

Dorsal fin is supported by 15 or 16 lepidotrichia placed on 14 somactidia. The proximal segment of each somactidia is large and dagger-shaped, and called **axonast** (interspinous bone). The mesial segment is short and distal segment is reduced.

Anal fin has a series of eight fin rays supported by seven somactidia.

Caudal fin is supported by a number of flattened bony rods. On the dorsal side of urostyle are present two **epiurals** and a **radial**, and on its ventral side are present nine **hypiurals**. The fin rays are attached with the epiurals and hypiurals in two symmetrical halves.

APPENDICULAR SKELETON

Pectoral Girdle and Fins

1. Pectoral girdle. Each half of pectoral girdle (Fig. 15.6) is formed of (i) a **scapula**, situated dorsally to the glenoid facets and developed partly as a replacing, partly as an investing bone; (ii) a **coracoid** situated ventrally to the glenoid facet and (iii) a **mesocoracoid** situated above the coracoid and anterior to the scapula. Externally to these is a very large investing bone, the **cleithrum**, extending downwards under the throat. Its distal end is connected by means of a **supraclavicle** to a forked bone, the **posttemporal**, one branch of which articulates with the epiotic and the other with the pterotic process. To the inner surface of the cleithrum are attached two flat scale-like bones with a slender rod-like **postclavicle** passing backwards and downwards among the muscles.

2. Pectoral fin. The pectoral fin is supported by nineteen lepidotrichia which are attached with four somactidia (radials). The radials articulate with the scapula.

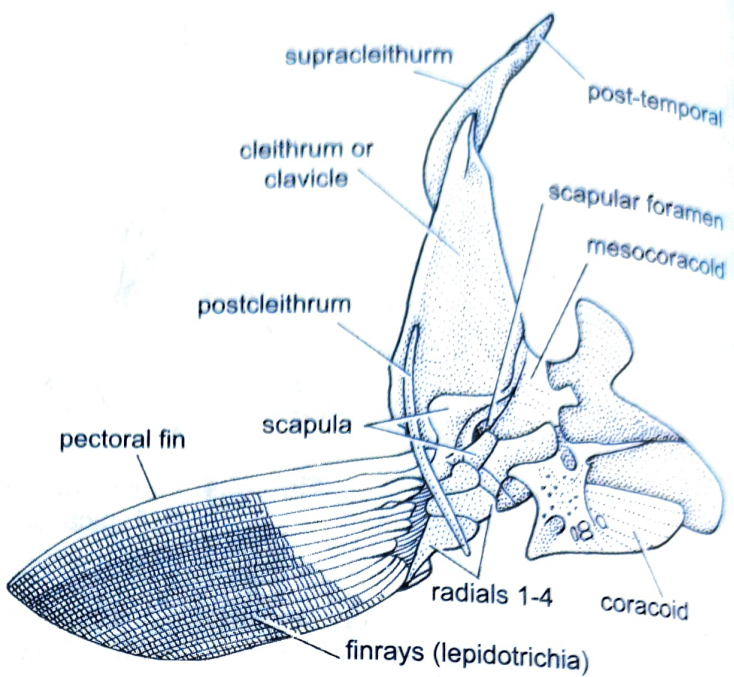


Fig. 15.6. *Labeo*. Left half of pectoral girdle with attached pectoral fin.

Pelvic Girdle and Fins

1. Pelvic girdle. Pelvic girdle (Fig. 15.7) is placed anterior to anal fin, at the level of cloaca. Like pectoral girdle, it is also formed of two similar halves. Each half is formed of large, flat bone, the **pelvic bone (basipterygium)**, lying in the middle line in the ventral body wall.

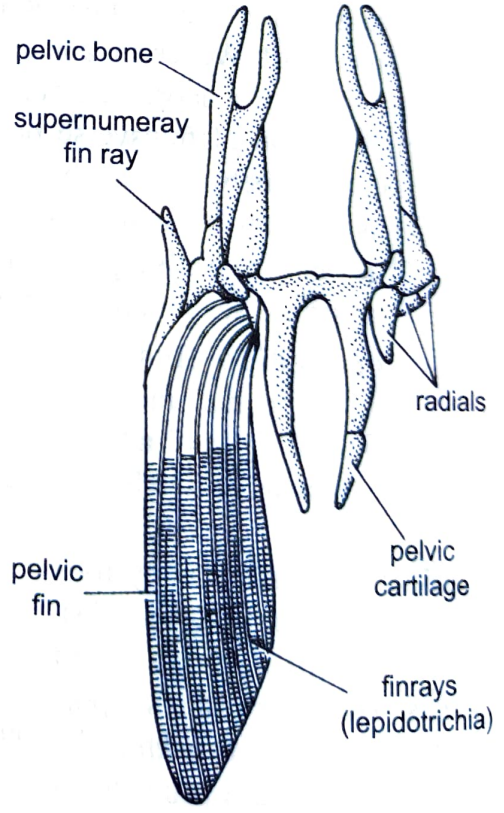


Fig. 15.7. *Labeo*. Pelvic girdle and right pelvic fin in ventral view.

