

## AXIAL SKELETON

The skeleton can be divided into two parts: the axial skeleton and the appendicular skeleton.

-axial: bones of the skull, vertebral column, and bony thorax.

-appendicular: bones of the pectoral and pelvic girdle, and of upper and lower limbs

### I. Skull - two sets of bones, cranial and facial bones

A. CRANIAL BONES: enclose and protect the brain and organs of hearing/equilibrium

#### 1. Geography: 2 parts to cranium -- vault and base

a. Cranial vault - forms the superior, lateral and posterior walls of the skull

b. Cranial base - forms the inferior aspect of the skull; there are 3 levels: anterior, middle, and posterior cranial cavities or fossae

#### 2. Cranium: composed of eight bones

a. Frontal Bone: anterior portion of the cranium; forms the forehead, superior parts of the orbits and the floor of the anterior fossa; features: the supraorbital foramen and the frontal squama.

b. Parietal Bones: (right and left sides) form the sides of the cranium; four largest sutures of the skull involve articulations of parietal bones with other bones -- know these.

c. Temporal Bones: (right and left sides) inferior to parietal bones, articulate with them at squamosal suture

-the squamous region includes zygomatic process (bridge-like projection joining temporal bone to zygomatic bone anteriorly); mandibular fossa (forms the socket for mandibular condyle)

-the tympanic region includes the external acoustic meatus (e.a.m., canal leading to the middle ear); styloid process (needle-like projection inferior to the e.a.m.)

-the mastoid region includes the mastoid process (rough projection inferior and posterior to the e.a.m.); stylomastoid foramen (opening between the mastoid process and the styloid process)

-the petrous region is where many foramina are located including the jugular foramen (medial to the styloid process); carotid canal (anterior to the jugular foramen and medial to the styloid process); internal acoustic meatus (supralateral to the jugular foramen); foramen lacerum (jagged opening between the temporal bone and the

sphenoid bone); forms middle cranial fossa with sphenoid bone

d. Occipital Bone: forms the posterior wall and the base of the cranium

-features: the lamboidal suture (articulation w/parietal bone); occipitomastoid suture (articulation with temporal bone); foramen magnum (large opening at the base of the skull); occipital condyles (articulate with the atlas--C1); hypoglossal canal

e. Sphenoid Bone: butterfly/bat shaped, spans width of middle cranial fossa, also contributes to anterior cranial fossa; includes central body, greater and lesser wings and pterygoid processes.

-features: the sella turcica (saddle-like projection in the body) containing a hypophyseal fossa (which houses the pituitary); greater wings (form dorsal walls of orbit, middle cranial fossa with petrous region of temporal bone; lesser wings (form part of anterior cranial fossa, portion of medial walls of orbit); pterygoid processes (project inferiorly from body, form lateral walls of nasopharynx); optic foramina (anterior to the sella turcica); optical fissures (slit between the greater and lesser wings, very obvious in the anterior view of the skull); foramen rotundum (at the base of the greater wings); foramen ovale (oval shape--posterior to foramen rotundum); foramen spinosum (posterolateral to foramen ovale) -- "the round, oval spec..."

f. Ethmoid Bone: between the sphenoid bone and the nasal bones

-forms the roof of the nasal cavities, upper nasal septum, and medial orbit walls

-features: the crista galli (vertical projection providing attachment point for dura mater), cribriform plates (lateral to the crista galli)

## B. FACIAL BONES: 14 bones

-only the mandible and vomer are unpaired

1. mandible: lower jaw, divided into two parts

a. Body:

-forms the chin and anchors lower teeth  
-features: the superior border or alveolar margin, mandibular symphysis, and the mental foramina

b. Rami:

-features: the mandibular condyle (forms the temporal mandibular joint); coronoid process; and mandibular foramina

