MAIN SYNOVIAL JOINTS OF THE LIMBS

Learning outcome

After studying this section you should be able to:

- describe the structure and movements of the following synovial joints: shoulder, elbow, wrist, hip, knee, ankle.

Individual synovial joints have the characteristics described above so only their distinctive features are included in this section.

Shoulder joint (Fig. 17.4)

This ball and socket joint is formed by the glenoid cavity of the scapula and the head of the humerus. The capsular ligament is very loose inferiorly to allow for the free movement normally possible at this joint. The glenoid cavity is deepened by a rim of fibrocartilage, the *glenoidal labrum*, which provides additional stability without limiting movement. The tendon of the long head of the *biceps muscle*, lying in the intertubercular (bicipital) groove of the humerus, extends through the joint cavity and is attached to the upper rim of the glenoid cavity. It has an important stabilising effect on the joint.

Synovial membrane forms a sleeve round the part of the tendon of the long head of the biceps muscles within the capsular ligament and covers the glenoidal labrum.

Extracapsular structures consist of:

- the *coracohumeral ligament*, extending from the coracoid process of the scapula to the humerus
- the *glenohumeral ligaments*, which blend with and strengthen the capsule
- the *transverse humeral ligament*, retaining the biceps tendon in the intertubercular groove.

The stability of the joint may be reduced if these structures, together with the tendon of the biceps muscle, are stretched by repeated dislocations of the joint.

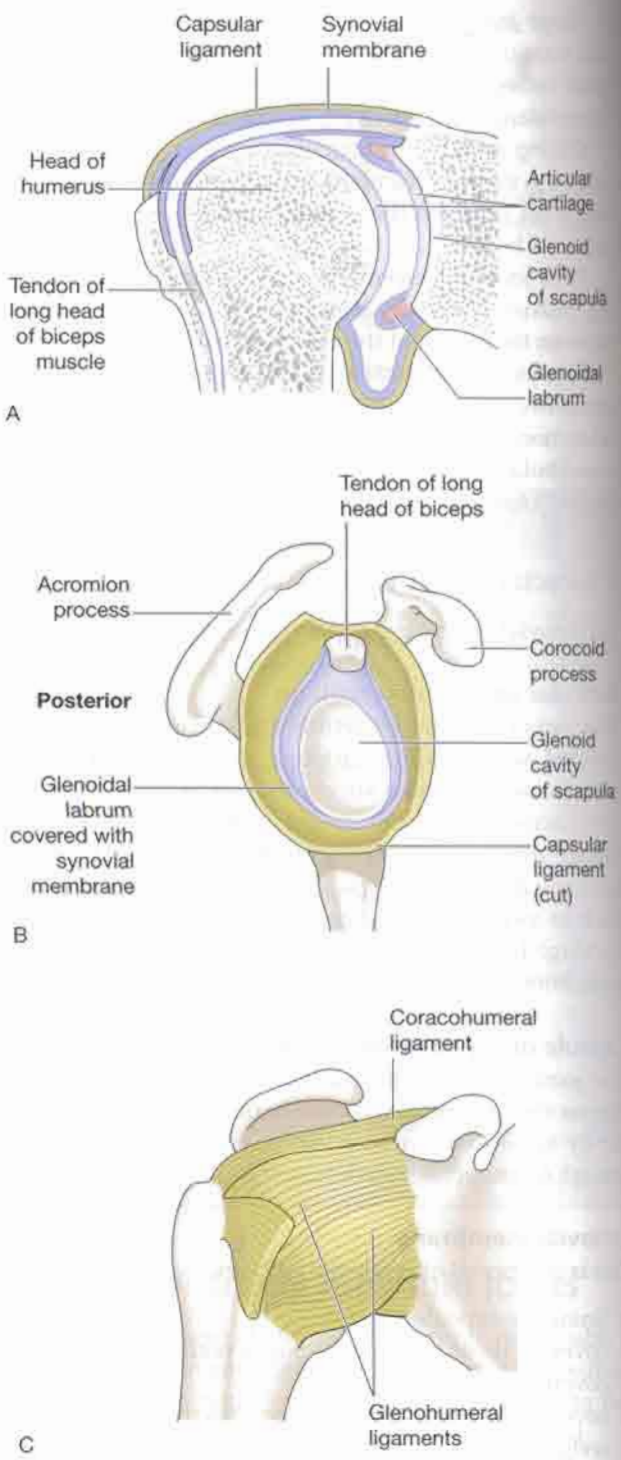

Figure 17.4 The right shoulder joint: A. Section viewed from the front. B. The position of glenoidal labrum with the humerus removed, viewed from the side. C. The supporting ligaments viewed from the front.

