

ACTIVITY 3: BONE HISTOLOGY, LONG BONE DISSECTION, AND CRANIAL AND FACIAL BONES, VERTEBRAE, RIBS, AND STERNUM

LABORATORY OBJECTIVES:

1. Review compact bone histology
2. Observe and dissect a fresh long bone from a cow
3. Identify the cranial and facial bones and important bone markings on each
4. Identify the vertebrae and other features of the vertebral column, and important bone markings on each.
5. Identify the ribs and sternum and important bone markings on each.

OBJECTIVE 1. BONE HISTOLOGY:

Be able to identify the following features of compact bone tissue:

- Osteon
- Central (Haversian) canal
- Osteocytes in lacunae
- Canaliculi
- Concentric lamellae
- Circumferential lamellae
- Interstitial lamellae

OBJECTIVE 2. COW BONE DISSECTION:

Be able to identify the following features on a **fresh cow long bone**:

- Diaphysis
- Compact bone tissue (forming most of the diaphysis, and the outside of all bones)
- Proximal and distal epiphysis (form the ends of the long bone)
- Articular surface with hyaline cartilage
- Metaphysis
- Epiphyseal line or epiphyseal (growth) plate
- Medullary (marrow) cavity and yellow bone marrow
- Spongy bone tissue and red bone marrow
- Trabeculae within spongy bone (thin bony plates running within spongy bone tissue)
- Periosteum (dense irregular connective tissue covering the outside of all bones)
- Endosteum (connective tissue lining the inside of the medullary cavity in the diaphysis)

Dissection Instructions:

1. Acquire all dissection materials. (1 set per table)
 - Dissection tray
 - Scalpel
 - Probe
 - Cow bone
 - Gloves (Supply your own)
 - Forceps
2. After getting cow bone back to your table, place it on your board, cut side up, and begin to examine it closely. Notice that within the compact bone there are red dots. Those dots are broken blood vessels within the compact bone.
3. Procedure
 - A) Take Probe and carefully dig into the yellow bone marrow in an attempt to find a nutrient artery (highly unlikely). Realize that bone is living tissue and is highly vascularized. After that dig out all of the marrow from the cavity to expose the trabeculae visible on the side toward the epiphysis. These trabeculae are the network that makes up

- the spongy bone. Within this spongy bone you will find an area that will be red and bloody, this is the red bone marrow and the site of blood cell production (hematopoiesis).
- B) Now look toward the outside of the bone to the outer lining of the shaft. Take a forceps and peel away the periosteum. The periosteum serves as a place of attachment for tendons and ligaments and an anchor for blood vessels. Notice the difference between the tendons and ligaments that attach to the periosteum and the periosteum itself. See the difference in the appearance of the fibers.
 - C) Now look for cartilage (fibrocartilage and hyaline cartilage). Hyaline will be located at the ends where the bone will articulate with another bone. In some cases fibrocartilage will be visible in the shape of a C on the end of the cow tibia. Closely look at the difference between the two cartilages.
 - D) YOU MUST DISPOSE OF THE COW BONE AS INSTRUCTED, AND COMPLETELY CLEAN, DRY, AND PUT AWAY ALL INSTRUMENTS AND TRAYS IN ORDER TO EARN YOUR GRADE FOR THE LAB.

OBJECTIVE 3. CRANIAL AND FACIAL BONES AND FEATURES:

- **SUTURES: Coronal, sagittal, squamous, lambdoidal**

Know which bones are joined by each major suture, and be able to identify the sutures from any view of the cranium.

- **PARANASAL SINUSES: frontal sinus, ethmoid sinus, sphenoid sinus, maxillary sinus**

These are air-filled chambers named for the bone in which they are housed. They can be identified in different sections of the the skull.

Be able to identify the paranasal sinuses in the appropriate skull sections.

- **FONTANELS: anterior fontanel, sphenoid fontanel, mastoid fontanel, posterior fontanel**

These are features (soft spots) of the fetal skull.

Be able to identify the fontanels on a fetal skull.

LIST OF CRANIAL AND FACIAL BONES (AND BONE MARKINGS) YOU ARE RESPONSIBLE FOR ON THE FIRST LAB PRACTICAL EXAM

You are responsible for determining left or right on all paired cranial and facial bones. Paired bones are indicated by (2) in parentheses.

