Name: _____ Class ID:_____

Unit 2 Lab Worksheet

(Dr. Kuo's Section)

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Intro to Bones & Bony Landmarks

This page is an adaptation from *Oregon State University.*

The surface features of bones vary considerably, depending on the function and location in the body. The table below describes the bone markings, which are illustrated in this figure.

There are 3 general classes of bone markings: (1) articulations, (2) projections, and (3) holes.

- Articulation — where two bone surfaces come together (articulus = "joint"). These surfaces tend to conform to one another, such as one being rounded and the other cupped, to facilitate the function of the articulation.
- Projection — an area of a bone that projects above the surface of the bone. These are the attachment points for tendons and ligaments. In general, their size and shape are an indication of the forces exerted through the attachment to the bone.
- Hole — an opening or groove in the bone that allows blood vessels and nerves to enter the bone. As with the other markings, their size and shape reflect the size of the vessels and nerves that penetrate the bone at these points.

Bone Marking	Description	Example
Articulations	Where two bones meet	Knee joint
Canal	Passage in bone	Auditory canal
Condyle	Rounded surface; rounded articular projection, often articulates with a corresponding fossa	Occipital condyles
Concha (pl. conchae)	A shell-like structure	
Crest	Ridge	Iliac crest
Epicondyle	raised area on or above a condyle	medial & lateral epicondyles of femur
Facet	Flat/smooth surface	Vertebrae
Fissure	narrow, slit-like opening through bone	Auricular fissure
Foramen (pl. *foramina*)	round or oval opening through a bone	Foramen magnum in the occipital bone
Fossa (pl. *fossae*)	shallow basin-like depression in a bone, often serving as an articular surface	Mandibular fossa
Fovea (pl. *foveae*)	Small pit	Fovea capitis on the head of the femur
Groove	furrow	
Head	Prominent rounded surface; bony expansion carried on a narrow neck	Head of femur
Holes	Holes and depressions	Foramen (holes through which blood vessels can pass through)
Line	Slight, elongated ridge	Temporal lines of the parietal bones
Meatus (pl. meatus or meatuses)	canal-like passageway	External auditory meatus
Notch	indentation at the edge of a structure	mandibular notch
Process	any bony prominence	Transverse process of vertebra
Projections	Raised markings	Spinous process of the vertebrae
Protuberance	Protruding	external occipital protuberance
Sinus	cavity within a bone, filled with air and lined with mucous membrane	frontal sinus
Spine	Sharp process	Ischial spine
Sulcus (pl. *sulci*)	Groove	Sigmoid sulcus of the temporal bones
Trochanter	very large, blunt, irregularly shaped process	greater & lesser trochanters of the femur
Tubercle	Small, rounded process	Tubercle of humerus
Tuberosity	Rough surface	Deltoid tuberosity
Ramus	arm-like projection	mandibular ramus
suture	a rigid type of fibrous joint found between the bones of the skull	lambdoidal suture

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Axial Bones – Skull

Special Parts of the Skull

- Pterion
- Orbits
- Nasal Cavity
- Hyoid bone (not part of the skull)
- Superior, middle and inferior nasal meatuses
- Paranasal Sinuses – frontal sinus, sphenoid sinus (sphenoidal sinus), maxillary sinus, ethmoid sinus.
- Sutures – sagittal suture, squamosal (squamous) suture, lambdoidal suture, coronal suture (not to be confused with frontal suture!)

Cranial bones

Frontal bone (*usually* fuses into a single bone during development)

- supraorbital foramen (supraorbital notch)
- glabella
- frontal sinuses

Parietal bone (paired)

- sagittal suture
- squamous (squamosal) suture
- coronal suture
- lambdoidal (lambdoid) suture

Occipital bone (single)

- foramen magnum
- lambdoidal suture
- external occipital protuberance
- occipital condyles
- hypoglossal canal

Temporal bones (paired)

Squamous region:

- zygomatic process ~~of the temporal bone~~
- mandibular fossa
- squamosal suture

Tympanic region:

- external auditory meatus (external acoustic meatus)
- styloid process

Mastoid region:

