

Anatomy of Skeletal System

two main subdivisions of skeletal system:

axial : skull, vertebral column, rib cage

appendicular: arms and legs and girdles

Bone Markings:

Foramen: opening in bone – passageway for nerves and blood vessels

Fossa: shallow depression – eg a socket into which another bone articulates

Sinus: internal cavity in a bone

Condyle: rounded bump that articulates with another bone

Tuberosity: large rough bump – point of attachment for muscle

Spine: sharp slender process

Skull

most complex part of the skeleton

consists of **facial** and **cranial** bones
most bones are paired, not all

joined at **sutures**

ossification of skull begins in about 3rd month of fetal development

not completed at birth † bones have not yet fused

gaps = **fontanel**s

- frontal (anterior)
- occipital (posterior)
- 2 sphenoid
- 2 mastoid

at this stage skull is covered by tough membrane for protection

normally, bones grow together and fuse to form solid case around brain

skull contains several significant **cavities**:

cranial cavity – largest (adult – 1,300 ml)

part of dorsal body cavity

orbits – eye sockets

nasal cavity

buccal cavity

middle and inner ear cavities

paranasal sinuses

in 4 of the bones making up the face

in life lined with mucous membrane to form sinuses

lighten bone, warm and moisten air

6 sinuses:

frontal -2

maxillary -2

ethmoid -1

sphenoid -1

if the top of the skull is removed and you look down into the cranial cavity can see the base divided into three basins (=fossae):

anterior cranial fossa

crescent shaped

relatively shallow

accommodates frontal lobes of brain

middle cranial fossa

drops abruptly deeper

shaped like a pair of bird wings

accommodates temporal lobes

posterior cranial fossa

deepest

houses mainly the cerebellum

many bones in skull have conspicuous **foramina**

‡ holes that allow passage of major nerves or blood vessels

Examples of paired skull bones:

1. Maxilla

cheek bones, upper teeth cemented to these bones

hard palate: palatine process and palatine bones

cleft palate ‡ when bones of **palatine process**
of **maxilla bones** do not fuse properly

not only cosmetic effect
can lead to serious respiratory and feeding problems in babies
and small children
today, fairly easily corrected

2. **temporal bone**

external auditory meatus - opening to ear canal
leads to middle ear chamber

ear ossicles **malleus** = hammer
incus = anvil
stapes = stirrup

3. **mandible** = lower jaw largest, strongest bone of face articulates at temporal bone

Examples of unpaired skull bones:

1. **occipital bone**

foramen magnum - large opening in base
through which spinal cord passes
occipital condyles - articulation of vertebral column

2. **sphenoid bone** – irregular, unpaired bone

resembles bat or butterfly
keystone in floor of cranium
anchors many of the bones of cranium
contains sinuses
sella turcica – pituitary

3. **ethmoid** – irregular, unpaired bone

honeycombed with sinuses

cribiform plate – perforated with openings which
allow olfactory nerves to pass

nasal conchae – passageways for air; filtering,
warming, moistening

crista galli – attachment of meninges

very delicate and easily damaged by sharp upward blow to the
nose

can drive bone fragments through the cribriform plate into the meninges or brain itself
can also shear off olfactory nerves → loses of smell

hyoid bone – single “U” shaped bone in neck
just below mandible
suspended from **styloid process** of temporal bone
only major bone in body that doesn’t directly articulate with other bones
serves as point of attachment for tongue and several other muscles

Vertebral Column

main axis of body

flexible rather than rigid
permits forward, backward, and some sideways movement

in the newborn the spinal column forms a “C” shaped curve

after ~ age 3 has a double “S” shape with 4 bends

cervical
thoracic
lumbar
pelvic

divided into 5 regions:

cervical
thoracic
lumbar
sacral
coccygeal

all but last two are similar in structure:

body
spinous process
vertebral foramen
transverse process
superior and inferior articular process
intervertebral foramen between each pair
separated by **intervertebral discs**

Cervical (7):

have **transverse foramina**

1st and 2nd are highly modified for movement:

atlas – holds head up
no body or spinous process

“yes” movement of head
axis -- **dens** (odontoid process) – forms pivot
“no” movement

