Lab #9

Skeletal system overview

Classification of Bones

- Bones are identified by:
  - shape
  - internal tissues
  - bone markings

Bone Shapes

1. Flat bones
2. Long bones
3. Short bones
4. Irregular bones
5. Sutural bones
6. Sesamoid bones

Flat Bones

- Thin with parallel surfaces
- Flattened and a bit curved
- Found in the skull, sternum, ribs, and scapula
- Resembles a sandwich of spongy bone between 2 layers of compact bone
- Middle layer is called diploe

Flat Bones

- The parietal bone of the skull

Long Bones

- Long and thin
- Found in arms, legs, hands, feet, fingers, and toes
Short Bones
- Are small and cube-shaped bones
- Examples:
  - Ankle bones
  - Wrist bones

Irregular Bones
- Have complex shapes
- Examples:
  - Spinal vertebrae
  - Pelvic bones

Sutural Bones
- Small, irregular bones
- Found between the flat bones of the skull
- Vary in number from one person to the next
- Not counted in the total number of bones in the body

Sesamoid Bones
- Small and flat, "sesame seed" shaped
- Develop inside tendons near joints of knees, hands, and feet

Long Bones
- Parts
  - Diaphysis
  - Epiphysis
  - Metaphysis
- Example: the femur

Structure of Long Bone
The Diaphysis

- Talkin’ ‘bout shaft
  - Tubular shaft that forms the axis of long bones
- A heavy wall of compact bone, or dense bone
- A central space called the marrow cavity
- Yellow bone marrow (fat) is contained in the medullary cavity

Structure of Long Bone: Diaphysis

The Epiphysis

- Expanded ends of long bones (Head)
- Mostly spongy (cancellous) bone
- Covered with compact bone (cortex)
- Joint surface is covered with articular (hyaline) cartilage

Structure of Long Bone: Epiphysis

Metaphysis

- The meeting point of diaphysis and epiphysis
- When the bone is growing the metaphysis consists of an epiphyseal plate. This is a layer of hyaline cartilage that allows the bone to grow in length.

Metaphysis

- When the bone stops growing the cartilage is replaced by bone and becomes the epiphyseal line (visible in X rays)
Structure of Short, Irregular, Flat and Sesamoid Bones

- Thin plates of periosteum-covered compact bone on the outside with endosteum-covered spongy bone (diploë) on the inside
- Have no diaphysis or epiphyses
- Contain bone marrow between the trabeculae

Articular Cartilage

- Hyaline cartilage that covers the epiphyses in order to reduce friction
- Left over from fetal bone development

Marrow Cavity

- Space inside the diaphysis that contains the marrow
- Lined by the endosteum

Gross Anatomy of Bones: Bone Textures

- Compact bone – dense outer layer
- Spongy bone – honeycomb of trabeculae filled with yellow bone marrow

Compact (dense) Bone

- Found wherever stress is placed on a bone from one direction
- Osteons w/concentric lamellae
- Interstitial lamellae
- Circumferential lamellae
- Perforating canal
- Central canals
- Canaliculi
Microscopic Structure of Bone: Compact Bone

- Trabeculae: lattice of bony struts composed of layers of lamellae, canaliculi
- Red marrow fills spaces between trabeculae
- **Diploe**: spongy bone layer filled with marrow
- Found where bone gets stress from many directions

Spongy (cancellous) bone

- Trabeculae: lattice of bony struts composed of layers of lamellae, canaliculi
- Red marrow fills spaces between trabeculae
- **Diploe**: spongy bone layer filled with marrow
- Found where bone gets stress from many directions

Spongy Bone

Bearing Weight: Compact vs spongy

- Compact bone is excellent for resisting force (compression or tension) in **one direction**
- Spongy bone is better for resisting force in **many directions**

Weight–Bearing Bones

- The femur transfers weight from hip joint to knee joint:
  - causing tension on the lateral side of the shaft
  - and compression on the medial side
- Structure is designed to transfer weight of upper body to tibia in calf, then on to the heel and arch of the foot.
Skeleton

- 206 total bones
  - 80 axial (frame)
    - skull, thoracic cage (ribs + sternum), vertebrae
  - 126 appendicular (appendages)
    - Pectoral girdle: scapula, clavicle
    - Upper limb: arm, wrist, hand
    - Pelvic girdle: coxal bones
    - Lower limb: leg, ankle, foot