Muscles and movements

Muscles (Fig. 17.5)

Coracobrachialis muscle. This lies on the upper medial aspect of the arm. It arises from the coracoid process of the scapula, stretches across in front of the shoulder joint and is inserted into the middle third of the humerus. It flexes the shoulder joint.

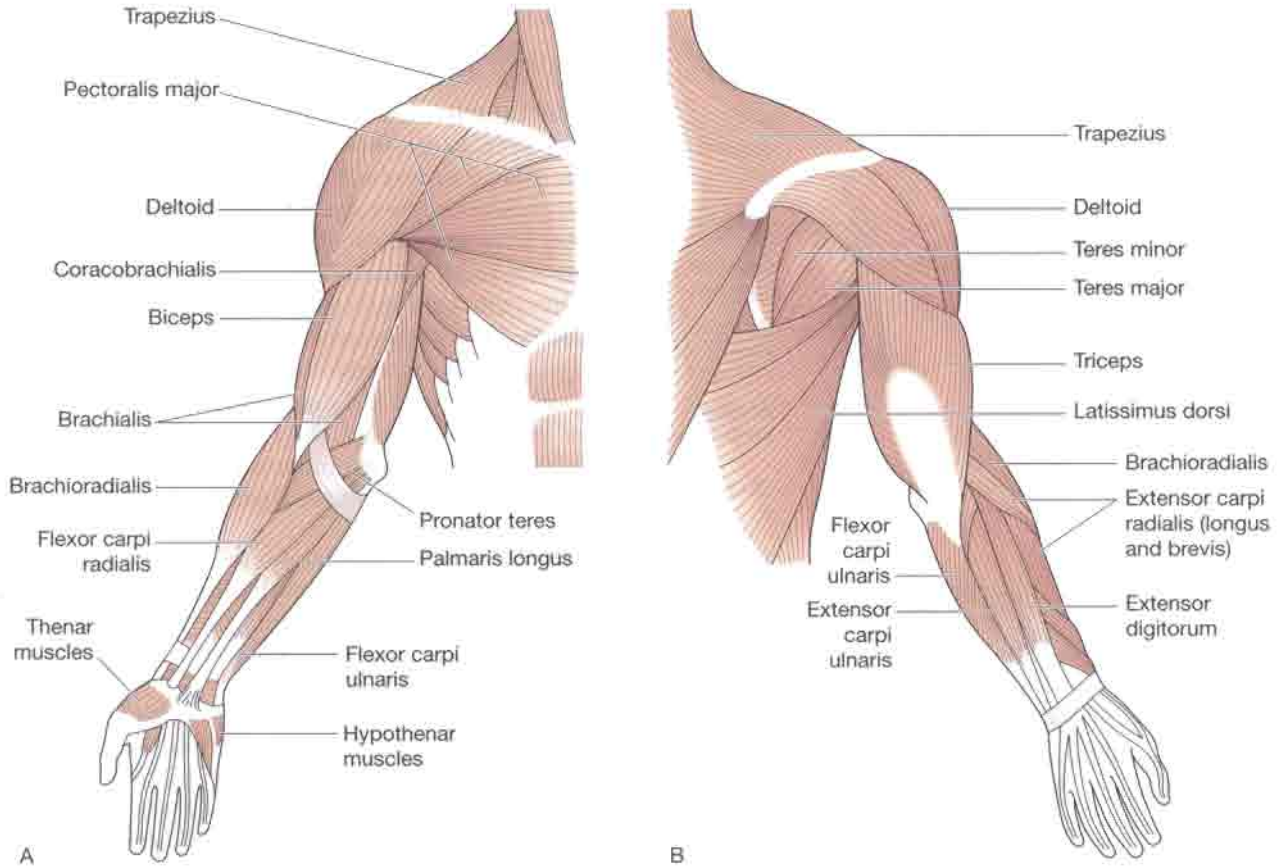

Figure 17.5 The main muscles that move the joints of the upper limb. A. Anterior view. B. Posterior view.

