axial skeleton the central core of the bony skeleton, consisting of the skull, spine, and supporting thoracic bones.

appendicular skeleton the periphery of the skeleton; the bones of the arms and legs.

axial pertaining to the axis of a body part.

The skeleton is divided into two major parts, the **axial skeleton** and the **appendicular skeleton**. The **axial** skeleton has 80 bones and consists of the skull, vertebrae, and thoracic cage (Figure 20-2a■). It transfers weight from the head, trunk, and upper extremities to the lower extremities at the pelvis. These bones are responsible for the upright position of the human body. The appendicular skeleton has 126 bones and consists of the bones of the shoulders, arms, pelvis, and legs (Figure 20-2b■). These bones are responsible for manipulating objects (the shoulder and the upper extremities) and for locomotion (the pelvis and the lower extremities).

The body contains three major types of bones based on shape: long bones, flat bones, and irregular bones (Figure 20-3■). Long bones include the humerus, radius, and ulna of the two upper extremities, and the femur, tibia, and fibula of the two lower extremities. Flat bones protect internal organs and include the skull, the scapula of the upper extremities, the ribs, the sternum, and the pelvic bones. Irregular bones have multiple functions and include the vertebrae, and the bones of the wrists, hands, ankles, and feet.

articular cartilage the cartilage that is affixed to the end of a bone within a joint.

Long bones consist of two parts: the epiphysis or bone ends, and the diaphysis or shaft (Figure 20-4■). Bone ends are covered with **articular cartilage**, which provides a nearly friction-free surface that allows bone ends to move smoothly against one another. Children's bones grow longer near the ends, along the epiphyseal line. Fractures at this line, especially during early childhood, can affect bone growth and development.

periosteum the thin outer covering of a bone.

cortex the hard outer layer of a bone.

The outer part of a bone is a tough lining known as **periosteum**. Beneath the periosteum is the hard **cortex**. Within the cortex is the bone marrow, a less-dense region where blood cells are made (Figure 20-5■). Bones are highly vascular and receive 10–20 percent of the blood pumped by the heart. When the cortex of a bone breaks, the highly vascular marrow may bleed severely.

Figure 20-2 (a) The appendicular skeleton. (b) The axial skeleton.

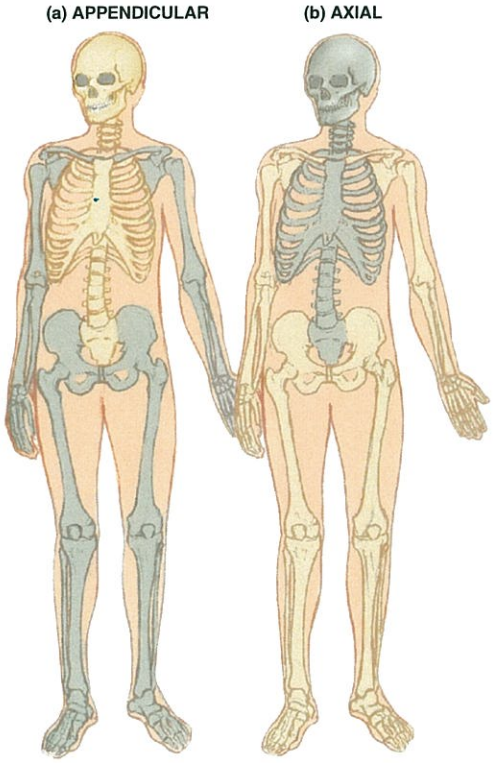
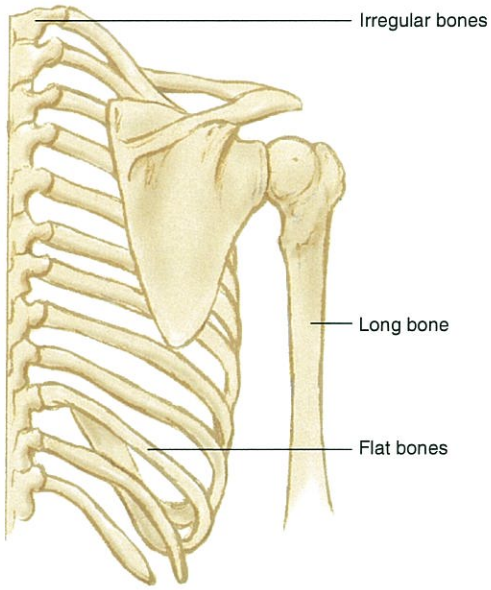


Figure 20-3 Three major types of bones according to shape.



STOP, THINK, UNDERSTAND *continued*

List

List three functions of the rigid skeletal framework.