Thoracic (12):

distinguished by **facets** smooth areas for articulation of ribs
each rib articulates at two places
one on body of vertebrae
one on transverse process

Lumbar (5):

short and thick spinous processes
modified for attachment of powerful back muscles

Sacrum (5 fused):

triangular bone formed from fused vertebrae
sacroiliac joint – lots of stress

Coccyx (4-5, some fused):

tailbone
painful if broken
sometimes blocks birth canal, must be broken

Ribcage

sternum { **manubrium**
 { **body (=gladiolus)**
 { **xiphoid process**

ribs: most joined to sternum by **costal cartilages**
true ribs (7prs)
false ribs (5 prs)
include floating ribs (2prs)

Upper Extremities

shoulder (=pectoral girdle)
upper and lower arm
wrist and hand

Pectoral Girdle:

scapula & clavicle

only attached to trunk by 1 joint (between sternum and clavicle)
scapula rides freely and is attached by muscles and tendons to
ribs but not by bone to bone joint
extensive flat areas of scapula are used as origins for arm
muscles and trunk muscles

scapula is very moveable – acts as almost a 4th segment of limb

clavicle

is the most frequently broken bone in the body, sometimes even during birth

Humerus:

longest and largest bone of arm

loosely articulates with scapula

head – glenoid cavity

large processes of scapula, **acromium** and **coracoid**

‡ have muscles which help to hold in place

Forearm:

very mobile

adds to flexibility of hand

consists of two bones: radius & ulna

they are attached along their length by **interosseous membrane**

ulna:

main forearm bone

firmly joined to humerus at elbow

large process = **olecranon process**,

extends behind elbow joint

acts as lever for muscles that extend forearm

radius:

more moveable of two

can revolve around ulna to twist lower arm and hand

Hand:

attached by muscles mainly to radius provides great flexibility

large # of rounded bones (**carpals**) provide flexibility

carpals allow movement in all directions

metacarpals also rounded for flexibility

phalanges, not rounded, simple hinges for grasping

Lower Extremities

pelvic girdle (pelvis, 2 coxal bones, sacrum, coccyx)

thigh

lower leg

feet

Pelvic Girdle

forms large basin of bone

receptacle for many internal organs

origin of thigh muscles and trunk muscles
rigid connection to axial skeleton
strength, not flexibility

large flaring portion = **false pelvis**
smaller actual opening = **true pelvis**
‡ actual space child must fit through in women

consists of a pair of **innominate bones** (= os coxae)
that articulate with sacrum
each innominate is produced by fusion of three bones:
ileum – upper, fan shaped
ischium – bottom
pubis – front
pubic symphysis: anterior joint of fibrous cartilage
in women before birth it softens to allow expansion of birth canal

as bipedal animals the pelvis must support most of the body weight,
viscera bear down on pelvic floor ‡ pelvis is funnel shaped
yet must remain large enough for the birth canal

pelvis is easiest part of skeleton to distinguish between sexes

number and arrangement of bones in the lower limb are similar to those of the upper limb

In the lower limb they are adapted for weight bearing and locomotion,
not dexterity

Upper Leg = Thigh

made up of single bone = **femur**
largest bone in body
head fits in large deep socket = **acetabulum** of pelvis
great strength, less flexibility than humerus

kneecap = patella

a **sesamoid** bone
bones found where tension or pressure exists
eg thumb and large toe
in tendons at knee joint
does not articulate directly with any other bone
acts as kind of a bearing
‡ allows tendon to slide smoothly across knee joint
if patella is lost through accident or injury get
~30% loss of mobility and strength due to > friction

Lower Leg

consists of two bones: tibia and fibula

tibia (=shinbone)

main bone, articulates with both femur and foot

‡ more strength, less mobility

fibula

small, offers extra support for lower leg and foot

foot

like hand, made of many bones

thick angular bones,

must support all the weight of the body

arches: strung with ligaments to provide double arches

= shock absorbers

arches also furnish more supporting strength than any other

type of construction ‡ more stability

if ligaments and muscles weaken, arches are lost

= flatfootedness = fallen arches, more difficult walking, foot pain, back pain

high heels redistribute the weight of foot ‡ throw it forward

ends of metatarsals bear most weight ‡ sore feet