Bone Classification

- 206 named bones
- Axial skeleton
- Appendicular skeleton
- Shape classification: long, short, flat, irregular, sesamoid

Bone Classification(cont'd)

- *Long bones*: length exceeds width;shaft & 2 ends;primarily compact w/spongy interior; ex. humerus, femur
- *Short bones*: cubelike;spongy bone; ex. carpals, tarsals
- *Flat bones*: thin,flattened, w/slight curvature;compact bone surfaces w/spongy layer; ex. sternum, ribs

Bone Classification(cont'd)

- *Irregular bone*: complicated shapes & mostly spongy bone; ex. vertebra, pelvis
- Sesamoid:short bone,forms within tendon;patella

Bone Functions

- Support-hard framework;supports body wall (limbs, rib cage)
- Protection-braincase, vert.foramina
- Movement-levers
- Storage
- Blood cell formation

Bone Structure

- Bones are organs-osseous tissue, along with nervous,cartilaginous,fibrous CT
- Osteocytes, osteoblasts, osteoclasts

Textures: Compact vs Spongy

- Compact-dense, smooth,solid outer layer
- Spongy bone-honeycomblike; trabeculae

Structure of Typical Long Bone

- Diaphysis-compact bone surrounds cavity;yellow marrow evident in adults
- Epiphyses-compact exterior,spongy interior;hyaline cartilage on joint surface

Structure of Typical Long Bone (cont'd)

- Periosteum-double layered (outer & inner);fibrous outer, inner has osteoblasts & osteoclasts;Sharpey's fibers
- Endosteum-lines marrow; osteoblasts & osteoclasts

Structure of short, irregular & flat bones

- Non-cylindrical
- No marrow cavity
- Diplöe-internal layer of spongy bone in flat bones

Hematopoietic Tissue

- **Red marrow**
- In newborns, red marrow predominate cavities
- Adults: RBC produced in femoral& humeral head, diploe of sternum, & irregular bones (pelvic)

Microscopic Structure of Bone

- Compact bone-has osteons
- Osteon-has Haversian system
- Haversion system-central canal, Volkmann's canal, lacunar osteocytes, & canaliculi
- Spongy bone

Chemical Composition of Bone

- Organic components-Osteoblasts, osteocytes, osteoclasts;glycoproteins & collagen fibers
- Inorganic components-hydroxyapatites (Ca phosphate/hydroxide),Ca carbonate & ions
- Organic/inorganic combo gives durability/strength w/o being brittle

Bone Markings

- Muscle & ligament attachment projections-tuberosity, crest, line, tubercle, trochanter, epicondyle, spine
- Joint forming projections-head,facet, condyle, ramus
- Depressions/openings for blood vessels & nerves-meatus, groove, fossa, foramen

The Axial Skeleton

- ***80 bones***
- ***The Skull***
- ***Vertebral Column***
- ***Bony Thorax***

The Skull

- ***Neurocranium (8)***-Enclose brain and protect organs of hearing and equilibrium.
- ***Viscerocranium (14)-*** (1) Forms facial framework;(2) Provide cavities for the sense organs of sight, taste, and smell;(3) Provide openings for passage of air and food;(4) Secure the teeth; (5) Anchor facial muscles of expression.

The neurocranium

1 ***Frontal bone*** -anterior portion of cranium;the forehead and roofs of the orbits.

- ***Orbits***
- ***Anterior cranial fossa***
- ***Glabella***
- ***Frontal sinuses***

Neurocranium (cont'd)

- ***2 Parietal Bones-*** Large,curved, rectangular bones forming superior and lateral aspects of the skull; largest sutures occur at parietal bone articulation points.
- ***Major Sutures*****-(1) Coronal suture-** parietal bones meet with frontal bone anteriorly.
  (2) **Sagittal suture**-right and left parietals meet superiorly at cranial midline.

Neurocranium (cont'd)

(3)Lambdoid suture-the parietal bones meet the occipital bone posteriorly.

(4)Squamous suture-parietal and temporal bone meet on lateral aspect of skull.

Neurocranium (cont'd)

1 ***Occipital Bone*** **-**posterior wall and base of the skull

- internally forms walls of ***posterior cranial fossa***
- ***foramen magnum***
- ***occipital condyles***
- ***external occipital protuberance ("occiput").***

Neurocranium (cont'd)

- *2* ***Temporal Bones*** **-**inferolateral aspects of the skull and partial cranial floor; four regions are squamous, tympanic, mastoid, petrous; ***zygomatic process and arch, mandibular fossa,external acoustic meatus, styloid process, mastoid process, middle cranial fossa, middle/inner ear cavities.***

Neurocranium (cont'd)

1 ***Sphenoid Bone*** **-**Keystone of cranium that forms central wedge; **greater/lesser wings, pterygoid processes.**

- ***Sella turcica*** (***hypophyseal fossa***)
- ***Optic canals, superior orbital fissure***
- ***Orbital wall (lateral)***

Neurocranium (cont'd)

1 ***Ethmoid*** **-**Complex shaped, lies between sphenoid and nasal bones,most deeply situated bone of the skull

- ***Cribiform plate***
- ***Crista galli (dura mater attachment)***
- ***Perpendicular plate***
- ***Superior/middle nasal conchae***
- ***Orbital wall (medial)***

Viscerocranium

- *1* ***Mandible*** **-**Largest,strongest, facial bone.