1. _____
2. _____
3. _____

Short Answer

1. Describe the components and actions of the axial skeleton.

_____

_____

2. Describe the components and functions of the appendicular skeleton.

_____

_____

Fill in the Blank

1. The end of a bone is called the_____; the shaft is called the _____.
2. The skeleton is divided into two major parts: the _____and the _____.

Joints

The site at which two or more bones make contact is known as a joint. Joints enable the body to bend, straighten, and produce all body movements. A joint consists of two or more bones and the connective tissues that surround, stabilize, and support the joint, called the **joint capsule**. This capsule contains a slippery lubricant known as synovial fluid made by the **synovium**. This fluid, along with the bones' articular surfaces, allows the bones to move freely within the joint capsule. The names of some joints come from the bones that form them. For example, the radiohumeral joint at the elbow is where the radius and the humerus meet. Other joints have unique names, such as the knee or the hip.

joint capsule a sheet of fibrous connective tissue enclosing a synovial joint.

synovium the inner layer of the joint capsule whose cells make a viscous fluid that lubricates joints.

Joints provide different degrees of movement. Many joints, such as the knee, hip, elbow, and shoulder joints, are essentially *freely movable* (Figure 20-6■). A few joints, such

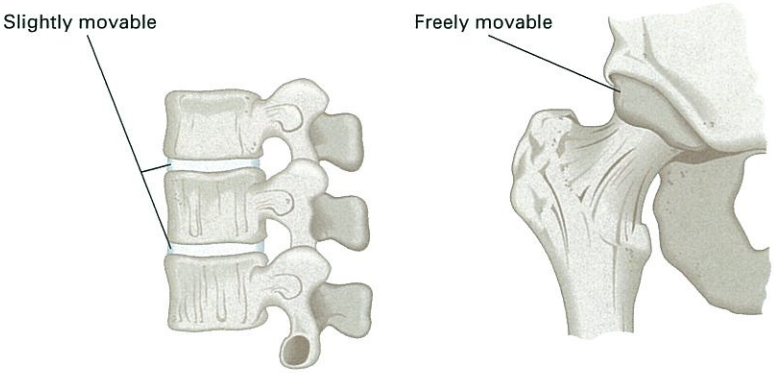


Figure 20-6 Types of movable joints.

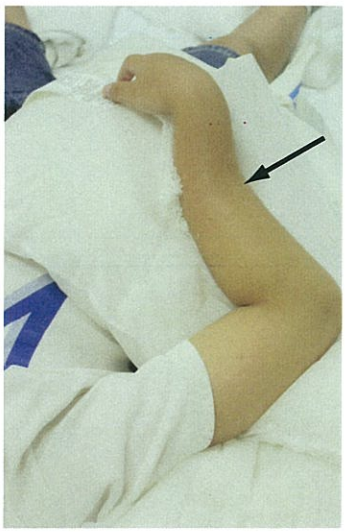


Figure 20-15 A displaced fracture of the forearm.
Copyright E. M. Singletary, M.D.

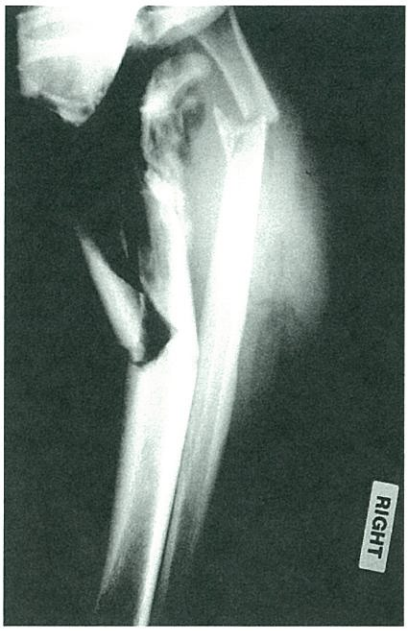


Figure 20-16a A complete fracture.
Copyright Charles Stewart, M.D.

Figure 20-16b An incomplete fracture of the tibia.
Copyright Charles Stewart, M.D.

the fracture line does not completely penetrate the entire bone, leaving one side of the bone intact (Figure 20-16b■). Incomplete fractures are nondisplaced. X-ray studies are generally needed to determine whether a fracture is complete or incomplete.

Some fractures are named according to either the specific mechanism of injury or the shape of the fracture line (Figures 20-17■). Table 20-1■ also lists and describes some types of fractures.

Figure 20-17 Types of fractures.