Deltoid muscle. These muscle fibres originate from the clavicle, acromion process and spine of scapula and radiate over the shoulder joint to be inserted into the deltoid tuberosity of the humerus. It forms the fleshy and rounded contour of the shoulder. The anterior fibres cause flexion, the middle or main part, abduction and the posterior fibres extend the shoulder joint.

Pectoralis major. This lies on the anterior thoracic wall. The fibres originate from the middle third of the clavicle and from the sternum and are inserted into the lip of the intertubercular groove of the humerus. It draws the arm forward and towards the body, i.e. flexes and adducts.

Latissimus dorsi. This arises from the posterior part of the iliac crest and the spinous processes of the lumbar and lower thoracic vertebrae. It passes upwards across the back then under the arm to be inserted into the bicipital groove of the humerus. It adducts, medially rotates and extends the arm.

Teres major. This originates from the inferior angle of the scapula and is inserted into the humerus just below the shoulder joint. It extends, adducts and medially rotates the arm.

Movements

Flexion: coracobrachialis, anterior fibres of deltoid and pectoralis major.
Extension: teres major, latissimus dorsi and posterior fibres of deltoid.
Abduction: deltoid.
Adduction: combined action of flexors and extensors.
Circumduction: flexors, extensors, abductors and adductors acting in series.
Medial rotation: pectoralis major, latissimus dorsi, teres major and anterior fibres of deltoid.
Lateral rotation: posterior fibres of deltoid.

Elbow joint (Fig. 17.6)

This *hinge* joint is formed by the trochlea and the capitulum of the humerus and the trochlear notch of the ulna and the head of the radius.

Extracapsular structures consist of anterior, posterior, medial and lateral strengthening ligaments.