  Body-forms the chin

  Rami-meet with body posteriorly to form angle.

  Mandibular notch separates ***coronoid process*** & ***mandibular condyle.***

  Mandibular, mental foramina

Viscerocranium (cont'd)

2 ***Maxillary bones-*** Keystone bones of the face;form upper jaw & central portion of facial skeleton.

- ***Incisive foramen***
- ***Infraorbital foramen***
- ***Maxillary sinuses***-Largest of paranasal sinuses

Viscerocranium (cont'd)

- ***2 Zygomatic Bones*** **–** **"**Cheekbones";articulates with temporal bones via zygomatic arch.
- ***2 Nasal Bones*****-**Thin rectangular bones fused medially; forms "nosebridge"; inferiorly attach to nasal cartilages.

Viscerocranium (cont'd)

- ***2 Lacrimal Bones*** -Delicate fingernail-shaped bones that contribute to the medial walls of each orbit; lacrimal fossa houses lacrimal sac.
- ***2 Palatine Bones***-Forms posterior part of the hard palate.

Viscerocranium (cont'd)

- ***1 Vomer*** **-**Slender,plow shaped bone that lies in the nasal cavity and forms part of the nasal septum.
- ***2 Inferior nasal conchae*** **-**Thin, curved bones of nasal cavity; inferior to middle nasal concha of ethmoid; largest of the three pairs of conchae.

Special Characteristics of the Orbits and Nasal Cavity

- Orbits formed by tributary bones:*Frontal, Sphenoid, Ethmoid, Zygomatic, Maxillary, Lacrimal, and Palatine*
- *Nasal Cavity*-Roof formed by cribiform plate; lateral walls formed by nasal conchae, floor formed by palatine process of maxillary bone and palatine bones.
- *Paranasal cavities*-frontal,sphenoid,ethmoid, maxillary.

The Hyoid Bone

- ***Does not articulate directly with any other bone in the body.***
- ***Greater horn supports larynx, acts as movable base for tongue.***
- ***Lesser horn are attachments for stylohyoid ligaments***

The Vertebral Column

- ***Comprised of 26 irregular bones***
- ***Axial support of the trunk***
- ***Spinal cord surrounded by vertebral foramen***
- ***Provides attachment points for the ribs and back muscles***

Ligaments/Discs

- *Supporting ligaments are the **anterior/posterior longitudinal ligaments.***
- *Intervertebral discs are cushionlike paddings; inner semifluid **nucleus pulposus** and a strong outer ring of fibrocartilage called the **annulus fibrosus.***
- *Discs accounts for **25%** of vertebral height.*
- *Herniated disc is the rupturing of the annulus fibrosus.*

Divisions and Curvatures

- ***Cervical***
- ***Thoracic***
- ***Lumbar***
- ***Sacrococcygeal***

Divisions and Curvatures (cont'd)

- *Primary (Thoracic & Sacral)*
- *Secondary (Cervical & Lumbar)*
- *Kyphosis*
- *Lordosis*
- *Scoliosis*

General Structure of Vertebrae

- *Body*
- *Vertebral arch (lamina & pedicles)*
- *Vertebral foramen*
- *Spinous/Transverse process*
- *Superior/Inferior articular processes/ facets*
- *Intervertebral foramina*

Cervical Vertebrae

- "Typical"(C3-C7) has oval body, short *bifid* spinous process, and transverse foramina.
- Vertebra prominens
- 1st (*atlas)* (no body, no spinous process, superior articular facets "carry" the skull)
- 2nd one is the *axis* (has body, spinous process, and dens)

Thoracic Vertebrae

- *Increase in size from the first to last.*
- *Heart shaped body,*
- *Circular vertebral foramen.*
- *Costal facets(on TPs)*

Lumbar Vertebrae

- *Large bodies*
- *Short laminas and pedicles*
- *Short & flat spinous processes*
- *Superior/inferior articular processes modified to"lock" preventing rotation of lumbar spine.*

The Sacrum

- *Formed by five fused vertebrae (in adults)*
- *Auricular surface (sacroiliac joint)*
- *Shapes the posterior wall of the pelvis*
- *Two wing like alae*
- *Sacral promontory*
- *Transverse lines*
- *Sacral foramina*
- *Median & lateral sacral crests*
- *Sacral canal & hiatus*

The Coccyx

- *Vestigial tailbone*
- *Attachment site for ligaments and sphincter muscle*
- *Four or five fused vertebrae (completed in late adulthood)*
- *Gender positions*

