The pectoral girdle is the set of bones which connect the upper limb to the axial skeleton on each side. It consists of the

- clavicle
- scapula in humans
- in those species with three bones in the pectoral girdle, the coracoid.

No joint exists between each clavicle and the thorax, instead the muscular connection between the two permits relatively great mobility of the shoulder girdle in relation to the pelvic girdle.

In humans, the only joints between shoulder girdle and axial skeleton are the sternoclavicular joints on each side.
Pectoral Girdle

Clavicle
Humerus

Anterior Humerus

coracoid fossa  intertubercular groove  greater tubercle

trochlea  medial epicondyle  deltoid tuberosity  lesser tubercle

capitulum  lateral epicondyle
Ulna

- trochlear notch
- coronoid process
- radial notch
- olecranon process
- styloid process

Radius

- radial tuberosity
- head
- styloid process
Pectoral girdle

• pectoral girdle = 2 clavicles + 2 scapulae

• **clavicle**: collar bone; keeps shoulders apart; vestigial or absent in quadrupeds; synovial jts with acromion process of scapula, and manubrium (sternum)

• **scapula**: shoulder blade; flat bone; coracoid process/spine: sites for muscle attachments to arm/thorax; extension of quadr limb (scapula glide); glenoid fossa forms synovial jt (shoulder) with humerus

1. Clavicle
2. Scapula
3. Humerus
4. Sternum
5. Cervical vertebrae
6. Thoracic vertebra
1. First rib
2. Scapula
3. Humerus
4. Cervical vertebrae
5. Thoracic vertebrae
clavicle, coracoid process and acromion. Immediately under the skin, the pectoralis major, deltoid, and trapezius muscles can be palpated. The clavicular triangle (or deltopectoral triangle), which contains the cephalic vein, is bordered by the clavicle, pectoralis major muscle and deltoid muscle.

Finally, remember that the neurovascular bundle containing the axillary artery, axillary vein and brachial plexus courses under the clavicle and deep to the pectoralis major and minor before coursing into the arm.
Bony landmarks include the spine of the scapula, medial border of the scapula, and the acromion.

Superficial muscles include the three parts of the trapezius, the deltoid, the teres major and the latissimus dorsi.
• A). clavicle
  • acromial end- is flat and has a small facet for articulation with the acromion;
  • sternal end- has a large facet for articulation with the manubrium, and first costal cartilage.
  • conoid tubercle- conoid ligament of the coracoclavicular ligament attaches here;

• B). scapula
  1). posterior surface
     • spine
     • acromion
     • coracoid process
     • suprascapular notch
     • supraspinous fossae
     • infraspinous fossae
  2). borders
     • superior border
     • medial border
     • lateral border
  3). anterior surface
     • scapular fossae
  4). lateral end
     • glenoid cavity
Joints

- *Glenohumeral* - humerus articulating with glenoid fossa of scapula
- *Sternoclavicular (SC)* - proximal clavicle articulating with manubrium and cartilage of rib 1
- *Acromioclavicular (AC)* - acromian process of scapula articulating with distal clavicle
- *Coracoclavicular* - coracoid process of scapula articulating with inferior clavicle
- *Scapulothoracic* - anterior scapula articulating with thoracic wall
Movements of Scapula and Muscles Causing Movement:

- **Protraction (scapular abduction)** - serratus anterior, pectoralis minor
- **Retraction (scapular adduction)** - trapezius, rhomboid, levator scapulae
- **Downward Rotation** - rhomboids, pectoralis minor
- **Upward rotation** - trapezius, serratus anterior
- **Depression** - trapezius (lower), pectoralis minor, subclavious
- **Elevation** - trapezius (upper), levatro scapulae, rhomboid
• **acromion** - lateral extension of spine of scapula;
• **spine of scapula** - the trapezius and deltoid attach here;
• **greater scapular notch** - point at which the spine of the scapula ends, but the acromion continues;
• **coracoid process** - partially seen as it projects anteriorly;
• **supraspinous fossa** - the supraspinatus muscle originates here (part of rotator cuff);
• **infraspinous fossa** - the infraspinatus muscle originates here (part of rotator cuff);
• **lateral border** - teres minor muscle attaches here (part of rotator cuff), as does the teres major and the long head of the triceps brachii.