| Bone | Bone Markings | Significance |
|---------------------------|---|--|
| Frontal (1) | Supraorbital foramen | supraorbital artery and nerve |
| | Frontal sinus | moisten air |
| Parietal (2) | | |
| Nasal (2) | | |
| Sphenoid (1) | Greater wing | |
| | Lesser wing | |
| | Sella turcica | houses pituitary gland |
| | Optic foramen/ canal | CNII (optic nerve) |
| | Foramen ovale | CNV (mandibular branch) |
| | Foramen rotundum | CNV (maxillary branch) |
| | Foramen spinosum | middle meningeal vessels |
| | Foramen lacerum | |
| | Superior orbital fissure | CNIII; CNIV; CNV (ophthalmic branch); CNVI |
| | Inferior orbital fissure | CNV (maxillary branch) |
| | Sphenoid sinus | |
| | Pterygoid processes (each with medial and lateral plates) | |
| Ethmoid (1) | Perpendicular plate | superior part of nasal septum |
| | Superior & middle nasal concha | increase surface area for warming and filtering air |
| | Cribriform plate (and foramina) | passageway for olfactory nerves |
| | Crista galli | attachment site for dura mater to skull |
| Inferior nasal concha (2) | | increase surface area for warming and filtering air |
| Lacrimal (2) | Lacrimal groove | nasolacrimal duct |
| Zygomatic (2) | Temporal process ¹ | forms anterior portion of zygomatic arch (cheekbone) |
| Maxilla (2) | Infraorbital foramen | infraorbital artery; CNV (maxillary branch) |
| | Alveolar processes | contain upper teeth |
| | Palatine process | form anterior portion of hard palate |
| | Incisive foramen (fossa) | branches of nasopalatine nerve (from CNV) |
| Mandible (1) | Body | |
| | Ramus | |
| | Alveolar processes | contain lower teeth |
| | Angle | |
| | Mental foramen | CNV (mandibular branch); blood vessels |
| | Coronoid process | insertion pt. of temporalis |
| | Mandibular condyle or condyloid process | forms joint w/ mandibular fossa of temporal bone |
| Mandibular notch | | |

| | | |
|--------------|--|---|
| Temporal (2) | Zygomatic process ¹ | forms posterior portion of zygomatic arch (cheekbone) |
| | Squamous region | remember: squamous means flat |
| | Styloid process | attachment for hyoid and tongue muscles |
| | Mastoid process | insertion for sternocleidomastoid and others |
| | External auditory/acoustic meatus ² | opening to the auditory/acoustic canal |
| | Petrous portion | |
| | Internal auditory/acoustic meatus/canal ² | CNVII and VIII and blood vessels to inner ear |
| | Jugular foramen | internal jugular vein; CNIX; CNX; CNXI |
| | Carotid canal | internal carotid artery |
| | Mandibular fossa | forms joint with mandibular condyle |
| Occipital | Foramen magnum | spinal cord (out); vertebral arteries (in); CNXI (in) |
| | Hypoglossal canal | CNXII (hypoglossal nerve) |
| | External occipital protuberance/ crest | attachment site for neck/back muscles |
| | Occipital condyles | articulate with atlas (1 st cervical vertebra) |
| Palatine (2) | Hard palate | form posterior portion of hard palate |
| | | |
| Vomer | | forms inferior part of nasal septum |
| | | |

¹Note: the zygomatic process of the temporal bone and the temporal process of the zygomatic bone were incorrectly labeled in fig. 7.6 (McKinley O'Laughlin, 1st edition)

²meatus = opening to a canal

OBJECTIVES 4 & 5. VERTEBRAE, RIBS AND STERNUM

Most of the 32 vertebrae have the following features to identify: *lamina, pedicle, transverse process, articular processes, vertebral foramen, body, intervertebral foramen*. Each type may also have some unique features.

Vertebral Column

| <u>Bone Name</u> | <u># bones</u> | <u>Bone marking</u> | <u>Description & Related Structures of Importance</u> |
|--------------------------------|-----------------|--|--|
| <i>Typical Vertebra</i> | 32 | lamina pedicle transverse process spinous process articular processes (superior and inferior) vertebral foramen body intervertebral foramen | connects transverse to spinous process connects body to transverse process process directed laterally process directed posteriorly form joints between adjacent vertebrae contains spinal cord largest part of the vertebra intervertebral discs are found between adjacent vertebral bodies formed when 2 vertebra come together, contain spinal nerves |
| <i>Cervical</i> | 7 | transverse foramen | contains vertebral artery |
| <i>Atlas (C1)</i> | | arch | contains articulation point for dens of axis has no body, body has become the dens (odontoid process) of the axis |
| <i>Axis (2)</i> | | body | has odontoid process (dens), which is the fused body of C1 |
| <i>Vertebra prominens (C7)</i> | | spinous process | very large, easily felt under the skin |
| <i>Thoracic</i> | 12 | transverse process | contains facets for articulation of the angle of a rib. |
| <i>Lumbar</i> | 5 | | |
| <i>Sacrum</i> | 5 (fused) | anterior sacral foramina posterior sacral foramina median sacral crest auricular surfaces superior articular processes | contain ventral (anterior) rami of sacral spinal nerves contain dorsal (posterior) rami of sacral spinal nerves represents fused spinous processes of sacral vertebrae "ear" like process, articulates with the iliac bones articulate with inferior articular processes of L5 |
| <i>Coccyx</i> | 2 to 3 fused | cornu (horns) | little "horns" that point superiorly |

| BONE | Bony Landmark |
|---|--|
| STERNUM manubrium body xiphoid process | sternal (jugular) notch sternal angle clavicular notch costal notches costal notches |
| RIBS typical rib | head neck tubercle angle costal groove shaft (body) |