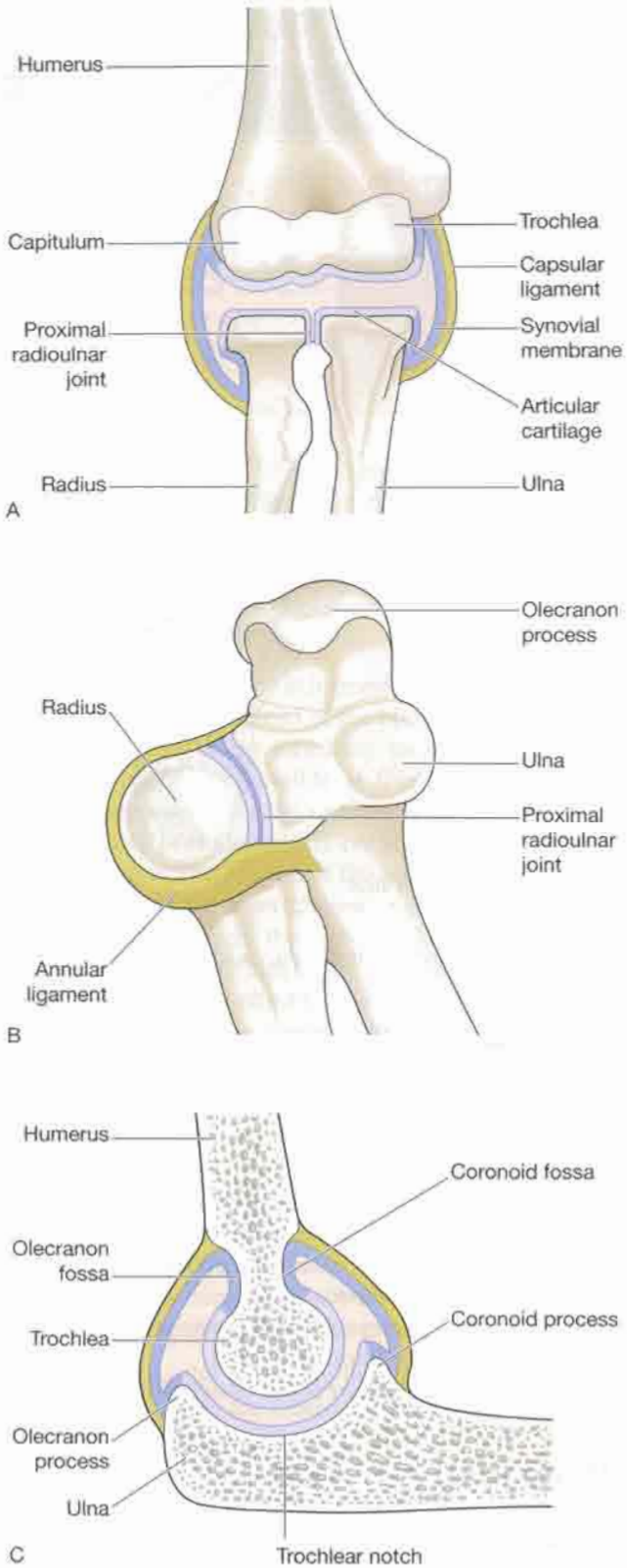

Figure 17.6 The elbow and proximal radioulnar joints. A. Section viewed from the front. B. The proximal radioulnar joint, viewed from above. C. Section of the elbow joint, partly flexed, viewed from the side.

Muscles and movements

Muscles (Fig. 17.5)

Biceps muscle. This lies on the anterior aspect of the upper arm. At its proximal end it is divided into two parts (heads) each of which has its own tendon. The short head rises from the coracoid process of the scapula and passes in front of the shoulder joint to the arm. The long head originates from the rim of the glenoid cavity and its tendon passes through the joint cavity and the bicipital groove of the humerus to the arm. It is retained in the bicipital groove by a transverse ligament which stretches across the groove. The distal tendon crosses the elbow joint and is inserted into the radial tuberosity. It helps to stabilise and flex the shoulder joint and at the elbow joint it assists with flexion and supination.

Brachialis muscle. This lies on the anterior aspect of the upper arm deep to the biceps. It originates from the shaft of the humerus, extends across the elbow joint and is inserted into the ulna just distal to the joint capsule. It is the main flexor of the elbow joint.

Triceps muscle. This lies on the posterior aspect of the humerus. It arises from three heads, one from the scapula and two from the posterior surface of the humerus. The insertion is by a common tendon to the olecranon process of the ulna. It helps to stabilise the shoulder joint, assists in adduction of the arm and extends the elbow joint.

Movements

Flexion: biceps and brachialis.
Extension: triceps.

Proximal and distal radioulnar joints

The *proximal radioulnar joint*, formed by the rim of the head of the radius rotating in the radial notch of the ulna, is in the same capsule as the elbow joint. The *annular ligament* is a strong extracapsular ligament which encircles the head of the radius and keeps it in contact with the radial notch of the ulna (Fig. 17.6B).

The distal *radioulnar joint* is a pivot joint between the distal end of the radius and the head of the ulna (Fig. 17.7).

Muscles and movements

Muscles (Fig. 17.5)

Pronator teres. This lies obliquely across the upper third of the front of the forearm. It arises from the medial epicondyle of the humerus and the coronoid process of the ulna and passes obliquely across the forearm to be

inserted into the lateral surface of the shaft of the radius. It rotates the radioulnar joints, changing the hand from the anatomical to the writing position, i.e. pronation.

Supinator muscle. This lies obliquely across the posterior and lateral aspects of the forearm. Its fibres arise from the lateral epicondyle of the humerus and the upper part of the ulna and are inserted into the lateral surface of the upper third of the radius. It rotates the radioulnar joints, changing the hand from the writing to the anatomical position, i.e. supination. It lies deep to the muscles shown in Figure 17.5.

Movements

Pronation: pronator teres.
Supination: supinator and biceps.