• **supraglenoid tubercle** - the long head of the biceps brachii attaches here;
• **infraglenoid tubercle** - the long head of the triceps brachii attaches here;
• **spinous process** - divides the supraspinous and infraspinous fossae, and serves as attachment for the deltoid and trapezius muscles;
• **acromion** - articulates with the clavicle and is an attachment for the trapezius and deltoid muscles;
• **superior and inferior angles**;
• **coracoid process** - serves as an attachment point for the short head of the biceps brachii, corachobrachialis, and pectoralis minor.
Glenohumeral joint
The Upper Limb

• The upper limb consists of the arm (brachium), forearm (antebrachium), and hand (manus)
• Thirty-seven bones form the skeletal framework of each upper limb
Arm

• The humerus is the sole bone of the arm
• It articulates with the scapula at the shoulder, and the radius and ulna at the elbow

Arm

• Major markings
  – Proximal humerus includes the head, anatomical and surgical necks, greater and lesser tubercles, and the intertubercular groove
  – Distal humerus includes the capitulum, trochlea, medial and lateral epicondyles, and the coronoid and olecranon fossae
  – Medial portion includes the radial groove and the deltid process
Forearm

- The bones of the forearm are the radius and ulna
- They articulate proximally with the humerus and distally with the wrist bones
- They also articulate with each other proximally and distally at small radioulnar joints
- Interosseous membrane connects the two bones along their entire length
Bones of the Forearm

Figure 7.24

Ulna

- The ulna lies medially in the forearm and is slightly longer than the radius
- Forms the major portion of the elbow joint with the humerus
- Its major markings include the olecranon, coronoid process, trochlear notch, radial notch, and the styloid process
Radius

• The radius lies opposite (lateral to) the ulna and is thin at its proximal end, widened distally
• The superior surface of the head articulates with the capitulum of the humerus
• Medially, the head articulates with the radial notch of the ulna
• Major markings include the radial tuberosity, ulnar notch, and styloid process
- Skeleton of the hand contains wrist bones (carpals), bones of the palm (metacarpals), and bones of the fingers (phalanges).

Upper Arm: **humerus**

A variety of muscles attach to the humerus. These enable movement at the elbow and at the shoulder. The rotator cuff muscles attach at the **proximal** humerus, and can rotate and abduct the arm at the shoulder. Some of the forearm muscles, (such as pronator teres, and the flexors and extensors of the wrist) also attach to the **distal** humerus.
1). proximal end
   • head of the humerus
   • greater & lesser tubercle

2). distal end
   • condyle
     • capitulum
     • trochlea
     • epicondyle
3). fossa
   • coronoid fossa
   • olecranon
1. Head
2. Anatomical Neck
3. Lesser Tubercle
4. Intertubercular Groove
5. Greater Tubercle
6. Surgical Neck
7. Deltoid Tuberosity

1. Radial Fossa
2. Lateral Epicondyle
3. Capitulum
4. Trochlea
5. Medial Epicondyle
6. Coronoid Fossa
7. Olecranon Fossa
Epiphysial lines of humerus in a young adult. Anterior aspect. The lines of attachment of the articular capsules are in blue.

Common Shoulder Injuries
• *Dislocation* - anteriorly (subcoracoid), posteriorly (subspinous) or downward (subglenoid) are three most common
  • common when humerus is abducted and externally rotated
• *Rotator Cuff Damage* (impingement syndrome, tears, especially "throwers" [javelin, tennis, pitchers, swimmers])
• *Subscapular Neuropathy* - denervation of infraspinatus with accompanying loss of strength during external rotation of humerus that is common in volleyball
Forearm

line radius up with thumb
line ulna up with little finger

A). ulna
1). proximal
   • olecranon
   • coronoid process
   • troclear notch
   • radial notch
2). distal
   • head of the ulna
   • styloid process

B). radius
1). proximal
   • head of the radius
   • radial tuberosity
2). distal
   • ulnar notch
   • styloid process

Ulna and Radius of the Right Forearm

Olecranon process
Trochlear (semilunar) notch
Coronoid process
Radial notch of ulna
Radial tuberosity
Head
Neck
Ulna
Radius
Styloid process
Joints

- **Humeroulnar Joint** - hinge joint (between trochlea and trochlear notch of ulna = "elbow joint")
- **Humeroradial Joint** - gliding joint (between capitulum and proximal head of radius)
- **Proximal Radioulnar Joint** - pivot joint (annular ligament binds radial head of radius to radial notch of ulna)
**Ulna - Proximal & Distal End**
*(Anterior Aspect)*

1. Olecranon Process
2. 2. Semilunar Notch
3. 3. Coronoid Process
4. 4. Tuberosity
5. 5. Radial Notch
6. 6. Ulna (Shaft)
7. 7. Head of Ulna
8. 8. Styloid Process

**RADIUS**

1. Head of Radius
2. 2. Neck of Radius
3. 3. Radial Tuberosity
4. 4. Radius (Shaft)
5. 5. Styloid Process
6. 6. Ulnar Notch
**Wrist and Hand**

