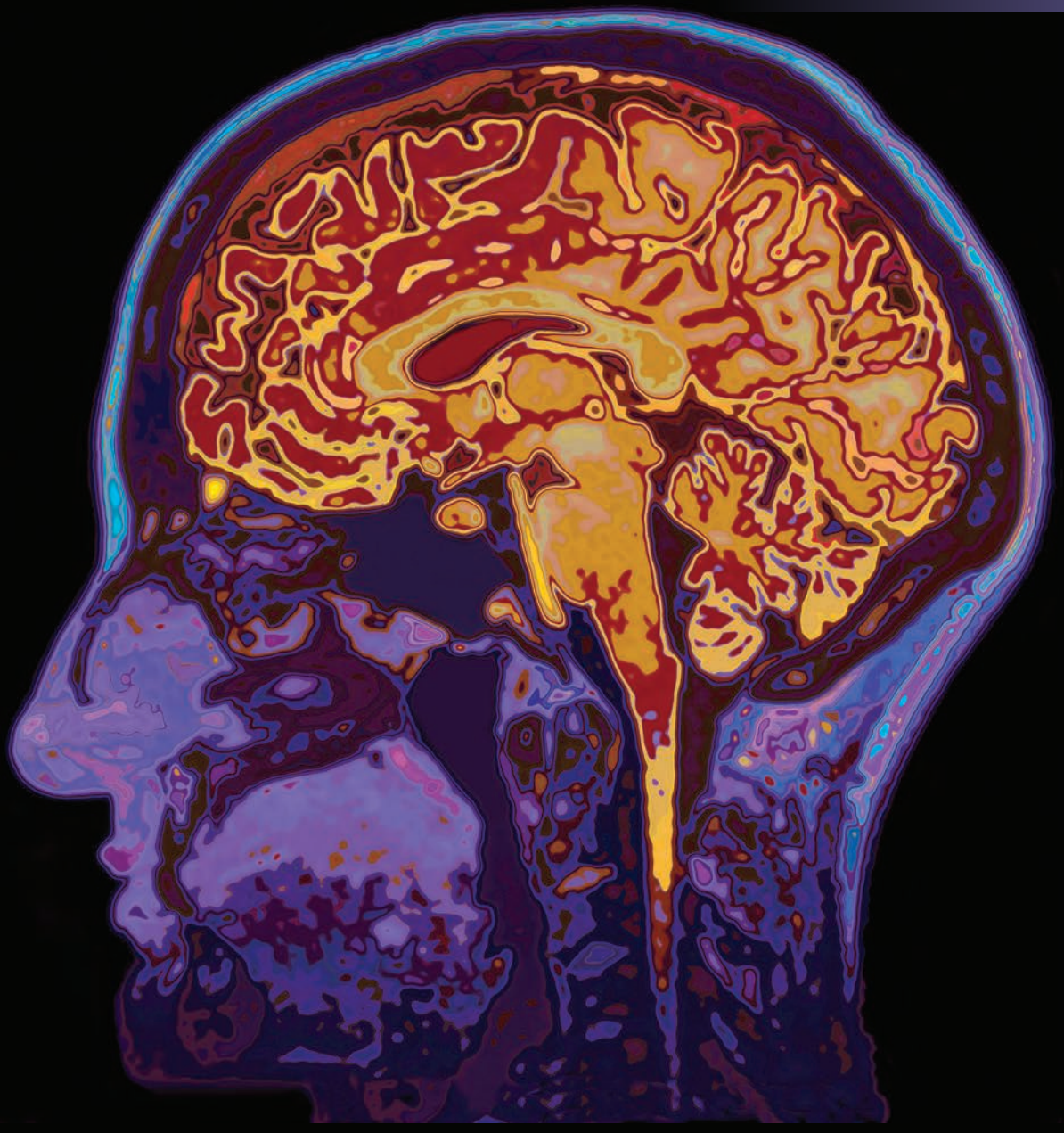
GLOBAL EDITION



Human Anatomy

Marieb Brady Mallatt

NINTH EDITION

BRIEF CONTENTS

Dislocations

A **dislocation (luxation)** occurs when the bones of a joint are forced out of alignment. This injury is usually accompanied by sprains, inflammation, pain, and difficulty in moving the joint. Dislocations may result from serious falls or blows and are common sports injuries. The jaw, shoulder, finger, and thumb joints are most commonly dislocated. Like fractures, dislocations must be reduced; that is, the bone ends must be returned to their proper positions by a physician. **Subluxation** is a partial or incomplete dislocation of a joint. In a subluxation, the bone ends return to their proper position on their own. A joint that has been dislocated once is susceptible to repeated injury because the initial dislocation stretches the joint capsule and ligaments. After the capsule is loosened, the joint is more likely to dislocate again. Injured ligaments eventually shorten to their original length, but this aspect of healing can take years.

