FIGURE 5-12

Bones of the thorax. Rib pairs 1 through 7, the true ribs, are attached by cartilage to the sternum. Rib pairs 8 through 10, the false ribs, are attached to the cartilage of the seventh pair. Rib pairs 11 and 12 are called floating ribs because they have no anterior cartilage attachments.

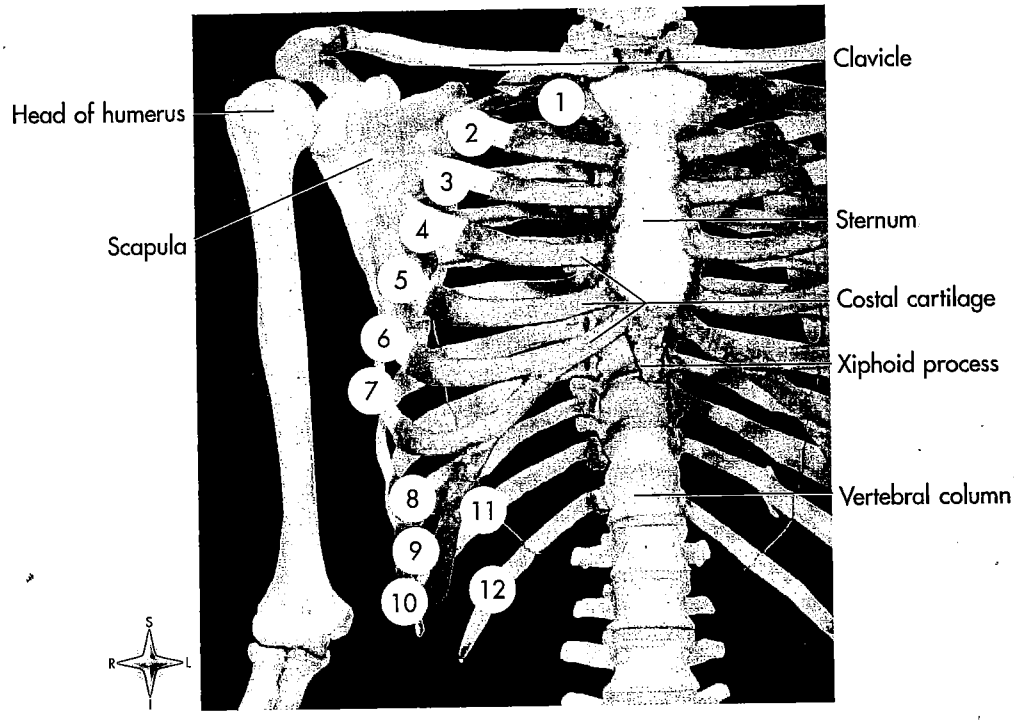


TABLE 5-4

Bones of the Thorax

NAME	NUMBER	DESCRIPTION
True ribs	14	Upper seven pairs; attached to sternum by *costal cartilages*
False ribs	10	Lower five pairs; lowest two pairs do not attach to sternum, therefore, called *floating ribs;* next three pairs attached to sternum by costal cartilage of seventh ribs
Sternum	1	Breastbone; shaped like a dagger; piece of cartilage at lower end of bone called *xiphoid process;* superior portion called the *manubrium*

The **humerus** (HYOO-mer-us) is the long bone of the arm and the second longest bone in the body. It is attached to the scapula at its proximal end and articulates with the two bones of the forearm at the elbow joint. The bones of the forearm are the **radius** and the **ulna.** The anatomy of the elbow is a good example of how structure determines function. Note in Figure 5-13 that the large bony process of the ulna, called the **olecranon** (o-LEK-rah-non) **process,** fits nicely into a

FIGURE 5-13

Bones of the arm, elbow joint, and forearm. Posterior aspect of **A,** right humerus; **B,** right radius and ulna; and **C,** right elbow.