Type 6. *Labeo rohita*: Rohu (A Bony Fish)

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The pelvic bone has an anterior elongated part which is deeply forked at the tip, and a posterior rod-like cartilaginous part. The anterior forked end is connected with the rib of the twelfth trunk vertebra by ligaments. The posterior rod-like parts of both the halves are united in the mid-line.

2. Pelvic fin. Each pelvic fin is supported by nine lepidotrichia or fin rays and three somactidia or radials. The radials articulate with the posterior border of the pelvic bone. The first and second radials, each bear two fin rays, and the third largest radial bears the remaining five fin-rays.

cylindrical, stout and backwardly directed. **Iliac facet** is present at the tip of each transverse process for the articulation of ilium bone of pelvic girdle. Neural spine is inconspicuous, *i.e.*, greatly reduced. Prezygapophyses are well developed along the anterior end of neural arch, while the postzygapophyses are entirely absent.

Functions of vertebral column.

The vertebral column serves the following functions :

1. It supports the trunk region.
2. It encloses and protects the spinal cord.
3. In front it supports the head which is held slightly above the ground.
4. It acts as a body-axis from which viscera are suspended in the body cavity by mesenteries.
5. It helps in locomotion by providing attachment in the pelvic girdle and hindlimbs.

Sternum. It lies midventrally connected between the two halves of pectoral girdle. It is composed of four parts. Anterior to the clavicle lies an inverted Y-shaped bony **omosternum** which is anteriorly attached with the rounded, flat cartilaginous **episternum**. Posterior to the epicoracoid and coracoids is a bony rod-like **sternum proper** or **mesosternum** to which is attached a broad cartilaginous **xiphisternum** posteriorly. Ribs are absent.

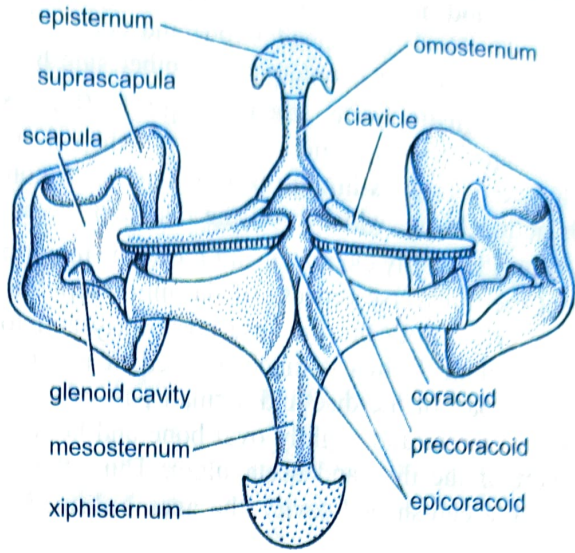


Fig. 18.15. Frog. Pectoral girdle and sternum (Ventral view).

Appendicular Skeleton

Pectoral girdle. The pectoral girdle or shoulder girdle (Fig. 18.15) is present in the thoracic region and provides attachment to the forelimbs and their muscles. It also protects the inner softer parts of the thorax. It consists of two similar halves united mid-ventrally and separated dorsally. Each half is divided into a dorsal **scapular portion** and a ventral **coracoid portion**.

Scapular region. The scapular portion comprises the **suprascapula** and **scapula**. **Suprascapula** is a thin, flat, somewhat rectangular cartilaginous plate on the dorsal side. It covers dorsally the first four vertebrae. Its free margin is calcified and the lower part articulating with the scapula is bony. At its posterior end is present a glenoid cavity into which articulates the head of humerus. **Scapula** is a strong, flat bony plate broad towards the end and narrower in the middle.