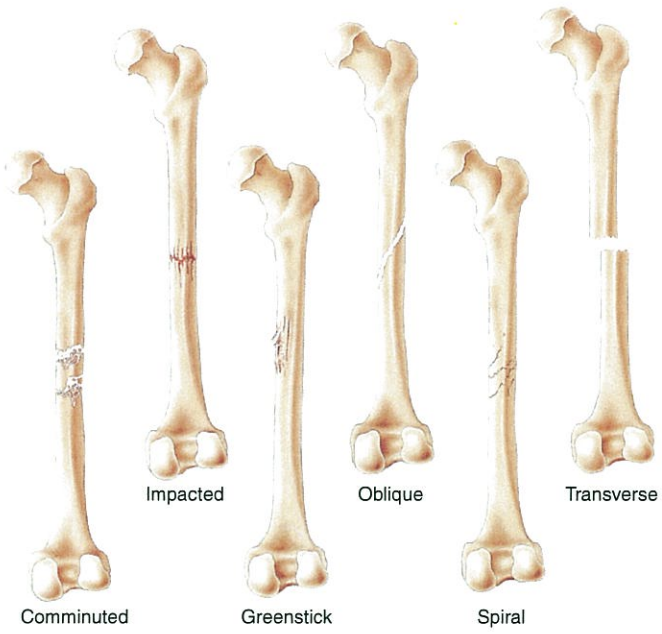


Figure 20-40 An X-ray of a mid-shaft fracture of the femur.

Figure 20-41 Information concerning the mechanism of injury and a thorough assessment of the patient provide clues about the nature of a thigh injury.

Fractures of the middle third of the femur (known as the "shaft") are caused by direct and forceful trauma to the thigh, a fall, or intense twisting of the thigh (Figure 20-40■). Assessment of the mechanism of injury generally provides clues concerning the forces involved (Figure 20-41■). Direct trauma results in a transverse fracture, whereas twisting results in a spiral fracture or an oblique fracture. Falls from a height often result in a comminuted fracture. Signs and symptoms of a femur fracture include intense pain, deformity, thigh swelling, and false movement. The bone may also be angulated.

The distal end of the femur has two large flared ends known as the medial and lateral condyles. A fracture occurring just above or between the two is called a supracondylar femur fracture. Fractures involving this area are characterized by severe pain and swelling just above the knee, deformity, inability to move the knee, and spasm of the thigh muscles. In addition, just behind the distal end of the femur are the large popliteal artery and its branches, the popliteal veins, and the major nerves to the lower leg. These structures can be damaged by jagged bone ends produced by a distal femur fracture. If this occurs, distal CMS may be compromised, resulting in poor perfusion, decreased motor function, and decreased sensation in the lower leg.

Knee Injuries

Knee injuries constitute 30 percent of all ski injuries and are a common occurrence in many other outdoor activities, especially those involving twisting of the knee during running and jumping. Most knee injuries are sprains involving the four main ligaments that support the knee joint. Return to Figure 20-8. The medial collateral and lateral collateral ligaments act as hinges on each side of the knee. Inside the joint are the anterior and posterior cruciate ligaments, which prevent forward and backward motion of the femur on the tibia. Depending on the mechanism of injury, one or more of these ligaments can be stretched or torn.

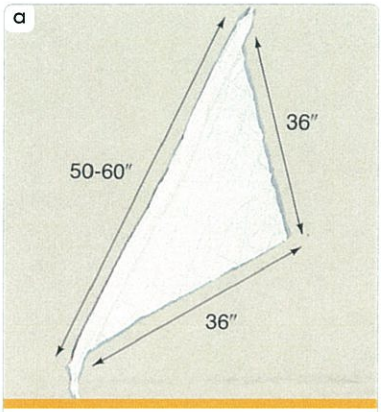
valgus medial (inward) angulation of a bone or joint (toward the midline).

varus lateral (outward) angulation of a bone or joint (away from the midline).

The most common ski injury is a medial collateral ligament sprain. This injury occurs when the knee is stressed while in a **valgus** position (when the knee is forced medially into an extremely "knock-kneed" position). Symptoms of this injury include point tenderness above, below, or over the joint line on the inside of the knee. Much less frequent is an injury to the lateral collateral ligament, which can occur if the knee is stressed in the opposite or **varus** position, in which the knee is forced laterally (as if the

OEC SKILL 20-1 Applying Sling and Swathe

a



Prepare the sling with a cravat or by folding a cloth into a triangle.

b

After assessing CMS, place the sling on the chest under the injured arm. Have the patient support the arm, or if there are two rescuers, have the second

c

Fold the lower half up and over the injured arm, then up and over the shoulder on the injured side. Raise or lower the arm to the appropriate level.

d

Tie the two ends at the side of the neck and place a pad under the knot.

e

Secure the point of the sling and either pin it to the front or tie a knot.

f

For the swathe: Fold a second triangular bandage to form a cravat that is 2–4 inches wide. Wrap around the patient's chest with the middle of the cravat over the injured arm, and tie the two ends under the opposite arm. Reassess CMS..