CLINICAL APPLICATION

Nursemaid's Elbow A common injury to the forearm in young children (less than 5 years of age) is subluxation of the proximal radioulnar joint. When the forearm is pulled with the arm outstretched, as in swinging a child by her hands, the head of the radius can be pulled away from the anular ligament (see Figure 9.12b–d), resulting in entrapment of the anular ligament in the humeroradial joint. The immediate pain that occurs upon injury subsides and is followed by a reluctance to use the injured arm. A history of pulling on the forearm is critical for diagnosing this injury accurately. Treatment is a simple reduction that results in immediate return to use of the arm.

9.6b Inflammatory and Degenerative Conditions

Inflammatory conditions that affect joints include inflammations of bursae and tendon sheaths and various forms of arthritis.

Bursitis, Tendonitis, and Tenosynovitis

Bursitis, inflammation of a bursa, usually results from a physical blow or friction, although it may also be caused by arthritis or bacterial infection. In response, the bursa swells with fluid. Falling on one's knee can cause a painful bursitis of the subcutaneous prepatellar bursa (see Figure 9.15a), known as **housemaid's knee.** Resting and rubbing one's elbows on a desk can lead to **student's elbow,** or **olecranon bursitis,** the swelling of a bursa just deep to the skin of the posterior elbow. Severe cases of bursitis may be treated by injecting inflammation-reducing drugs into the bursa. Excessive fluid accumulation may require fluid removal by needle aspiration.

Tendonitis is an inflammation of a tendon. **Tenosynovitis** is inflammation of a tendon sheath. These two conditions commonly occur together. Causes (overuse injury or infection), symptoms (pain, swelling, tenderness) and treatments (rest, ice, anti-inflammatory drugs) mirror those of bursitis.

Arthritis

The term **arthritis** describes over 100 kinds of inflammatory or degenerative diseases that damage the joints. Around 10 million people in the United Kingdom suffer from arthritis or related conditions per yer, with about 16,000 children and adolescents experiencing juvenile forms of arthritis. All forms of arthritis have, to a greater or lesser degree, the same initial symptoms: pain, stiffness, and swelling of the joint.

Osteoarthritis (Degenerative Joint Disease) The most common type of arthritis is **osteoarthritis (OA),** a chronic (long-term) degenerative condition that is often called "wear-and-tear arthritis." It is most common in the aged and is probably related to the normal aging process. OA affects women more often than men, but most of us will develop this condition by the age of 80. OA affects the articular cartilages, causing them to soften, fray, crack, and erode.

The cause of OA is unknown. According to current theory, normal use causes joints to release metalloproteinase enzymes that break down the cartilage matrix (especially the collagen fibrils); meanwhile, the chondrocytes continually repair the damage by secreting more matrix. Whenever the strain on a joint is repeated or excessive, too much of the cartilage-destroying enzyme is thought to be released, causing OA. Because this process occurs most where an uneven orientation of forces causes extensive microdamage, badly aligned or overworked joints are likely to develop OA.

The bone directly below the articular cartilage is also affected, becoming dense and stiff. As the disease progresses, bone spurs tend to grow around the margins of the damaged cartilages, encroaching on the joint cavity and perhaps restricting joint movement **(Figure 9.19)**. Patients complain of stiffness upon waking in the morning, but this decreases within a half hour. However, there is always joint pain during use. The affected joints may make a crunching noise (called *crepitus*) as their roughened surfaces rub together during movement.

The joints most commonly affected in OA are those of the fingers, knuckles, hips, and knees. The nonsynovial joints between the vertebral bodies are also susceptible, especially in the cervical and lumbar regions of the spine.