**Bones** (29 including radius and ulna)
- radius/ulna
- carpals
  - proximal row (medial to lateral)
    - scaphoid, lunate, triquetrum, pisiform
  - distal row (medial to lateral)
    - trapezium, trapezoid, capitate, hamate
- metacarpals
- phalanges

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A). **carpals**
2 rows of 4 each lateral to medial

**HAND**
A). **carpals**
   1). proximal (articulate radius and ulna)
      a). scaphoid
      b). luna
      c). triquetral
      d). pisiform
   2). distal (articulate with metacarpals)
      a). trapezium
      b). trapezoid
      c). capitate
      d). hamate

B). **metacarpals**
numbered 1 to 5 starting with the thumb side

C). **phalanges**
numbered 1 to 5 starting with the thumb side
   • proximal phalanx
   • medial phalanx
   • distal phalanx
Bones of the Right Hand (Dorsal Surface)

1. Styloid Process of Radius
2. Navicular (Scaphoid)
3. Lunate
4. Triquetral
5. Pisiform
6. Trapezium
7. Trapezoid
8. Capitate
9. Hamate
10. Metacarpal
11. Proximal Phalange
12. Middle Phalange
13. Distal Phalange
14. Styloid Process of Ulna

Bones of the Right Hand (Palmar Surface)

1. Navicular (Scaphoid)
2. Lunate
3. Triquetral
4. Pisiform
5. Trapezium
6. Trapezoid
7. Capitate
8. Hamate
9. Metacarpal
10. Proximal Phalange
11. Middle Phalange
12. Distal Phalange
Some upper extremity bones and landmarks to be familiar with

**Clavicle:**  
- Acromial extremity  
  Acromioclavicular [AC] joint (acromian process and distal clavicle)  
- Conoid tubercle  
- Subclavian groove  
- Costal tuberosity  
- Sternal extremity  
  Sternoclavicular [SC] joint (proximal clavicle and manubrium + 1st rib)

**Scapula:**  
- Acromion process  
- Coracoid process  
  Coracovicular joint (coracoid process and inferior clavicle)  
- Scapular notch  
- Superior border  
- Medial border  
- Lateral border  
- Superior angle  
- Inferior angle  
- Subscapular fossa  
- Infraspinous fossa  
- Supraspinous fossa  
- Glenoid fossa  
  Glenohumeral joint (humeral head and glenoid fossa)  
- Spine
Humerus:
- Head
- Neck
- Greater tubercle
- Lesser tubercle
- Intertubercular (bicipital) groove
- Deltoid tuberosity
- Shaft (diaphysis)
- Lateral supracondylar ridge
- Lateral epicondyle
- Capitulum  Humeroradial joint (gliding joint between capitulum and radial head)
- Radial fossa
- Medial supracondylar ridge
- Medial epicondyle
- Trochlea  Humeroulnar joint (humeral trochlea and trochlear notch of ulna) "elbow joint"
- Coronoid fossa
- Olecranon fossa

Radius:
- Head  Radioulnar joints
- Neck
- Radial tuberosity
- Shaft (diaphysis)
- Styloid process

Ulna:
- Olecranon process
- Semilunar (trochlear) notch
- Coronoid process
- Ulnar tuberosity
- Shaft (diaphysis)
- Head
- Styloid process

Wrist/Hand:  Wrist joint (condyloid between distal radius and proximal carpals)
Carpals: (radial to ulnar)
- **Proximal Row**  Intercarpals (gliding or plane joints between carpal bone)
  - Scaphoid
  - Lunate
  - Triquetrum
  - Pisiform
- **Distal Row**
  - Trapezium
  - Trapezoid
  - Capitate
  - Hamate
5 Metacarpals (1 = thumb) Carpometacarpal (CMC) (saddle for 1, plane for 2-5)  
Phalanges/digits (14 per hand)  
• 5 proximal phalanges  
  Proximal Interphalangeal (PIP) (hinge joint between 1st and 2nd phalanges of 2-5)  
  Interphalangeal (IP) (hinge joint on thumb only between distal and proximal phalanx)  
• 4 middle phalanges (thumb doesn't have)  
• 5 distal phalanges  
  Distal Interphalangeal (DIP) (hinge joint between middle and distal phalanges of 2-5)

Want an easy way to remember the carpal bones?!!!

*Remember this...*

Naughty (Navicular)  
Lovers (Lunate)  
Try (Triquetral)  
Positions (Pisiform)  
That (Trapezium)  
They (Trapezoid)  
Can't (Capitate)  
Handle (Hamate)
Comminuted clavicle fracture; Note 5th rib fracture in addition
Fracture Dislocations of the Proximal Humerus: