

INTRODUCTION TO OSTEOLOGY

The primary functions of the skeleton are to support the body, to provide the system of levers used in locomotion and to protect soft and internal tissues/organs. For this reason, biomechanical factors are of utmost importance in shaping the bones and determining their design.

Bone is the major skeletal tissue and it also has a secondary function in mineral homeostasis supplying a reserve of calcium, phosphate and other ions.

CLASSIFICATION OF BONES

Bones are classified in various ways.

TOPOGRAPHIC CLASSIFICATION

This recognizes

1. the axial (cranial part i.e. the skull and post cranial part i.e. the vertebrae)
2. the appendicular (fore and hind limbs)

ONTOGENIC CLASSIFICATION

1. somatic skeleton (formed in the body wall)
2. visceral skeleton (derived from the pharyngeal (branchial) arches)

CLASSIFICATION BASED ON DEVELOPMENT

1. Parts formed in cartilage (and later largely replaced by bone)
2. Parts that ossify directly in fibrous connective tissue

Individual bones are classified according to shape and these include

LONG BONES: consist of a cylindrical shaft known as the *DIAPHYSIS* and two extremities called the *EPIPHYSES* (plural)..*EPIPHYSIS* (singular) with a marrow cavity. They grow in length only at the epiphyseal cartilage.

They usually function in support, locomotion and prehension (in primates). They are found in the limbs e.g. humerus, femur, tibia and fibula.

SHORT BONES: appear cuboidal in shape and do not have a marrow cavity. They function in absorbing concussion (shock) and are often found in complex joints such as the carpals and tarsal bones.

FLAT BONES: are relatively thin and extended in two directions. Consist of 2 plates of compact substance, internal and external laminae, separated by a spongy material. They protect many of the vital organs e.g. cranium (brain), ribs (heart and lungs).

SESSAMOID BONES: sessamoid means seed like. They are usually found along the course of a tendon or may change the angle of pull of muscles to thus give better mechanical advantage to the surrounding structures e.g. Patella (the largest sessamoid bone in the body).

PNEUMATIC BONES: contain air spaces or sinuses that communicate with the exterior

IRREGULAR BONES: these are unpaired bones located in the median plane. They include the vertebrae and unpaired bones of the skull. They serve to protect, support and for muscular attachment.

NB: certain soft bones referred to as splanchnic bones are found in some organs of some animals e.g. Entoglossal bone in the tongue of chickens, Os penis in penis of dogs, Os cordis in the heart of Cattle.

THE VERTEBRAL COLUMN

Composed of median unpaired irregular bones called vertebrae. These bones vary in number from one animal to the other as a result there are vertebral formulae. The following letters are used to designate the specific regions.

C-cervical vertebrae (neck)

T –thoracic vertebrae (chest)

L –Lumbar vertebrae (loin)

S – Sacral vertebrae (pelvis; usually fused)

Cy – Caudal vertebrae (Coccygeal)

The vertebral formula for each animal species consists of symbols of each region and the number of bones in the region.

VERTEBRAL FORMULAE OF DIFFERENT ANIMAL SPECIES

SPECIES	C	T	L	S	Cy
Bovine	7	13	6-7	5	18-20
Equine	7	18	6	5	15-21
Canine	7	13	7	3	20-23
Sheep/Goat	7	13	6-7	4	12-18
Porcine	7	14-15	6-7	4	20-23
Man	7	12	5	5	4
Avian	16-17	5-6	15-16 (fused)		Pygostyle

DIFFERENTIATIVE CHARACTERISTICS OF THE VERTEBRAE

A typical vertebra consists surrounded by an arch that completes the closure of the vertebral foramen; it is a summation of these vertebral foramina that form the vertebral canal through which the spinal cord passes.

The body is broadly cylindrical, somewhat flattened on its dorsal surface, which faces into the vertebral canal, may carry a median crest ventrally. The extremities are usually curved, the cranial one being convex, the caudal- concave.

The arch consists of 2 pedicles from which a lamina projects each, to meet medially to meet its fellow and thus complete the ring about the spinal cord. The bases of each pedicle is notched, and when successive bones articulate, these notches combine to outline the intervertebral foramina, openings through which passes the spinal nerves and vessels that supply the structures within the intervertebral foramen.

Each vertebra carries a number of processes.

The dorsal or spinous process arising from the union of the laminae. It is generally prominent, although its form, length and inclination vary with the region and species.

The transverse processes project to each side at the junction of the body and the arch; these processes arise at the level of the intervertebral foramina and divide the muscles of the trunk into dorsal and ventral divisions.

CERVICAL VERTEBRAE

In mammals generally, there are usually seven cervical vertebrae. The first two i.e. the atlas and the head and require individual description. The remaining five are more typical (alike/similar).

ATLAS

Appears to possess no body but consists of 2 lateral masses joined by ventral arches (see fig). A plate of bone, the wing of the atlas (transverse process, ala atlantis), projects laterally from each mass, constituting a landmark that is often visible or palpable in the living animal.

The cranial aspect of the ventral arch and the adjacent areas on the wings carry two deep excavations that receive the occipital condyles of the skull. These facets approach ventrally and in some species they merge.

The caudal aspect of the ventral arch is hollowed transversely to provide an articular surface that engages with the cranial extremity of the axis. An extension (fovea dentis) of this facet onto the dorsal surface of the ventral arch accommodates the dens. The dorsal arch is perforated by openings that correspond with the transverse and intervertebral foramina of more typical cervical vertebrae; in some species a third (alar) foramen perforates the wing.

AXIS

Is the longest vertebra. Its cranial extremity bears the dens, which is rodlike in carnivores and spout like in other species. The cranial extremity of the body and the ventral surface of the dens concur in forming a single wide articulation for the atlas. Dorsally the dens is roughened for ligamentous attachment. The arch carries a long spinous process that bears articular surfaces at its caudal extremity which meet with corresponding facets on the 3rd cervical vertebra.

Transverse processes are large, each is perforated toward its root by a transverse foramen that transmits the vertebral artery, vein and nerve.

C₃-C₇