The course of OA is slow and irreversible. It is not usually crippling, except for some severe cases involving the hip and knee joints. Inflammation may or may not accompany the degeneration of the joints, but it is usually not severe. In many cases the symptoms of OA can be controlled with a pain reliever such as aspirin or acetaminophen plus a program of low-impact exercise. Rubbing a hot-pepper-like substance called capsaicin on the skin over the joint also helps lessen the pain of OA. As more aging individuals are enjoying active lifestyles, joint replacement has become a common treatment for joints severely damaged by arthritis (Figure 9.19c).

Rheumatoid Arthritis Another kind of arthritis, **rheumatoid** (roo″mah-toid) **arthritis (RA)** is a chronic inflammatory disorder. Its onset usually occurs between the ages of 30 and

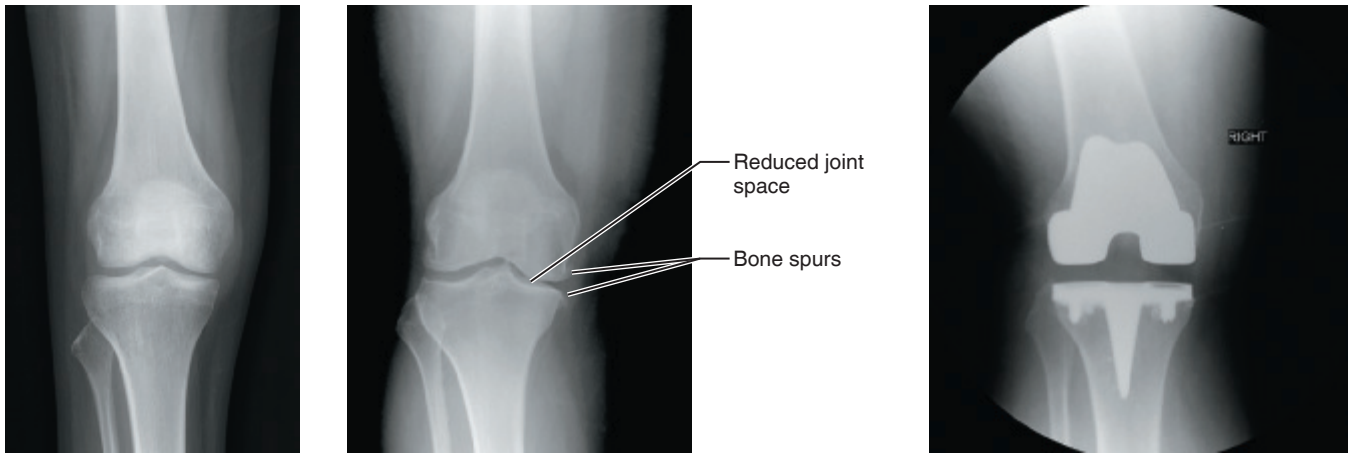


Figure 9.19 Osteoarthritis of the knee.

50, but it may arise at any age. The course of RA is variable: It may develop gradually or in spurts that are years apart. It is marked by flare-ups and remissions. RA tends to affect many joints simultaneously and bilaterally (on both sides of the body), especially the small joints of the fingers, wrists, ankles, and feet. Along with pain and swelling of the joints, other manifestations of RA include osteoporosis, muscle weakness, and cardiovascular problems.

RA is an **autoimmune disease**—a disorder in which the body's immune system attacks its own tissues. The cause of this reaction is unknown, but RA might follow infection by certain bacteria and viruses that bear surface molecules similar to molecules normally present in the joints. When the body is stimulated to attack the foreign molecules, it inappropriately destroys its own joint tissues as well.

RA begins with an inflammation of the synovial membrane. Capillaries in this membrane leak tissue fluid and white blood cells into the joint cavity. This excess synovial fluid then causes the joint to swell. The chronic inflammation and swelling can deteriorate the connective tissues surrounding the joint. In the hand, the loss of integrity of the joint capsules in the metacarpophalangeal and interphalangeal joints leads to the characteristic deformities due to RA (Figure 9.20). With time, the inflamed synovial membrane thickens into a *pannus* ("rag"), a coat of granulation tissue that clings to the articular cartilages. The pannus erodes the cartilage and, often, the underlying bone. As the cartilage is destroyed, the pannus changes into a fibrous scar tissue that interconnects the bone ends. This scar tissue eventually ossifies, and the bone ends fuse together, immobilizing the joint. This end condition, called **ankylosis** (ang″kĭ-lo′sis; "stiff condition"), often produces bent, deformed fingers.