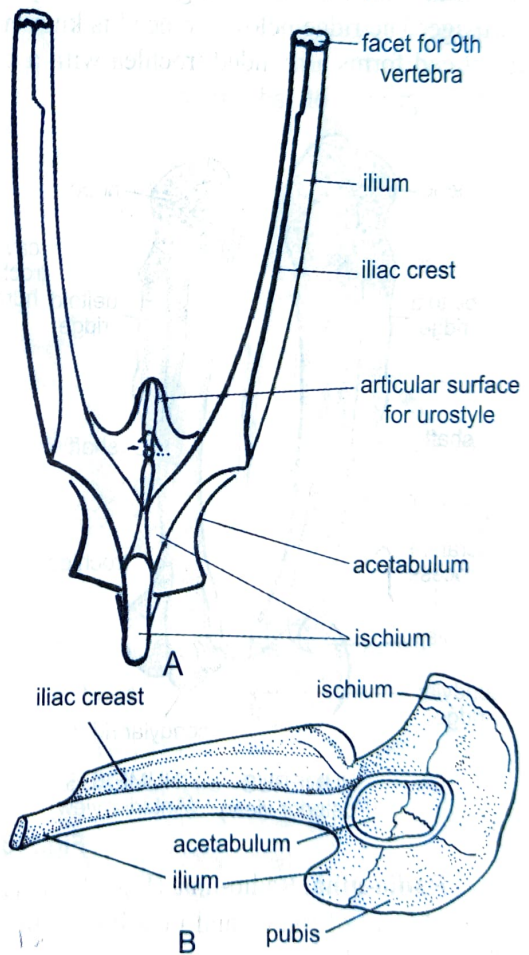


Fig. 18.16. Frog. Pelvic girdle, A-Dorsal view; B-One half (os-innominatum) in lateral view.

Coracoid portion. The coracoid portion comprises the clavicle, coracoid, precoracoid and epicoracoid. Clavicle (a slender rod) and coracoid (dumb-bell-shaped) meet mid-ventrally with the sternum and their counterparts of other side by a strip of cartilage, the epicoracoid.

Pelvic girdle. In frog, the pelvic girdle (Fig. 18.16) lies in the posterior region of the trunk. It gives support to the hindlimbs. It is V-shaped and composed of two similar halves, each of which is known as **os-innominatum**. Each os-innominatum is composed of three bones, **ilium**, **pubis** and **ischium**, which form the disc and the acetabulum.

Ilium is greatly elongated and forms the major part of each os-innominatum. It runs forwards to meet the transverse process of the ninth vertebra. It bears a prominent dorsal vertical ridge, the **iliac crest**. Both the ilia fuse posteriorly and form the anterior and upper half of the disc and acetabulum. **Pubis** is much reduced. It is a triangular piece of calcified cartilage, forming the central part of the disc and a small part of the acetabulum. Both the pubes are also fused. **Ischium** is larger and slightly oval bone and both the ischia fused in the middle and form one-third part of the disc and acetabulum. Thus, the disc is formed by the union of three bones containing a cup-shaped cavity, the **acetabulum**. In acetabulum the head of femur articulates.

Appendicular Skeleton

Pectoral girdle. The pectoral or shoulder girdle (Fig. 21.14) is situated at the anterior end of the trunk. It protects the heart and lungs along with the sternum and ribs and also provides articulation to the bones of forelimbs. The pectoral girdle is composed of two similar halves one lying

on either side of the T-shaped interclavicle and sternum. Each half of the pectoral girdle consists of scapula, suprascapula, coracoid and epicoracoid.

Scapula. Scapula is bony, oblong and flat plate which is narrow in the middle. Its outer broader end articulates with the suprascapula, while its inner narrow end unites with the coracoid. Its lower posterior end forms a part of the **glenoid cavity** and its dorsal anterior end gives out an ossified process, the **mesoscapula**.

Suprascapula. Suprascapula is more or less rectangular thin plate of calcified cartilage with a free distal border. It articulates proximally with the scapula and its distal border is free.

Coracoid. Coracoid is large, flat and fenestrated bone. It is partly ossified and partly cartilaginous. Two large fenestrae divide the coracoid into outer **procoracoid**, middle **mesocoracoid** and inner **coracoid proper**. Inner anterior part of coracoid is cartilaginous forming the **epicoracoid**. It lies above the two fenestrae. Epicoracoid meet with the posterior long arm of interclavicle and sternum.