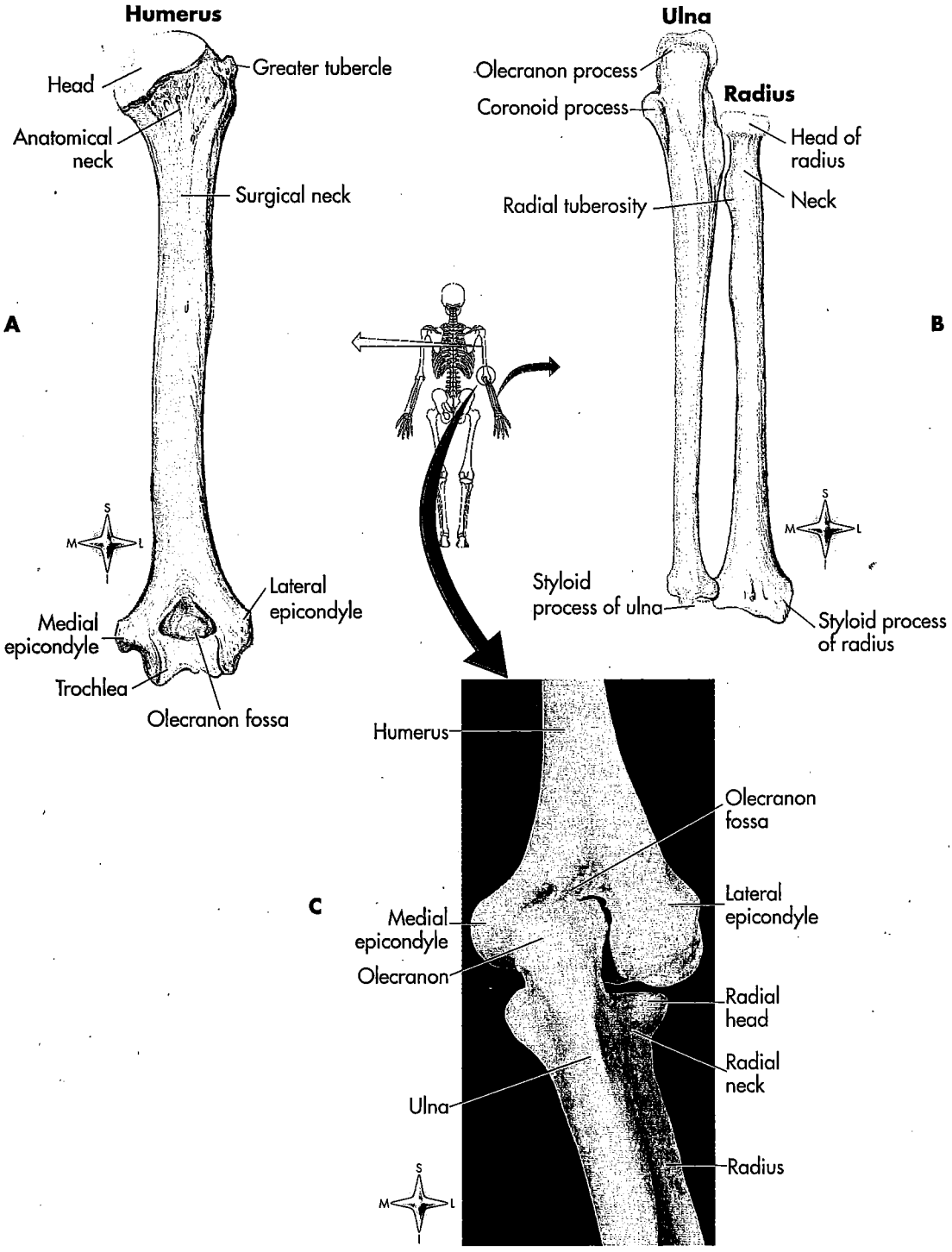


TABLE 5-5

Bones of the Upper Extremities

NAME	NUMBER	DESCRIPTION
Clavicle	2	Collarbones; only joints between shoulder girdle and axial skeleton are those between each clavicle and sternum *(sternoclavicular joints)*
Scapula	2	Shoulder blades; scapula plus clavicle forms *shoulder girdle; acromion process*—tip of shoulder that forms joint with clavicle; *glenoid cavity*—arm socket
Humerus	2	Upper arm bone (Muscles are attached to the *greater tubercle* and to the *medial* and *lateral epicondyles;* the *trochlea* articulates with the ulna; the *surgical neck* is a common fracture site.)
Radius	2	Bone on thumb (lateral) side of lower arm (Muscles are attached to the *radial tuberosity* and to the *styloid process.*)
Ulna	2	Bone on little finger (medial) side of lower arm; *olecranon process*—projection of ulna known as elbow or "funny bone" (Muscles are attached to the *coronoid process* and to the *styloid process.*)
Carpal bones	16	Short bones at upper end of hand; anatomical wrist
Metacarpals	10	Form framework of palm of hand
Phalanges	28	Finger bones; three in each finger, two in each thumb

large depression on the posterior surface of the humerus, called the **olecranon fossa.** This structural relationship makes possible movement at the joint.

The radius and the ulna of the forearm articulate with each other and with the distal end of the humerus at the elbow joint. In addition, they also touch each another distally where they articulate with the bones of the wrist. In the anatomical position, with the arm at the side and the palm facing forward, the radius runs along the lateral side of the forearm, and the ulna is located along the medial border.

The wrist and the hand have more bones in them for their size than any other part of the body—8 **carpal** (KAR-pal) or wrist bones, 5 **metacarpal** (met-ah-KAR-pal) bones that form the support structure for the palm of the hand, and 14 **phalanges** (fah-LAN-jeez) or finger bones—27 bones in all (Table 5-5). This composition is very important structurally. The presence of many small bones in the hand and wrist and the many movable joints between them makes the human hand highly maneuverable. Some anatomists refer to the hand and wrist as the functional "reason" for the upper extremity. Figure 5-14 shows the relationships between the bones of the wrist and hand.