2. Maxillary bones: two bones fused medially; forms the upper jaw; "keystone" of face
  - features: the palatine processes (form anterior 2/3 of the hard palate); zygomatic processes (articulate with the zygomatic bone); inferior orbital fissures (deep within the orbits, junction of maxilla with greater wing of sphenoid); infraorbital foramina (openings under the orbits)
3. Zygomatic Bones: cheekbones
  - irregularly shaped
  - form the inferolateral margins of the orbits
4. Nasal Bones:
  - form the medial aspects of the bridge of the nose
  - two bones fused medially
5. Lacrimal Bones: very small
  - contribute to the medial walls of the orbit walls
  - pierced by lacrimal fossa, a passageway for tears
6. Palatine Bones:
  - have horizontal (form from remaining 1/3 of hard palate) and vertical plates (posterolateral walls of nasal cavity).
7. Vomer:
  - slender, plow shaped
  - found within the nasal cavity and forms part of the nasal septum

C. ORBITS: bony cavities, which enclose the eyes; formed by maxilla, zygomatic, sphenoid, frontal, ethmoid, lacrimal and palatine bones.

D. HYOID BONE: (not part of the skull)  
 -located in the throat above the larynx  
 -does not articulate with any other bone

## II. Vertebral Column

### A. GENERAL CHARACTERISTICS

- 26 irregular bones with a flexible and curved structure
- creates a central cavity which encloses and protects the spinal cord
- provides attachments for ribs as well as many muscles
- there are 5 major divisions:
  - cervical (7); thoracic (12); lumbar (5) vertebrae; sacrum; and coccyx
  - the curvatures of the spine include the cervical, thoracic, lumbar, and sacral curvatures

## B. GENERAL STRUCTURE OF VERTEBRAE

- the weight-bearing portion is called the body
- the vertebral arch includes the 2 pedicles and the 2 laminae
- pedicles are the short, bony, cylinders projecting posteriorly from the vertebral body, form the sides of the vertebral arch
- laminae are flattened plates that fuse together to complete the arch posteriorly
- there are 7 processes that project from each arch:

1. Spinous process (1) arising at junction of the two laminae
2. Transverse processes (2) arising at junction of pedicles and laminae, arise from lateral aspects of vertebral arch
3. Superior (2) and Inferior (2) articular processes projecting upward and downward from pedicle/lamina junction
  - pedicles have notches on the superior and inferior borders that provide openings between the vertebrae to form the intervertebral foramina where spinal nerves exit cord
  - vertebrae of different areas have modifications that reflect their specific functions and movements allowed.

## C. TYPES OF VERTEBRAE

1. Cervical Vertebrae: C1-C7
  - smallest and lightest vertebrae
  - C1 = atlas and C2 = axis; these have NO intervertebral disk between them
  - the atlas articulates with the occipital condyles and with the dens of the axis at the fovea dentis
  - C3-C7 have an oval body, and large triangular vertebral foramen, transverse processes have transverse foramina, spinous processes are bifid (except C7)
  - C7 has a large spinous process that is palpable at the base of the neck - vertebra prominences
2. Thoracic Vertebrae: T1-T12
  - have a large body with 2 facets, inferior and superior, where head of ribs articulate
  - vertebral foramen in circular
  - spinous process is long and points inferiorly
  - transverse processes have facets that articulate with the ribs
3. Lumbar Vertebrae (L1-L5)
  - receive the most stress and therefore have an enhanced weight bearing structure
  - massive bodies (kidney shaped)

- short, flat spinous process projecting directly back
- triangular vertebral foramen

#### 4. Sacrum:

- composed of 5 fused bones
- located between L5 and the coccyx
- features; two lateral wings or alae (fused remnants of transverse processes); sacral promontory (anterosuperior margin of S1); median sacral crest (fused spinous processes of sacral vertebrae); sacral foramina (holes where blood vessels and nerves can exit); sacral canal ( area of sacrum where vertebral canal continues-- terminates near the coccyx)

#### 5. Coccyx:

- fusion of 3-5 irregularly shaped vertebrae, attached to sacrum by ligaments

### III. Bony Thorax (thoracic cage)

#### A. STERNUM

- typical flat bone
- results from the fusion of the three bones:
- manubrium - "tie knot"; articulates laterally with the clavicles and the body inferiorly
- body - makes up the bulk of the sternum
- xiphoid process - most inferior section of the sternum

#### B. RIBS

- 12 pairs; form the wall of the thoracic cage
- first 7 pairs: true ribs because they attach directly to the sternum
- next 3 pair: false ribs because they have an indirect "cartilage" attachment to the sternum
- last 2 pairs: floating ribs because these have no sternal attachment