Most drugs used to treat RA are either anti-inflammatory drugs or immunosuppressants. These must be given for long periods and are only partly successful; there is no cure. Joint prostheses are the last resort for severely crippled patients. Some RA sufferers have over a dozen artificial joints.

Figure 9.20 Rheumatoid arthritis. Classic signs of RA: prominent ulnar deviation of digits and swelling in the metacarpophalangeal joints.

Gouty Arthritis (Gout) Ordinarily, people maintain proper blood levels of uric acid, a normal waste product of nucleic acid metabolism, by excreting it in the urine. If the rate of excretion is low, uric acid levels rise abnormally in the blood and body fluids, and the acid precipitates as solid crystals of urate in the synovial membranes. An inflammatory response follows as the body tries to attack and digest the crystals, producing an agonizingly painful attack of **gouty** (gow′te) **arthritis,** or **gout.** The initial attack involves a single joint, usually in the lower limb, often at the base of the big toe. Other attacks usually follow, months to years later. Gout is far more common in men than in women because men naturally have higher levels of uric acid in their blood (perhaps because estrogens increase the rate of its excretion).

Untreated gout can cause the ends of articulating bones to fuse, immobilizing the joint. Fortunately, effective treatment is

available. For acute attacks, nonsteroidal anti-inflammatory drugs such as ibuprofen are used. For the long term, urate-lowering drugs and dietary measures (avoidance of alcohol and red meat) are effective.

Check Your Understanding

☐ **17.** Identify the type of arthritis described in each case: (a) crystallization of uric acid in synovial membranes; (b) erosion of articular cartilage; (c) autoimmune response causing inflammation of the synovial membrane.

☐ **18.** Why is an injured joint more susceptible to repeat of the injury following a sprain or subluxation?

For answers, see Answers Appendix.

9.7 THE JOINTS THROUGHOUT LIFE

Learning Outcome

▶ Describe how joints develop and how their function may be affected by aging.

Synovial joints develop from mesenchyme that fills the spaces between the cartilaginous "bone models" in the late embryo. The outer region of this intervening mesenchyme condenses to become the fibrous layer of the joint capsule, whereas the inner region hollows to become the joint cavity. By week 8, these joints resemble adult joints in form and arrangement; that is, their synovial membranes are developed, and synovial fluid is being secreted into the joint cavities. These basic structural features are genetically determined, but after birth a joint's size, shape, and flexibility are modified by use. Active joints grow larger and have thicker capsules, ligaments, and bony supports than they would if they were never used.

During youth, many injuries to joints tear or knock the epiphysis off the shaft, a vulnerability that ends after the epiphyseal plates close in early adulthood. From that time on, comparable injuries merely result in sprains.

Osteoarthritis is the most common joint problem associated with advancing age. Just as bones must be stressed to maintain their strength, joints must be exercised to keep their health. Exercise squeezes synovial fluid in and out of articular cartilages, providing the cartilage cells with the nourishment they need. And although exercise cannot prevent osteoarthritis, it strengthens joints and slows degeneration of the articular cartilages. It also strengthens the muscles that stabilize the joints. Overexercising, however, worsens osteoarthritis. Because the buoyancy of water relieves much of the stress on weight-bearing joints, people who exercise in pools often retain good joint function throughout life.

Check Your Understanding

☐ **19.** By what age of development are synovial joints formed?

For the answer, see Answers Appendix.

RELATED CLINICAL TERMS

Ankylosing spondylitis (ang″kĭ-lo′sing spon″dĭ-li′tis) (*ankyl* = stiff joint; *spondyl* = vertebra) A distinctive kind of rheumatoid arthritis that mainly affects men. It usually begins in the sacroiliac joints and progresses superiorly along the spine. The vertebrae become interconnected by so much fibrous tissue that the spine becomes rigid ("poker back").

Arthroplasty ("joint reforming") Replacing a diseased joint with an artificial joint (see Figure 9.19).