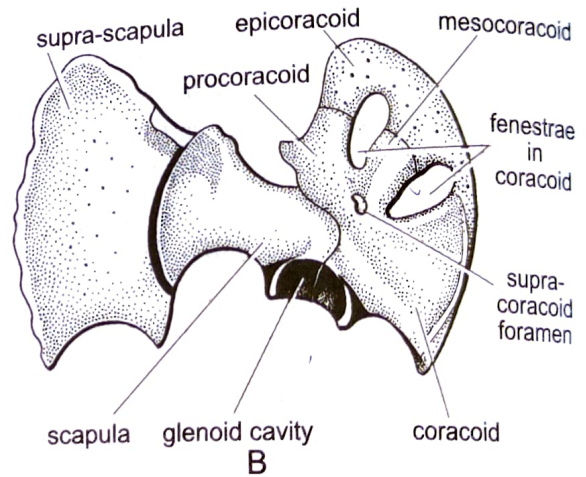
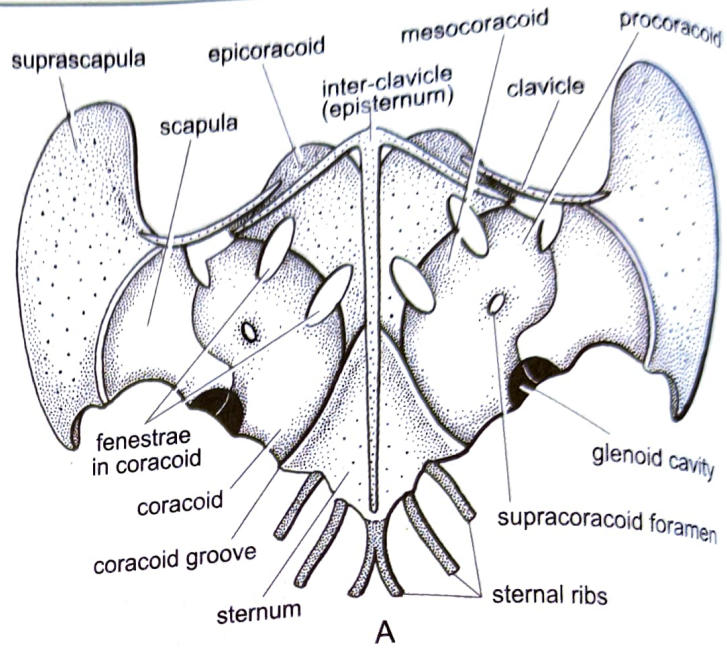


Fig. 21.14. *Varanus*. A – A pectoral girdle and sternum (Ventral view); B – One half of pectoral girdle (Ventral view).

Interclavicle or episternum. It is a T-shaped bone located in between the two halves of pectoral girdle. Its lateral curved limbs lie anterior to the scapulae and the posterior long limb is closely set to the mid-ventral surface of sternum.

Clavicle. It is a small curved narrow bone attached to the anterior side of lateral limb of interclavicle. Its outer distal end articulates with the union of scapula and suprascapula, while its inner limb does not reach up to the middle of interclavicle. At the joint of scapula and coracoid along the ventral side is present a glenoid cavity for the articulation of head of humerus.

Pelvic girdle. The pelvic or hip girdle (Fig. 21.15) is situated at the hind end of the trunk. It provides articulation to the bones of the hindlimbs. Pelvic girdle also consists of two similar halves meeting in the mid-line by a vertical ligament. Each half is known as **os-innominatum** and composed of ilium, pubis and ischium. All these three bones are not fused with each other. At their meeting points on the outer surface is a concave acetabulum for the head of humerus.

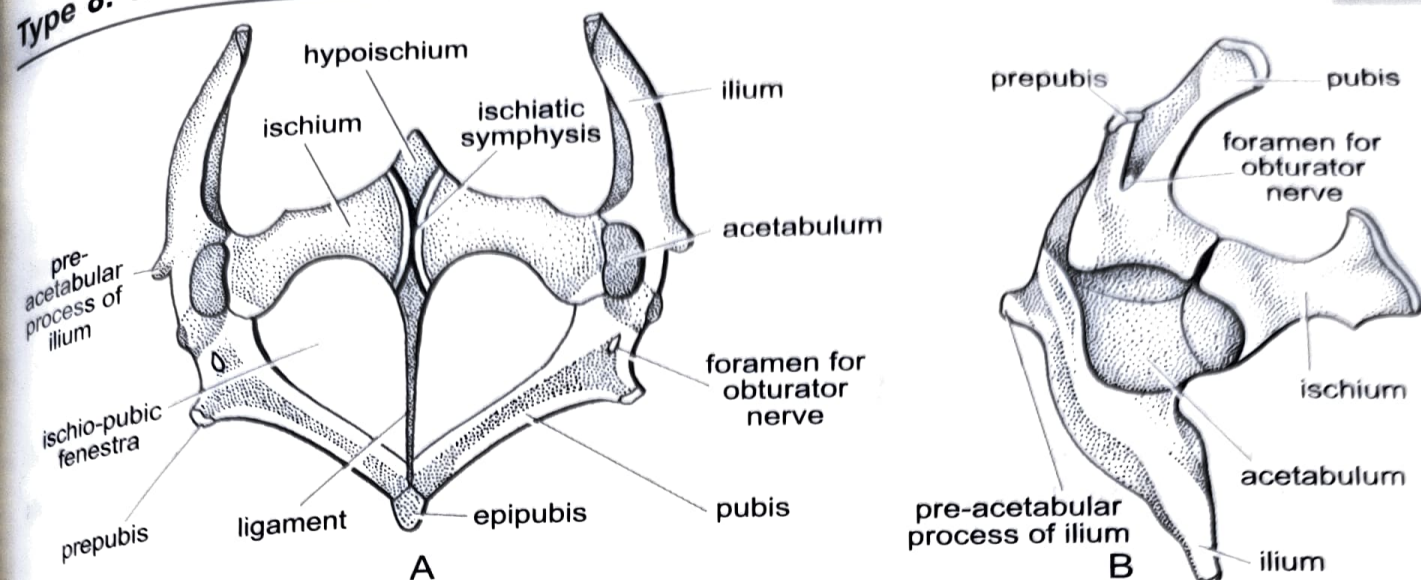


Fig. 21.15. *Varanus*. A – A pelvic girdle (Ventral view); B – One half of pelvic girdle.