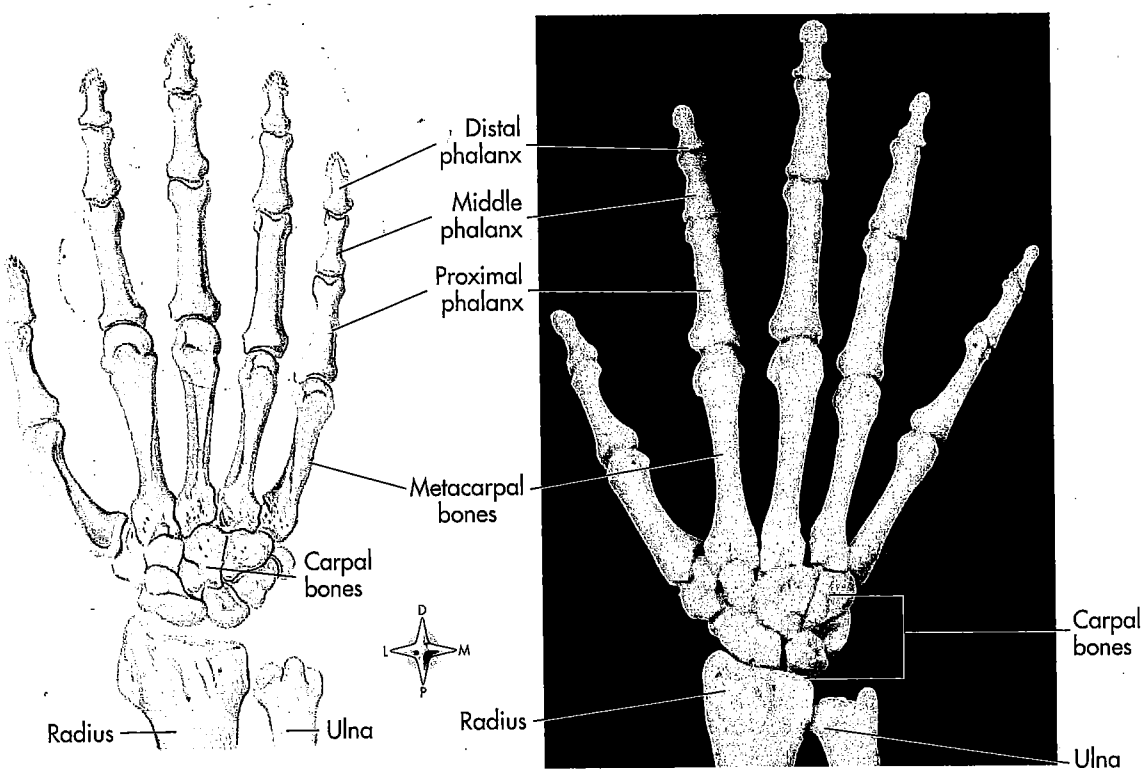
Lower Extremity

The *hip* or *pelvic girdle* connects the legs to the trunk. The hip girdle as a whole consists of two large **coxal** or pelvic bones, one located on each side of the pelvis. These two bones, with the sacrum and coccyx behind, provide a strong base of support for the torso and connect the lower extremities to the axial skeleton. In an infant's body each coxal bone consists of three separate bones—the **ilium** (ILL-ee-um), the **ischium** (IS-kee-um), and the **pubis** (PYOO-bis) (Figure 5-6). These bones grow together to become one bone in an adult (Figures 5-7 and 5-18).

Just as the humerus is the only bone in the arm, the **femur** (FEE-mur) is the only bone in the thigh (Figure 5-15). It is the longest bone in the body and

FIGURE 5-14

Bones of the right hand and wrist. There are 14 phalanges in each hand. Each of these bones is called a phalanx.



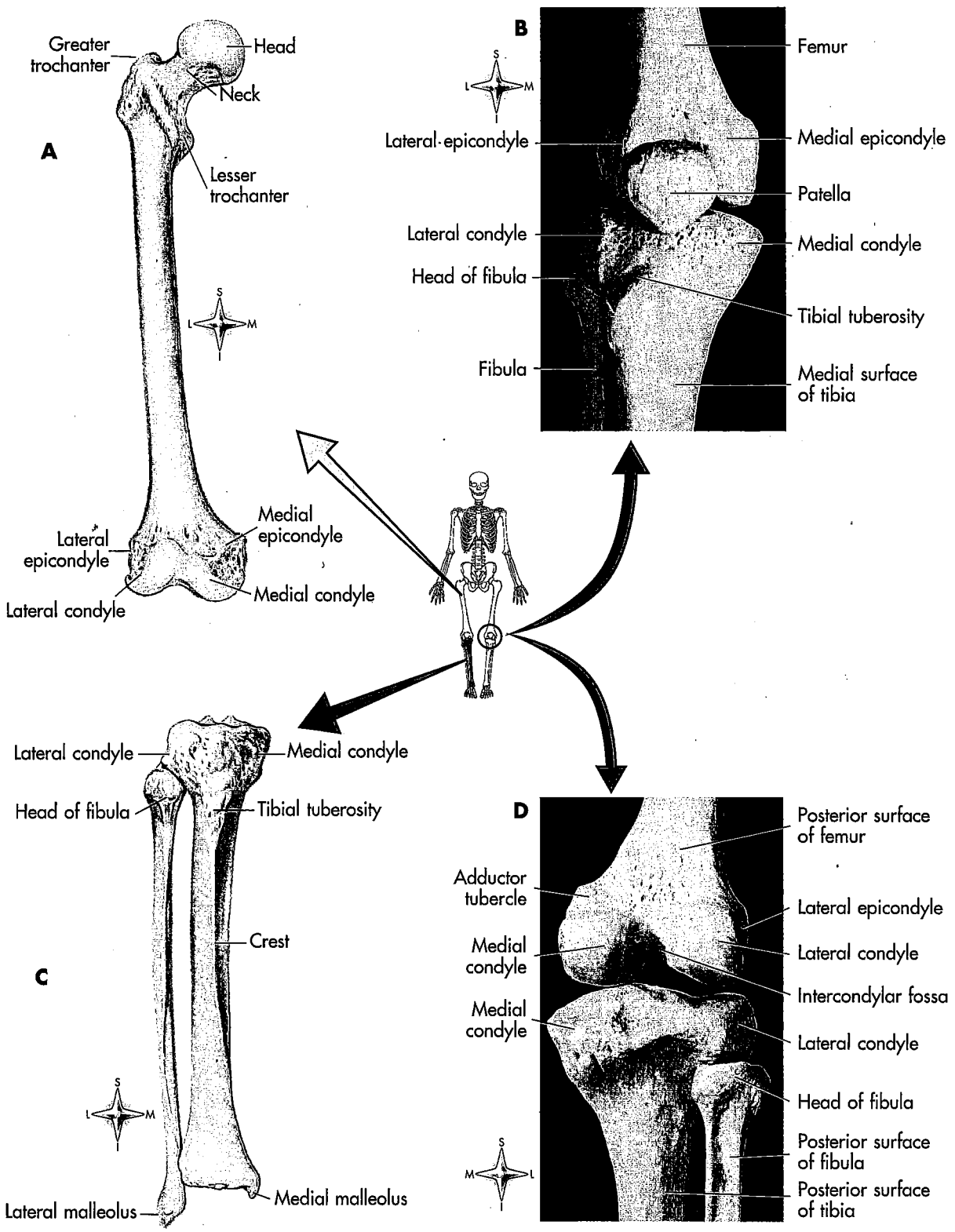
articulates proximally (toward the hip) with the coxal bone in a deep, cup-shaped socket called the **acetabulum** (as-e-TAB-yoo-lum). The articulation of the head of the femur in the acetabulum is more stable than the articulation of the head of the humerus with the scapula in the upper extremity. As a result, dislocation of the hip occurs less often than does disarticulation of the shoulder. Distally, the femur articulates with the knee cap or **patella** (pah-TEL-ah) and the **tibia** or "shinbone." The tibia forms a rather sharp edge or crest along the front of your lower leg. A slender, non–weight-bearing, and rather fragile bone named the **fibula** lies along the outer or lateral border of the lower leg.

Toe bones have the same name as finger bones—**phalanges.** There are the same number of toe bones as finger bones, a fact that might surprise you because toes are shorter than fingers. Foot bones comparable to the metacarpals and carpals of the hand have slightly different names. They are called **metatarsals** and **tarsals** in the foot (Figure 5-16). Just as each hand contains five metacarpal bones, each foot contains five metatarsal bones. However, the foot has only seven tarsal bones, in contrast to the hand's eight carpals. The largest tarsal bone is the **calcaneus** or heel bone. The bones of the lower extremities are summarized in Table 5-6.

You stand on your feet, so certain features of their structure make them able to support the body's weight. The great toe, for example, is considerably more solid and less mobile than the

FIGURE 5-15

Bones of the thigh, knee joint, and leg. A, Anterior aspect of right femur; **B,** anterior aspect of the knee; **C,** right tibia and fibula; and **D,** posterior aspect of the right knee.



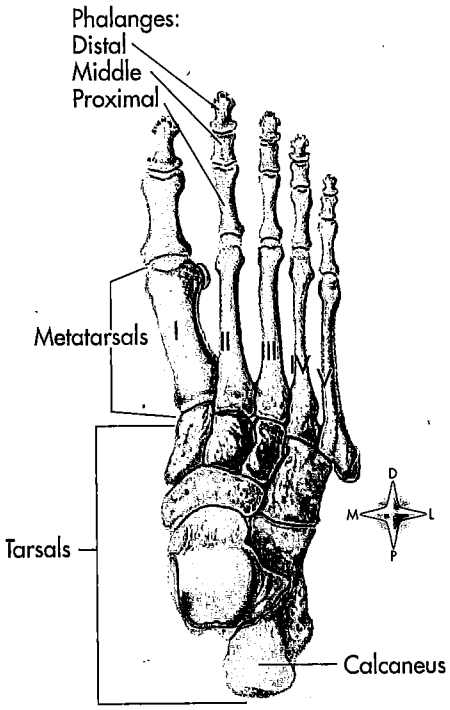


FIGURE 5-16

Bones of the right foot. Compare the names and numbers of foot bones (viewed here from above) with those of the hand bones shown in Figure 15-14.