Chondromalacia patellae ("softening of cartilage of the patella") Damage and softening of the articular cartilages on the posterior surface of the patella and the anterior surface of the distal femur. This condition, seen most often in adolescent athletes, produces a sharp pain in the knee when the leg is extended (in climbing stairs, for example). Chondromalacia may result when the quadriceps femoris, the main group of muscles on the anterior thigh, pulls unevenly on the patella, persistently rubbing it against the femur in the knee joint. Chondromalacia can often be corrected by exercises that strengthen weakened parts of the quadriceps muscles.

Lyme disease An inflammatory disease that often results in joint pain and arthritis, especially in the knee joint. It is caused by spirochetes, bacterial organisms transmitted by the bites of ticks that live on deer and mice. Lyme disease is first characterized by a skin rash and flulike symptoms. It is treatable with antibiotics, especially if detected early.

Patellofemoral pain syndrome Persistent pain in the region behind the patella; results from rubbing pressure between the femoral condyles and the patella, as may occur with overuse of the quadriceps femoris muscles or an abnormally shaped patella. Is distinguished from chondromalacia patellae (see above) by usual absence of damage to the cartilage and generally younger age at onset. Treatment is exercise that strengthens the different quadriceps muscles evenly and gradually.

Synovitis Inflammation of the synovial membrane of a joint. Can result from an injury, an infection, or arthritis. Synovitis leads to the production of excess fluid, causing the joints to swell. Such accumulation of fluid in the joint cavity is called *effusion*.

Valgus and varus injuries *Valgus* means "bent outward, away from the body midline," such as in abduction of the leg at the knee or the forearm at the elbow. *Varus* means "bent inward," such as in adduction of these elements. Because the knee and elbow are not designed for such movements, strong valgus and varus bending injures them.

CHAPTER SUMMARY

1. Joints (articulations) are sites where elements of the skeleton meet. They hold bones together and allow various degrees of movement.

9.1 CLASSIFICATION OF JOINTS (p. 241)

2. Joints are classified functionally as synarthrotic (no movement), amphiarthrotic (slight movement), or diarthrotic (free movement). They are classified structurally as fibrous, cartilaginous, or synovial.

9.2 FIBROUS JOINTS (pp. 241–242)

3. In fibrous joints, the bones are connected by fibrous connective tissue. No joint cavity is present. Nearly all fibrous joints are synarthrotic (immovable).
4. The types of fibrous joints are sutures (between skull bones), syndesmoses ("ligament joints"), and gomphoses (articulation of the teeth with their sockets).

9.3 CARTILAGINOUS JOINTS (p. 242)

5. In cartilaginous joints, the bones are united by cartilage. No joint cavity exists.
6. Synchondroses are immovable joints of hyaline cartilage, such as epiphyseal plates. Symphyses are amphiarthrotic (slightly movable) fibrocartilage joints, such as intervertebral discs and the pubic symphysis.

9.4 SYNOVIAL JOINTS (pp. 242–253)

7. Most joints in the body are synovial. Synovial joints are diarthrotic (freely movable).

9.4a General Structure of Synovial Joints (pp. 243–245)

8. Synovial joints have a fluid-containing joint cavity and are covered by an articular capsule. The capsule has an outer fibrous layer, often reinforced by ligaments, and an inner synovial membrane that produces synovial fluid. The articulating ends of bone are covered with impact-absorbing articular cartilages. Nerves in the capsule provide a sense of "joint stretch."
9. Synovial fluid is mainly a filtrate of the blood, but it also contains molecules that make it a friction-reducing lubricant. The cartilage-covered bone ends glide on a slippery film of synovial fluid squeezed out of the articular cartilages. This mechanism is called weeping lubrication.
10. Some joints contain fibrocartilage discs (menisci), which distribute loads evenly and may allow two movements at one joint.
11. Bursae and tendon sheaths are often associated with synovial joints. A bursa is a fibrous sac lined by a synovial membrane and containing synovial fluid. Tendon sheaths, which are similar to bursae, wrap around certain tendons. They act as lubricating devices that allow adjacent structures to move smoothly over one another.

9.4b Movements Allowed by Synovial Joints (pp. 245–249)

12. Contracting muscles produce three common kinds of bone movements at synovial joints: gliding, angular movements (flexion, extension, abduction, adduction, and circumduction), and rotation.
13. Special movements include elevation and depression, protraction and retraction, supination and pronation of the forearm, opposition of the thumb, inversion and eversion of the foot, and dorsiflexion and plantar flexion of the foot.

9.4c Types of Synovial Joints (p. 249)

14. The shapes of the articular surfaces reflect the kinds of movements allowed at a joint. Joints are classified by shape as plane (nonaxial), hinge or pivot (uniaxial), condylar or saddle (biaxial), or ball-and-socket (multiaxial) joints.

9.4d Factors Influencing the Stability of Synovial Joints (pp. 249–253)

15. Joints are the weakest part of the skeleton. Factors that stabilize joints are the shapes of the articulating surfaces, ligaments, and the tone of muscles whose tendons cross the joint.

9.5 SELECTED SYNOVIAL JOINTS (pp. 253–266)

16. The temporomandibular joint is a modified hinge joint formed by (1) the condylar process of the mandible and (2) the mandibular fossa and articular tubercle of the temporal bone. This joint allows both a hingelike opening of the mouth and an anterior gliding of the mandible. It often dislocates anteriorly and is frequently the site of stress-induced temporomandibular disorders.
17. The sternoclavicular joint is a saddle joint between the medial end of the clavicle and the manubrium of the sternum. This joint allows for elevation, depression, protraction, retraction, and slight rotation. It is an extremely stable joint.
18. The shoulder (glenohumeral) joint is a ball-and-socket joint between the glenoid cavity and the head of the humerus. It is the body's most freely movable joint. Its socket is shallow, and its capsule is lax and reinforced by ligaments superiorly and anteriorly. The tendons of the biceps brachii and the rotator cuff help stabilize the joint. The humerus often dislocates anteriorly and inferiorly at the shoulder joint.
19. The elbow is a hinge joint in which the ulna and radius articulate with the humerus. It allows flexion and extension. Its articular surfaces are highly complementary and help stabilize it. Radial and ulnar collateral ligaments prevent side-to-side movement of the forearm.
20. The wrist is composed of a condylar joint between the distal end of the radius and the proximal carpals (scaphoid, lunate) that allows for flexion, extension, abduction, and adduction of the hand. The intercarpal joint between the proximal row of carpals and the distal row of carpals is a gliding joint allowing sliding movements between the carpals.
21. The hip joint is a ball-and-socket joint between the acetabulum of the hip bone and the head of the femur. It is adapted for weight bearing. Its articular surfaces are deep and secure, and its capsule is strongly reinforced by three ligamentous thickenings.
22. The knee is a complex and shallow joint formed by the articulation of the tibial and femoral condyles (and anteriorly by the patella with the femur). Extension, flexion, and some rotation are allowed. C-shaped menisci occur on the articular surfaces of the tibia. The capsule, which is absent anteriorly, is reinforced elsewhere by several capsular and extracapsular ligaments. For example, the tibial and fibular collateral ligaments help prevent hyperextension, abduction, and adduction of the leg. The intracapsular cruciate ligaments help prevent anterior-posterior displacement of the joint surfaces and help lock the knee when one stands. The tone of the muscles crossing this joint is important for knee stability. In contact sports, lateral blows are responsible for many knee injuries. In noncontact sports, the anterior cruciate ligament is a frequent site of injury caused by quick stopping and change of direction.
23. The ankle joint is a hinge joint between (1) the distal tibia and fibula and (2) the talus of the foot. Its medial and lateral ligaments allow plantar flexion and dorsiflexion but prevent anterior and

posterior displacements of the foot. Inversion and eversion of the foot occur through gliding movements at the intertarsal joints.

9.6 DISORDERS OF JOINTS (pp. 266–269)

9.6a Joint Injuries (pp. 266–267)

24. Trauma can tear joint cartilages. Sports injuries to the knee menisci are common and can result from twisting forces as well as from direct blows to the knee. Arthroscopic surgery is used to repair knee and other joint injuries.

25. Sprains are the stretching and tearing of joint ligaments. Because ligaments are poorly vascularized, healing is slow.

26. Joint dislocations move the surfaces of articulating bones out of alignment. Such injuries must be reduced.

9.6b Inflammatory and Degenerative Conditions (pp. 267–269)

27. Bursitis and tenosynovitis are inflammation of a bursa and a tendon sheath, respectively. Tendonitis is inflammation of a tendon.

28. Arthritis is the inflammation or degeneration of joints accompanied by pain, swelling, and stiffness. Arthritis includes many different diseases and affects millions of people.

29. Osteoarthritis is a degenerative condition that first involves the articular cartilages. It follows wear or excessive loading and is common in older people. Weight-bearing joints are most often affected.

30. Rheumatoid arthritis, the most crippling kind of arthritis, is an autoimmune disease involving severe inflammation of the joints, starting with the synovial membranes.

31. Gout is joint inflammation caused by a deposition of urate salts in the synovial membranes.

9.7 THE JOINTS THROUGHOUT LIFE (p. 269)

32. Joints develop from mesenchyme between the cartilaginous "bone models" in the embryo.

33. Joints usually function well until late middle age, when osteoarthritis almost always appears.

REVIEW QUESTIONS

To access additional practice questions using your smartphone, tablet, or computer: **Mastering A&P** > Study Area > Study by Chapter

Multiple Choice/Matching Questions

For answers, see Answers Appendix.

1. Match the joint types in the key to the descriptions that apply to them. (More than one joint type might apply.)

Key: (a) fibrous joints
(b) cartilaginous joints
(c) synovial joints

____ **(1)** have no joint cavity

____ **(2)** types are sutures and syndesmoses

____ **(3)** dense connective tissue fills the space between the bones

____ **(4)** almost all joints of the skull

____ **(5)** types are synchondroses and symphyses

____ **(6)** all are diarthroses

____ **(7)** the most common type of joint in the body

____ **(8)** nearly all are synarthrotic

____ **(9)** shoulder, hip, knee, and elbow joints

2. Which of the following joints listed is *not* a plane joint? (a) intercarpal joint, (b) intertarsal joint, (c) metacarpophalangeal joint, (d) femoropatellar joint.

3. The articular disks present in some synovial joints assist in (a) dividing the joint cavity into two, (b) improving the fit of the articular cartilages, (c) distributing the load more evenly, (d) producing synovial fluid, (e) a, b and c.

4. Which of the following terms is *not* related to the TMJ? (a) mandibular fossa, (b) articular tubercle, (c) lateral ligament, (d) cartilaginous joint.

5. Supination occurs when the (a) palm faces posteriorly, (b) palm faces anteriorly, (c) radius rotates laterally, (d) radius rotates medially.

6. Match the parts of a synovial joint listed in the key to their functions below. (More than one part may apply.)

Key: (a) articular cartilage (b) ligaments and fibrous layer of capsule
(c) synovial fluid (d) muscle tendon

____ **(1)** keeps bone ends from crushing when compressed; resilient

____ **(2)** resists tension placed on joints

____ **(3)** lubricant that minimizes friction and abrasion of joint surfaces

____ **(4)** helps prevent dislocation

7. Indicate the joint (or joints) from the list in column B that contains the structure listed in column A.

Column A	**Column B**
____ **(1)** medial meniscus	**(a)** sternoclavicular joint
____ **(2)** anular ligament of the radius	**(b)** temporomandibular joint
____ **(3)** saddle joint	**(c)** wrist joint
____ **(4)** articular disc	**(d)** shoulder joint
____ **(5)** rotator cuff	**(e)** elbow joint
____ **(6)** anterior cruciate ligament	**(f)** hip joint
____ **(7)** deltoid ligament	**(g)** knee joint
____ **(8)** ulnar collateral ligament	**(h)** ankle joint
____ **(9)** fibular collateral ligament	

8. Classify each of the synovial joints listed as one of the following: (a) plane joint, (b) hinge joint, (c) pivot joint, (d) condylar joint, (e) saddle joint, (f) ball-and-socket joint.