Ilium. Ilium is strong, compressed, rod-like bone directed upwards and backwards to articulate with the sacral vertebrae (within the groove of transverse process of I sacral). On the outer side it is produced into a **pre-acetabular process** in front of the acetabulum and also contributes in the formation of about one-third part of acetabulum.

Pubis. Pubis is flat and slightly curved bone, passes downwards to meet in front with its fellow of the other side in the middle line at the pubic symphysis. Between the anterior ends of two pubes is present a backwardly directed nodule of calcified cartilage, the **epipubis**. On the anterior end near its fusion with the ilium and ischium it has an oval foramen for the obturator nerve. Just external and slightly posterior to the foramen is a small rod-like process, the **prepibus**, which is directed outwards. Pubis also contributes to about one-third of the acetabulum.

Ischium. Ischium is a flat and slightly curved bone, runs inward to meet its fellow of the other side at the ischiatic symphysis. It articulates on the outer side with the pubis and ilium of its side. A small rhomboidal piece of calcified cartilage, **hypoischium**, is present in between the two ischia at the anterior face of ischiatic symphysis and gives support to the ventral wall of cloaca. Ischium also forms about one-third of the acetabulum. The acetabulum is a cup-shaped cavity situated on the outer side at the point where all the three bones of each half of pelvic girdle join with each other. It provides articular surface for the head of femur.

A wide space is present between the pubes and ischia of both sides which is divided into two lateral **ischio-pubic fenestrae** by a median ligament. The ligament is often lost in the dried girdle.

Appendicular Skeleton

Pectoral Girdle

The pectoral girdle (Fig. 26.22 & 26.23) is very stout bony structure connected with the sternum on either side to support the wings. On either side it consists of a scapula, coracoid and a clavicle.

Scapula. Scapula is long, flattened, slightly curved, sabre-shaped bone lying above the thoracic ribs and parallel to the vertebral column. The expanded anterior end of scapula is firmly united with the coracoid by ligament. Its anterior end bears a shallow depression forming a part of **glenoid cavity**. The glenoid end of scapula is produced into an **acromian process** to provide articular surface to the clavicle and to form a part of the **foramen triosseum**. Suprascapula is wanting.

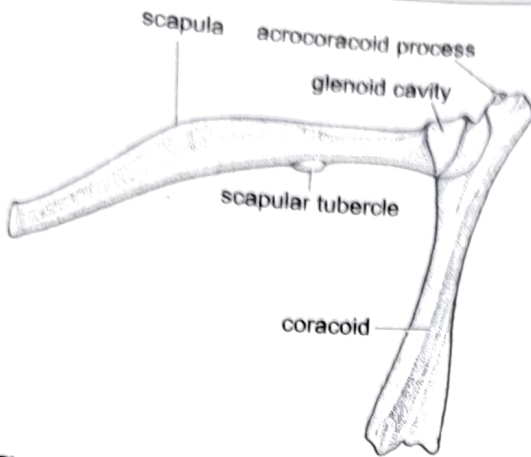


Fig. 26.22. Fowl. Pectoral girdle (Right half). Outer view.

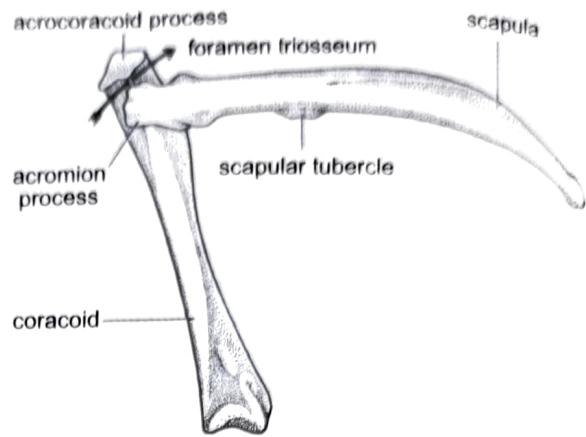


Fig. 26.23. Fowl. Pectoral girdle. Inner view.

Coracoid. Coracoid is a stout, straight rod-like bone directed downwards and articulates with the **coracoid groove** on the antero-lateral edge of the sternum at the base of manubrium. The upper end of coracoid on its inner side articulates with the scapula and on its outer side it bears a deep cup-shaped depression which forms the greater part of the glenoid cavity. The upper end of coracoid is also produced into a hook-like **acrocoracoid** process which articulates with the clavicle.

Clavicles. Clavicles are a pair of slender, curved delicate rod-like bones connected by their expanded upper ends with the scapula and acrocoracoid process of coracoid to enclose a circular **foramen triosseum**.

Furcula. Ventrally the two clavicles are fused with a small interclavicle to form a laterally compressed disc or **hypocondrium**. It is connected with the rostrum of the sternum by a ligament. The V-shaped bone, thus, formed is known as **furcula** or **merry thought** or **wish bone**. It works as a spring-like connection between the two halves of shoulder girdle.

Pelvic Girdle

The pelvic girdle (Fig. 26.24) consists of two separate halves lying on either side of the **synsacrum**. Each half is known as **os-innominatum**. Each os-innominatum is composed of **ilium**, **ischium** and **pubis**. At the junction of three bones is present a concavity, the **acetabulum**, which provides surface for the articulation of the head of femur.

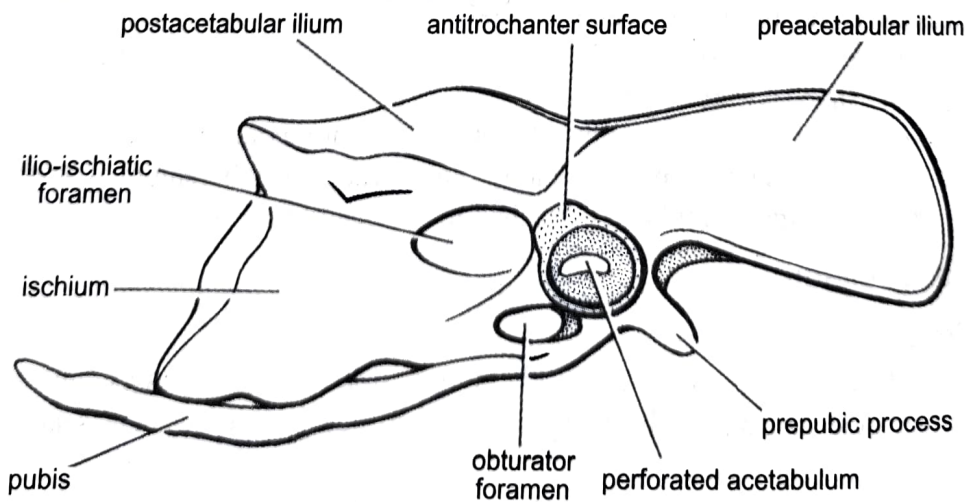


Fig. 26.24. Fowl. Pelvic girdle (Right os-innominatum in outer view).

Ilium. Ilium is an elongated and remarkably expanded bone extending both anterior and posterior to the acetabulum and is called preacetabular part and postacetabular part of ilium respectively. The inner margin of ilium is fused with the transverse processes and neural spines

Type 10. *Columba livia* (The Common Rock Pigeon)

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of the synsacrum. The outer surface of its anterior part is concave and posterior part is fused with the ischium. Ilium forms the dorsal part of acetabulum. On the outer surface above the acetabulum is a projection, the **antitrochanter**, which articulates with the great trochanter of femur.

Ischium. Ischium is also dorso-ventrally flattened bone projecting backwards behind the acetabulum and parallel to the posterior part of the ilium. Ischium is fused posteriorly with the ilium but separated anteriorly from it by a large, oval **ilio-ischiatric foramen**.

Pubis. Pubis is a long, thin, curved, slender bone directed backward parallel to the ventral margin of ischium with which it is usually fused. It forms ventral part of acetabulum. Behind the acetabulum the pubis and ischium are separated by an oval opening, the **obturator foramen**. Just in front and outside the acetabulum the pubis gives off a short and blunt process, the **prepubic** or **preacetabular process**.

and slender. Except first rib, all the sternal ribs called **xiphoid cartilage** are attached at the intersternbral junctions.

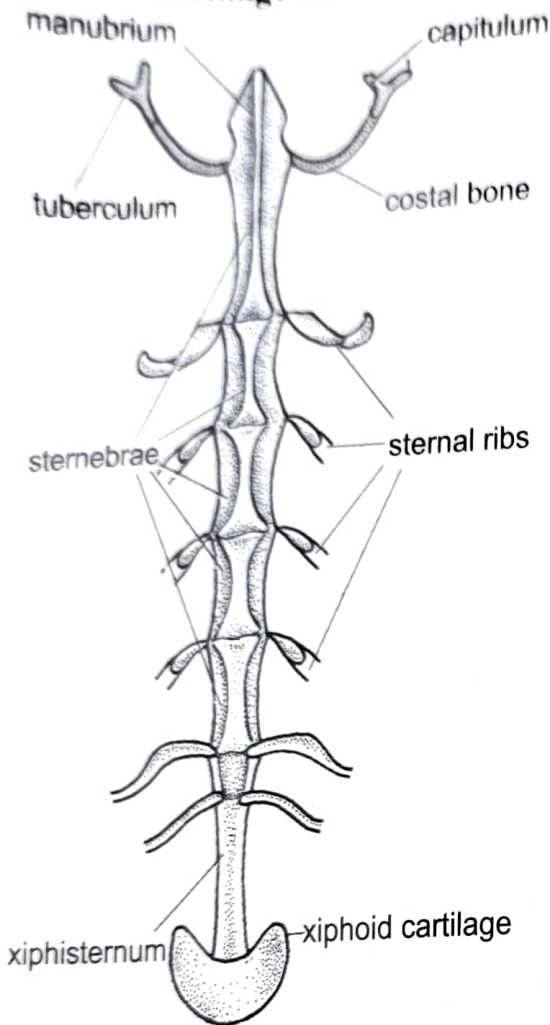


Fig. 29.15. Rabbit. Sternum.

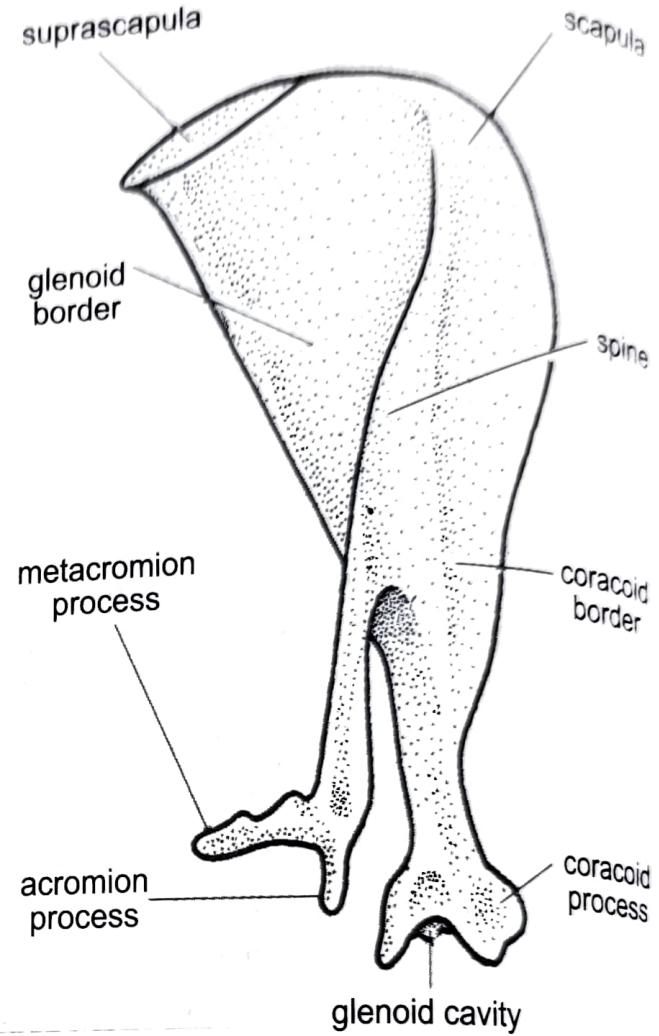


Fig. 29.16. Rabbit. Pectoral girdle. Right half in outer view.

Appendicular Skeleton

Pectoral Girdle

It consists of two separate halves placed dorsal to the anterior thoracic ribs in between the forelimbs. It supports forelimbs and protects the soft parts of the body from the ventral side. Each half of the pectoral girdle is known as **innominate**. Thus, one half of the pectoral girdle is formed of a broad, more or less triangular bony plate, called **scapulo-coracoid** and a small **clavicle** bone.

Scapulo-coraciod. It is mainly formed of **scapula** which is a thin, flat, and more or less triangular bony structure. Its outer surface bears a prominent ridge, called the **spine** which divides its surface into antero-dorsal and postero-dorsal portions to which are attached muscles. The spine terminates ventrally into an expanded knob-like structure, the **acromion process** which posteriorly bears backwardly directed **metacromion process**. The apex of scapulo-coracoid is directed downwards and forwards terminating below into a concave **glenoid cavity** for the head of humerus. Above this cavity is present a small hook-like coracoid process, the rudimentary coracoid. The

suprascapula is in the form of a thin strip of cartilage situated along the dorsal or vertebral border of the scapula.