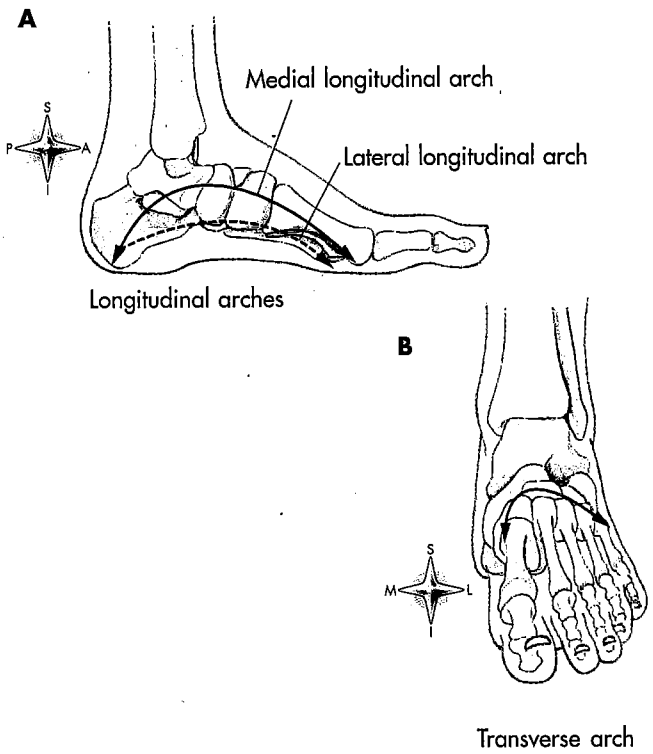
TABLE 5-6

Bones of the Lower Extremities

NAME	NUMBER	DESCRIPTION
Coxal bone	2	Hipbones; *ilium*—upper flaring part of pelvic bone; *ischium*—lower back part; *pubic bone*—lower front part; *acetabulum*—hip socket; *symphysis pubis*—joint in midline between two pubic bones; *pelvic inlet*—opening into *true pelvis* or pelvic cavity; if pelvic inlet is misshapen or too small, infant skull cannot enter true pelvis for natural birth
Femur	2	Thigh or upper leg bones; *head of femur*—ball-shaped upper end of bone; fits into acetabulum (Muscles are attached to the *greater* and *lesser trochanters* and to the *lateral* and *medial epicondyles;* the *lateral* and *medial condyles* form articulations at the knee.)
Patella	2	Kneecap
Tibia	2	Shinbone; *medial malleolus*—rounded projection at lower end of tibia commonly called *inner anklebone;* muscles are attached to the *tibial tuberosity*
Fibula	2	Long slender bone of lateral side of lower leg; *lateral malleolus*—rounded projection at lower end of fibula commonly called *outer anklebone*
Tarsal bones	14	Form heel and back part of foot; anatomical ankle; largest is the *calcaneus*
Metatarsals	10	Form part of foot to which toes are attached; tarsal and metatarsal bones arranged so that they form three arches in foot; *inner longitudinal arch* and *outer longitudinal arch,* which extend from front to back of foot, and transverse or *metatarsal arch,* which extends across foot
Phalanges	28	Toe bones; three in each toe, two in each great toe

FIGURE 5-17

Arches of the foot. A, Medial and lateral longitudinal arches. **B,** Transverse arch.



thumb. The foot bones are held together in such a way as to form springy lengthwise and crosswise arches. These provide great supporting strength and a highly stable base. Strong ligaments and leg muscle tendons normally hold the foot bones firmly in their arched positions. Frequently, however, the foot ligaments and tendons weaken. The arches then flatten, a condition appropriately called *fallen arches* or *flatfeet*.