____ **(1)** proximal radioulnar joint

____ **(2)** trapezium and metacarpal I

____ **(3)** knee (tibiofemoral)

____ **(4)** metacarpophalangeal joint

____ **(5)** wrist joint

____ **(6)** atlanto-occipital joint

____ **(7)** atlantoaxial joint

____ **(8)** sternocostal joints, ribs 2–7

____ **(9)** intervertebral joints (between articular processes)

____ **(10)** acromioclavicular

Short Answer Essay Questions

9. Define joint.

10. Where does synovial fluid come from?

11. Explain weeping lubrication of the synovial joint surfaces.

12. While a partially torn ligament can heal itself, a completely torn ligament cannot. Explain.

13. Name two specific examples of each: hinge joint, plane joint, condylar joint, ball-and-socket joint.

14. What is the most dangerous injury that the intracapsular ligaments tend to suffer from? How can it be treated?

15. What does being "double-jointed" mean?

16. Name the most common direction in which each of the following joints tends to dislocate: (a) shoulder, (b) elbow.

17. Examine the thorax using a skeleton or an illustration. Classify the various joints you see as containing either hyaline cartilage, fibrocartilage, or fibrous tissue (fibrous joints).

18. What are the technical terms for the joint movements mentioned below? Which joints are involved in these movements? (a) moving the arm away from the midline, (b) increasing the angle between the bones in the arm and the forearm, (c) rotating the thigh away from the median plane, (d) jutting the jaw, (e) turning the sole medially.

19. What is muscle tone? How does it help to stabilize joints?

20. Compare a bursa and a tendon sheath in terms of their structure, function, and locations.

21. Provide the anatomically proper names of the joints between (a) the scapula and clavicle, (b) the articular processes of successive vertebrae, (c) the ribs and sternum, (d) the ribs and vertebrae, (e) the various tarsal bones. (Refer to Table 9.3 if needed.)

22. Name the joint that contains the (a) glenoid cavity and labrum; (b) cruciate ligaments and menisci; (c) anular ligament and head of radius; (d) coronoid process, trochlea, and radial collateral ligament; (e) medial and lateral ligaments and talus.

23. From your knowledge of word roots, determine the shape of each ligament listed: arcuate popliteal ligament, anulus ligament, deltoid ligament, oblique popliteal ligament.

Critical Reasoning & Clinical Application Questions

1. Harry was jogging down the road when he tripped in a pothole. As he fell, his ankle twisted violently to the side. The diagnosis was severe dislocation and spraining of the ankle. The surgeon stated that she would perform a reduction of the dislocation and then attempt to repair the injured ligament using arthroscopy. (a) What kinds of movements can normally occur at the ankle joint? (b) Was the doctor telling Harry that his bones were broken? (c) What is reduction of a joint? (d) Why is it often necessary to repair ligaments surgically? (e) How will the use of arthroscopic surgery minimize Harry's recovery time and his suffering?

2. Standing on an old tool, Lisa was cleaning the top shelf of her kitchen. Unfortunately, she slipped and fell on her knee. The knee swelled up immediately, and the pain became unbearable. When the doctor examined her, the knee was warm to touch as it was filled with fluid. What has happened to Lisa?

3. Shaun wakes up in the middle of the night feeling like his big toe is on fire. He has never experienced anything like this before and decides to visit his physician in the morning. The physician makes the following notes on Shaun's file: "excruciating pain" and "redness at base of the big toe". (a) What type of arthritis does Shaun suffer from? (b) Why is this condition more common in men than in women? (c) What medication is the physician likely to prescribe to relieve Shaun's pain?

4. Three-year-old Tom was giggling as his father was swinging him holding his hands. All of a sudden, he cried out loudly and said that his right arm hurt very much. What has happened to Tom's arm?

5. At his ninety-fourth birthday party, Jim was complimented on how good he looked and was asked about his health. He answered, "I feel good, except that some of my joints ache and are stiff, especially my knees and hips and lower back, and especially when I wake up in the morning." A series of X-ray studies and an MRI scan taken a few weeks earlier showed that the articular cartilages of these joints were rough and flaking off and that bone spurs were present at the ends of some of Jim's bones. What is Jim's probable condition?

6. During an anatomy lecture, the professor mentioned that a specific movement of the human thumb makes the hand a very dynamic tool. Name this movement, and the joint that allows it. What actions does this movement help the hand to perform?

7. Describe how the structure of the joints in each limb reflects the function of each limb (mobility in the upper limb, stability in the lower limb). What movements are unique to the upper limb? Which joints enable these unique movements?

8. Using your knowledge of word roots, provide the meaning of each of the clinical terms listed here. Compare the word root meaning to the definition of each term or disorder: (a) subcutaneous prepatellar bursa, (b) subluxation, (c) osteoarthritis, (d) chondromalacia patellae, (e) arthroscopy.