Bone Markings

- Depressions or grooves:
  - along bone surface; things run along them
- Projections:
  - where tendons and ligaments attach
  - found at articulations with other bones
- Holes and Tunnels:
  - where blood and nerves enter bone

Bone Markings: Projections – Sites of Muscle and Ligament Attachment

- Tuberosity – rounded projection
- Crest – narrow, prominent ridge of bone
- Trochanter – large, blunt, irregular surface
- Line – narrow ridge of bone
- Tubercle – small rounded projection
- Epicondyle – raised area above a condyle
- Spine – sharp, slender projection
- Process – any bony prominence

Bone Markings: Projections – Projections That Help to Form Joints

- Head – bony expansion carried on a narrow neck
- Facet – smooth, nearly flat articular surface
- Condyle – rounded articular projection
- Ramus – armlike bar of bone

Bone Markings: Depressions and Openings

- Meatus – canal-like passageway
- Sinus – cavity within a bone
- Fossa – shallow, basin-like depression
- Groove – furrow
- Fissure – narrow, slit-like opening
- Foramen – round or oval opening through a bone
Today

- Examine a long bone, look at bone model, skeleton
- Effects of heat and HCl on bone
- Examine slide of ground bone
- Examine slide of endochondral ossification

Lab report due next Thursday (11/1)

Bone Practical

- Thursday 11/8
- Covers all bones on list
- Need to be able to identify each bone and bone part on disarticulated bones or skeleton
- Know the basic functions of each bone and part
- Know whether the bone is a left or a right (mostly for the appendicular skeleton)
Remember these terms?

80 bones make up the axial skeleton

- cranial bones: frontal, occipital, sphenoid, ethmoid, parietal, temporal
- facial bones: mandible, vomer, maxilla, zygomatic, lacrimal, nasal, palatine, inferior nasal concha
- sutures: coronal, sagittal, squamosal, lambdoidal
- sinuses: frontal, maxillary, sphenoidal, ethmoidal
- processes: styloid, zygomatic, mastoid, palatine

Skull = 22 bones
- Associated = 7 bones

- foramina: foramen magnum, supraorbital, infraorbital, mental, optic, ovale, rotundum, jugular
- fontanels: frontal (anterior), occipital (posterior), mastoid (anteriolateral), sphenoidal (anteriolateral)
- other structures: zygomatic arch, orbit, sella turcica, crista galli, cribiform plates, external acoustic canal, mandibular condyler process, nasal septum, hard palate
Sphenoid

Ethmoid

Sinuses

Fetal skull
4 Fontanels
Vertebral column = 26 bones

Vertebrae

types of vertebrae - cervical, atlas, axis, thoracic, lumbar, sacral, coccygeal
parts of a vertebra - body, spinous process, transverse process, articular processes, vertebral foramen, costal facets, intervertebral disc

Vertebrae

- Bodies get larger as you descend (more weight)
- Foramen get smaller as you descend (less information in spinal cord)
- Shape of spinous process helps to identify vertebrae from each region:

Cervical vertebrae (7)

Thoracic vertebrae (12)
Lumbar vertebrae (5)

Sacrum and Coccyx

Thoracic cage

• 25 bones:
  – Sternum (3 parts = 1 bone)
  – 24 ribs

Ribs and Sternum

• ribs - true, false, floating
• parts of a rib – head (capitulum), neck, body, tubercle
• parts of the sternum - manubrium, body, xiphoid process, clavicular articulation, jugular notch

Ribs: 12 pairs total
true = 7 pairs
false = 3 pairs
floating = 2 pairs

Sternum (3 parts)
Ribs (24)

Hyoid
• Hyoid bone

Whale hyoid

Activities
• Work with skulls and identify bones and bone parts from the list
• Palpate skull markings (list on page 132)
• Skull with sinuses exposed, fetal skull
• Disarticulated vertebrae, ribs
• Sternum and ribs (on skeleton)

Review Sheet due Thurs 11/1

Advice
• **Pay attention to the list.** Everything you need to know is on it; if it’s in the book or on the review sheet but NOT on the list, just ignore it.
• **You get out of it what you put into it**