The Bony Thorax

- *Forms protective cage around vital organs of the thoracic cavity (heart, lungs, and great blood vessels).*
- *Supports the shoulder girdles and upper limbs.*
- *Provides attachment points for the muscles of the back, chest, and shoulders.*
- *Intercostal spaces between the ribs are occupied by intercostal muscles.*

The sternum

- **Flat bone approximately 15cm.long (6 in.)**
- **Fusion of three bones: *manubrium, body, and xiphoid process.***
- **Landmarks: *jugular notch,sternal angle and xiphisternal joint.***

The ribs

- **Ribs originate on/between thoracic vertebrae; attach to sternum**
  12 pairs
  7 true (vertebrosternal)
  3 false (vertebrochondral)
  2 floating(vertebromuscular ribs)
- **Rib morphology: *head, neck, tubercle,angle, shaft, costal groove.***

The Appendicular Skeleton

- ***The pectoral(shoulder) girdle and upper limb***
- ***The pelvic (hip)girdle and lower limb***

Pectoral girdle

- ***Clavicles:*** Direct connection between pectoral girdle/axial skeleton;slender doubly curved long bones; have acromial and sternal ends.
- ***Scapulae:*** Thin, triangular flat bones; important structures are:**borders (sup., med.,lat.), spine, acromion (ac joint)**,**glenoid cavity, coracoid process, supra/infra spinous fossae**,and **subscapular fossa.**

Upper Limb(brachium)

- ***Humerus***: Articulates with glenoid cavity at the scapula and with ulna/radius at the elbow; important structures are: **head,surgical neck, greater/lesser tubercles;capitulum, trochlea, coronoid and olecranon fossae, lateral and medial epicondyles.**

Forearm (antebrachium)

- ***Ulna:*** Slightly longer than radius & medial; important structures are: olecranon and coronoid processes, trochlear notch, ulnar head and styloid process.
- ***Radius***: Lateral; important structures are the radial head and styloid process.
- ***Antebrachial interosseous membrane***
- ***Pronation/supination***

Carpal bones(carpus)

- ***Proximal bones (medial to lateral)***
  Scaphoid
  Lunate
  Triquetral
  Pisiform

Carpus(cont'd)

- ***Distal bones(medial to lateral)***
  Trapezium
  Trapezoid
  Capitate
  Hamate

The Hand (manus)

- ***Metacarpals (Palm):*** 5 small long bones; Roman numerals(I-V) used to identify; proximal “base”, “body”, distal “head”; heads are what make up the “knuckles”.
- ***Phalanges (Fingers):*** 14 miniature long bones; pollex = thumb; all except pollex have proximal,middle, and distal phalanges.

The Pelvic Girdle

- Comprised of three fused bones: The **ilium**, **ischium**, and **pubis**
- ***Ilium:*** Superior region;important structures are: iliac crest, anterior/posterior superior iliac spines, anterior/posterior inferior iliac spines.
- ***Ischium***:Posteroinferior region;ischial spine, ischial tuberosity;lesser sciatic notch.
- ***Pubis***:Superior/inferior rami, pubic symphysis, pubic arch;forms obturator foramen(isch./pubis)

Pelvic girdle (cont'd)

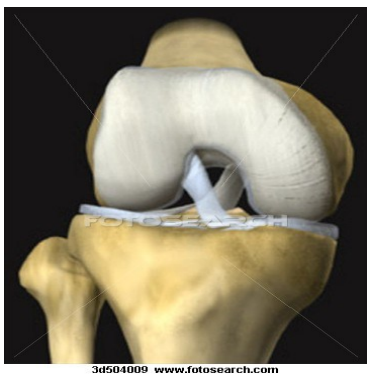
- ***False pelvis***- Portion of pelvis superior to pelvic brim.
- ***True pelvis***-Portion of pelvis inferior to pelvic brim; forms deep bowl containing the pelvic organs.

Lower limb

- ***Femur***- Largest, longest, strongest bone in the body;length is 1/4th of a person's height; articulates with hip.Important structures are: *fovea capitis, head, neck (weakest), greater/lesser trochanters,linea aspera,lateral/medial condyles, patellar surface,*
- ***Knee****-patella*

Lower limb (cont'd)

- ***Tibia***- 2nd largest, longest, strongest bone in body;important structures are: *the medial/lateral condyles, intercondylar eminence (with tubercles),tibial tuberosity, anterior crest, medial malleolus.*
- ***Fibula***- Sticklike bone with slightly expanded ends; the head and its lower end is the lateral malleolus.
- ***Crural interosseous membrane***



Tarsal bones (tarsus)

- **Talus**-transmits weight of body from tibia towards toes;2nd largest foot bone.
- **Calcaneus**-largest of tarsal bones; posterior surface attaches calcaneal tendon.
- **Cuboid bone**
- **Navicular**
- **Cuneiforms**-medial, intermediate, lateral.

The foot (pes)

- **Metatarsals-**1st metatarsal supports weight of body.
- **Phalanges**-14 bones organized anatomically the same as fingers; hallux=big toe