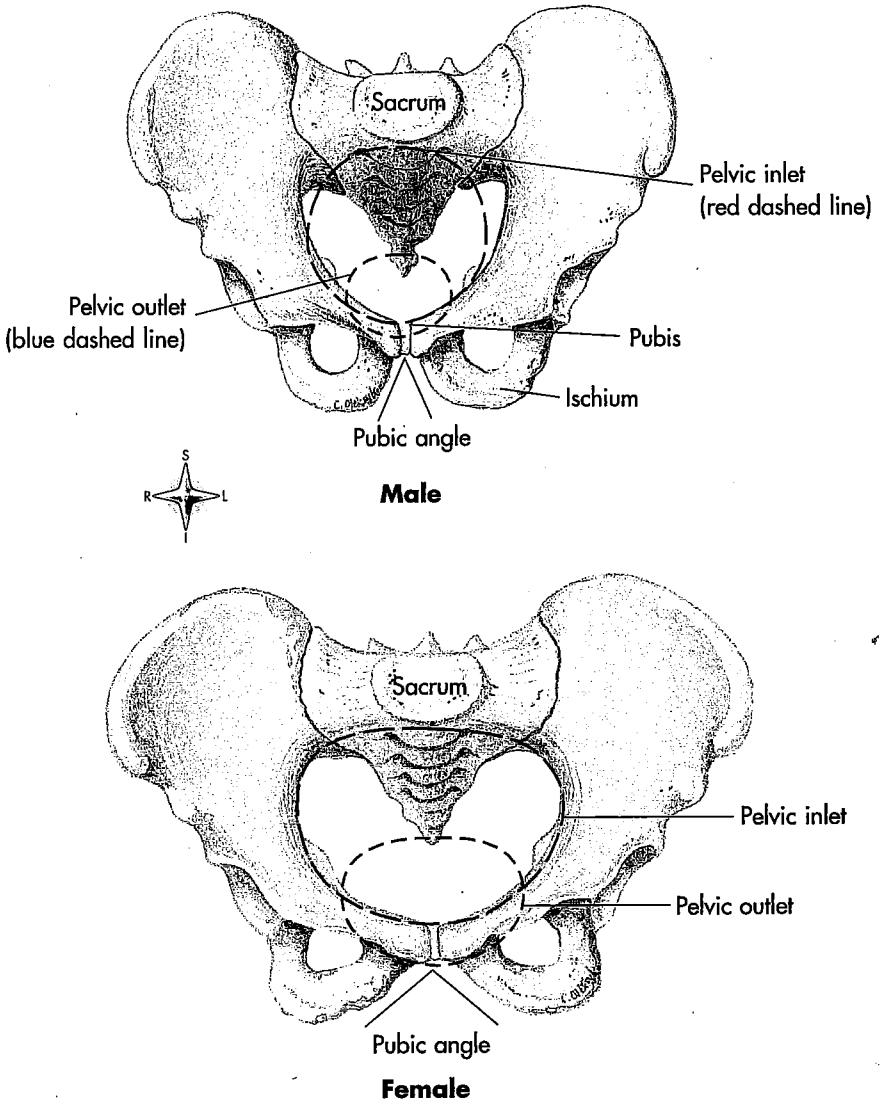
Two arches extend in a lengthwise direction in the foot (Figure 5-17, *A*). One lies on the inside part of the foot and is called the **medial longitudinal arch.** The other lies along the outer edge of the foot and is named the **lateral longitudinal arch.** Another arch extends across the ball of the foot; this arch is called the **transverse** or **metatarsal arch** (Figure 5-17, *B*).

Differences Between a Man's and a Woman's Skeleton

A man's skeleton and a woman's skeleton differ in several ways. If you were to examine a male skeleton and a female skeleton placed side by side, you would probably first notice the difference in their sizes. Most male skeletons are larger than most female skeletons, a structural difference that seems to have no great functional importance. Structural differences between the male and female hipbones, however, do have functional importance. The female pelvis is made so that the body of a baby can be cradled in it before birth and can pass through it during birth. Although the individual male hip-

FIGURE 5-18

Comparison of the male and female pelvis. Notice the narrower width of the male pelvis, giving it a more funnel-like shape than the female pelvis.



bones (coxal bones) are generally larger than the individual female hipbones, together the male hipbones form a narrower structure than do the female hipbones. A man's pelvis is shaped something like a funnel, but a woman's pelvis has a broader, shallower shape, more like a basin. (Incidentally, the word *pelvis* means "basin.") Another difference is that the pelvic inlet and pelvic outlet are both normally much wider in the female than in the male. Figure 5-18 shows this difference clearly. The angle at the front of the female pelvis where the two pubic bones join is wider than it is in the male.