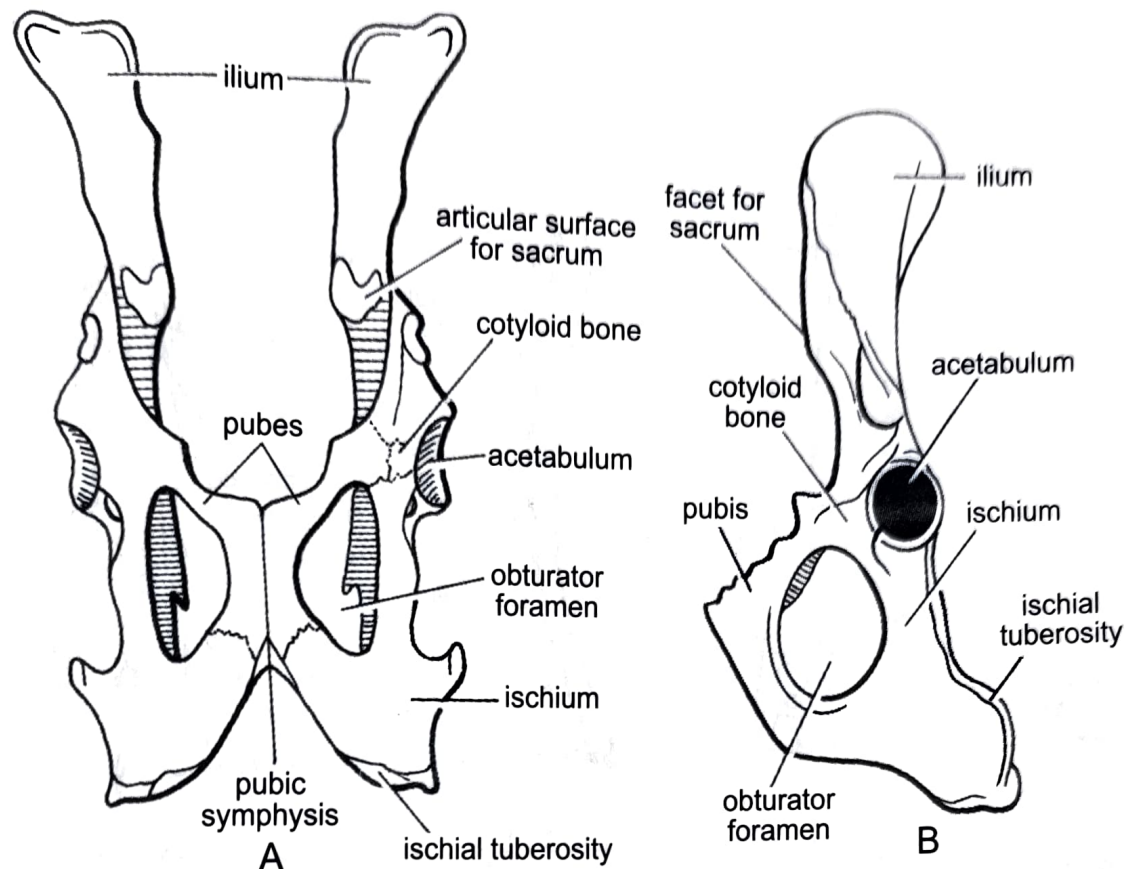


Fig. 29.17. Rabbit. Pelvic girdle. A – Complete girdle in ventral view; B – Left half.

Clavicle is a thin, slightly curved bone extending between the acromion processes and manubrium of the sternum.

Pelvic Girdle

The pelvic girdle is also formed of two equal halves or **os-innominate**. Both the halves are joined together mid-ventrally by **pubic symphysis** to form a stout and strong **girdle** situated in the pelvic region between the two hindlimbs.

Each half or os-innominatum is formed of three bones, the **ilium**, **ischium**, and **pubis**. All these bones are fused together to form a single hip bone.

The **ilium** is the antero-dorsal longest bone, which bears a rough flat articular surface roughly at about the middle of its length for sacrum. The anterior and dorsal edge of the ilium is raised into **iliac-crest**. The ilium extends posteriorly up to the **acetabulum**. The postero-dorsal part of the os-innominatum is formed by the **ischium**. The posteriormost part of ischium is broad and projects outwards into a prominent **ischial tuberosity**. The **pubis** is a narrow bone and forms the ventro-medial portion of innominate. Both the pubes unite with each other on the mid-ventral line to form a **pubic-symphysis**. The pubis do not take part directly in the formation of acetabulum, because a **cotyloid bone** is present in between the acetabulum and pubis. A big **obturator foramen** is present between the **ischium** and **pubis** which is always covered by the obturator membrane and muscles in the lifetime. **Acetabulum** is only formed by the ilium and ischium on both sides of the girdle and into it articulates the head of humerus.