Wrist joint (Fig. 17.7)

This is a *condyloid* joint between the distal end of the radius and the proximal ends of the scaphoid, lunate and triquetral. A disc of white fibrocartilage separates the ulna from the joint cavity and articulates with the carpal bones. It also separates the inferior radioulnar joint from the wrist joint.

Extracapsular structures consist of medial and lateral ligaments and anterior and posterior radiocarpal ligaments.

Muscles and movements

Muscles (Fig. 17.5)

Flexor carpi radialis. This lies on the anterior surface of the forearm. It originates from the medial epicondyle of the humerus and is inserted into the second and third metacarpal bones. It flexes the wrist joint, and when acting with the extensor carpi radialis, abducts the joint.

Flexor carpi ulnaris. This lies on the medial aspect of the forearm. It originates from the medial epicondyle of the humerus and the upper parts of the ulna and is inserted into the pisiform, the hamate and the fifth metacarpal bones. It flexes the wrist, and when acting with the extensor carpi ulnaris, adducts the joint.

Extensor carpi radialis longus and brevis. These lie on the posterior aspect of the forearm. The fibres originate from the lateral epicondyle of the humerus and are inserted by a long tendon into the second and third metacarpal bones. They extend and abduct the wrist.

Extensor carpi ulnaris. This lies on the posterior surface of the forearm. It originates from the lateral epicondyle of the humerus and is inserted into the fifth metacarpal bone. It extends and adducts the wrist.

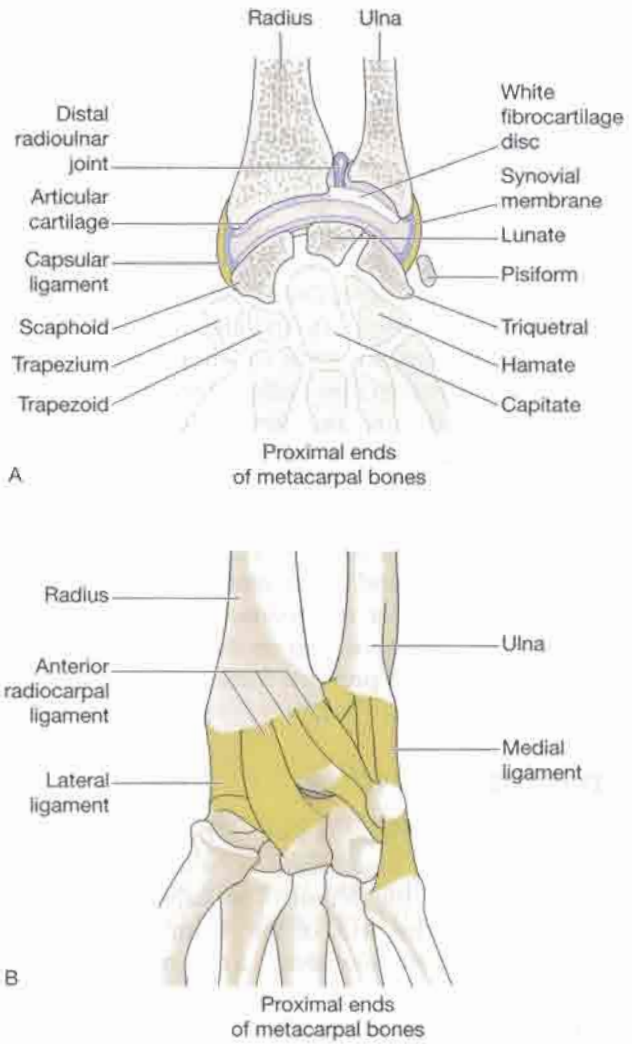

Figure 17.7 The wrist and distal radioulnar joints. Anterior view. A. Section. B. Supporting ligaments.

Movements

Flexion: flexor carpi radialis and the flexor carpi ulnaris.
Extension: extensors carpi radialis (longus and brevis) and the extensor carpi ulnaris.
Abduction: flexor and extensors carpi radialis.
Adduction: flexor and extensor carpi ulnaris.

Joints of the hands and fingers

There are synovial joints between the carpal bones, between the carpal and metacarpal bones, between the metacarpal bones and proximal phalanges and between the phalanges. The powerful movements that occur at