OEC SKILL 20-3 Reducing a Posterior Sternoclavicular (S/C) Injury

a

Place a blanket roll between the shoulder blades to elevate the thorax.
Copyright Edward McNamara

b

Apply traction to the arm on the affected side by pulling the arm at the wrist.
Copyright Edward McNamara

c

Apply counter-traction by pulling on the other side near the axilla with a long broad cravat.
Copyright Edward McNamara

OEC SKILL 20-4 Applying a Blanket Roll Splint to a Shoulder

a

Fold a blanket lengthwise into thirds or fourths and lay four cravats crosswise onto the blanket. Knots can be tied in the cravats for differentiating ties.
Copyright Edward McNamara

b

Roll or fold the blanket into the appropriate size to fit the patient.
Copyright Edward McNamara

c

Place the blanket roll snugly up into the patient's armpit and hold in place.
Copyright Edward McNamara

d

Tie one of the cravats from the blanket roll under the opposite shoulder and another around the neck.
Copyright Edward McNamara

e

Stabilize the hand and forearm with the other two cravats and then reassess CMS.
Copyright Edward McNamara

Skill Guide

Date:_____

(CPI) = Critical Performance Indicator

Candidate: _____

Start time: _____

End time: _____

Posterior S/C Dislocation Reduction

Objective: To demonstrate how to reduce a posterior S/C dislocation.

Skill	Max Points	Skill Demo	
Determines that scene is safe.	1		(CPI)
Introduces self, obtains permission to treat/help.	1		
Initiates Standard Precautions.	1		(CPI)
Assesses CMS.	1		(CPI)
Ties wide cravat around upper chest, under armpits.	1		
Forms a tight blanket roll.	1		
Places patient in supine position, with blanket roll under shoulder blades.	1		
Rescuer #1 applies traction to the wrist on affected side by pulling arm out and downward toward ground.	1		(CPI)
Rescuer #2 simultaneously places counter-traction on the other side of body by pulling on cravat tied around upper chest.	1		(CPI)
Reassesses CMS.	1		(CPI)
Applies figure-eight splint and then applies a swathe.			(CPI)
Treats for shock.	1		
Arranges for transport of patient.	1		

Must receive 10 out of 13 points.

Comments: _____

Failure of any of the CPIs is an automatic failure.

Evaluator: _____ NSP ID: _____

PASS FAIL

Skill Guide

Date:_____

(CPI) = Critical Performance Indicator

Candidate: _____

Start time: _____

End time: _____

Traction Splinting

Objective: To demonstrate the ability to apply a traction splint.

Skill	Max Points	Skill Demo	
Determines that scene is safe.	1		(CPI)
Introduces self, obtains permission to treat/help.	1		
Initiates Standard Precautions.	1		(CPI)
Exposes and assesses the injury to determine the location and proximity to hip or knee joint; checks for bleeding and treats bleeding if present.	1		
Rescuer #1 manually stabilizes the fracture site above and below the injury.	1		(CPI)
Rescuer #2 stabilizes the boot/shoe or the ski/snowboard if the equipment is still in place.	1		
Rescuer #3 assesses CMS.	1		(CPI)
Rescuer #3 prepares traction splint and adjusts to proper size according to manufacturer's instructions; rescuer uses uninjured leg to measure splint.	1		
Rescuer #2 removes ski or snowboard if present and then applies the ankle hitch.	1		
Rescuer #2 firmly grasps ankle hitch with one hand and places other hand under the calf and moves the injured leg in a coordinated fashion with Rescuer #1 to straighten leg into anatomical alignment using manual traction; maintains traction as Rescuer #1 releases manual stabilization.	1		
Rescuer #3 positions the splint according to manufacturer's directions and secures the groin strap around upper thigh.	1		
Rescuer #3 connects ankle strap if needed and turns crank/knob, gradually replacing manual traction with mechanical traction.	1		
Rescuers secure Velcro support straps or cravats.	1		
Secures patient to a backboard.	1		(CPI)
Reassesses CMS.	1		(CPI)
Treats for shock/provides oxygen.	1		(CPI)
Prepares patient for transport, activates EMS.	1		(CPI)

Must receive 13 out of 17 points.

Comments: _____

Failure of any of the CPIs is an automatic failure.

Evaluator:_____ NSP ID:_____

PASS FAIL