- mastoid process
- stylomastoid foramen

Petrous region:

- internal auditory meatus (internal acoustic meatus)
- jugular foramen
- carotid foramen (carotid canal)

(you're not responsible for knowing the "regions"; but you do have to be able to ID the bone markings)

Sphenoid bone (single)

- Sphenoid body
- foramen rotundum
- foramen ovale
- foramen spinosum
- foramen lacerum
- greater wings & lesser wings
- optic canal (optic foramen)
- superior orbital fissure
- sphenoid sinus
- sella turcica

Ethmoid bone (single)

- cribriform plate
- olfactory foramina (cribriform foramina)
- crista galli
- ethmoid sinuses
- perpendicular plate
- superior nasal concha (pl. conchae)
- middle nasal concha (pl. conchae)

Facial bones

Maxilla (paired)

- plural *is maxillae or maxillary bones*
- palatine process of the maxilla
- incisive fossa or foramen
- infraorbital foramen
- alveolar margin (alveolar ridge)
- maxillary sinus

Zygomatic bones (paired)

- temporal process ~~of the zygomatic bone~~

Palatine bones (paired)

Inferior nasal conchae (paired)

- *concha is* singular

Mandible (single)

- Mandibular body
- mandibular angle
- mandibular ramus (plural is rami)
- coronoid process
- mandibular condyle
- mandibular foramen
- mental foramen
- alveolar margin (alveolar ridge)

You do not have to know these terms that have been crossed out

Lacrimal bones (paired)

- ~~lacrimal canal or sulcus~~

Nasal bones (paired)

Auditory ossicles (all paired)

- ~~Malleus (hammer)~~
- ~~Incus (anvil)~~
- ~~Stapes (stirrup)~~

Vomer (single)

Newly added:
septal cartilage

Study Questions

Q3.2 What is clinically important about the pterion?

Q3.3 What structures contribute to the zygomatic arch?

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Axial Bones – Vertebral Column & Thoracic Cage

Special features of the vertebral column.

- Regions and Curves of the column
  - Normal
  - Scoliosis
  - Kyphosis
  - Lordosis
- Intervertebral discs
  - Nucleus pulposus
  - Annulus fibrosus
- Intervertebral foramen (pl. *foramina*)

Bones of the vertebral column

Structure of the typical vertebra

- Vertebral body (centrum)
- pedicles
- lamina
- spinous process
- transverse processes
- vertebral arch
- vertebral foramen
- intervertebral foramen
- superior articular facet & process
- inferior articular facet & process

Regional characteristics

Cervical vertebrae (C1- C7)

- transverse foramina on transverse processes
- Short, bifid (C2-C6) spinous process that projects posteriorly
- Small, wide vertebral body
- Triangular vertebral foramen
- C1 (atlas) — lacks body & spinous process
- C2 (axis) — Distinct odontoid process (dens)

Thoracic vertebrae (T1 - T12)

- long, sharp spinous process that projects inferiorly
- heart-shaped vertebral body.
- Transverse costal facets
  - articulate with costal tubercles
- Superior & inferior costal facets & demifacets
  - articulate with costal heads

Lumbar vertebrae (L1 - L5)

- large stout/ robust body,
- Short, blunt spinous process that projects posteriorly
- Thin, tapered transverse processes

Sacrum (S1 – S5)

- made up of 5 fused sacral vertebrae
- fused vertebral bodies (sacral body)
- transverse ridges
- sacral promontory
- superior articular processes
- ala
- sacral canal
- anterior and posterior sacral foramina
- median sacral crest
- auricular surface

Coccyx

- made up of 5 or so fused coccygeal vertebrae

Bones of the thoracic cage

Sternum

- manubrium
- sternal body
- clavicular notch
- xiphoid process
- jugular (suprasternal) notch

Ribs (*costa*)

- All paired. Numbered 1 – 12 from superior to inferior

General structure of the *typical* rib (be able to tell if R or L)

- costal head
- costal neck
- articular tubercle
- shaft (body)
- costal groove (subcostal groove)
- costal cartilage

- True ribs (ribs 1-7) — directly attached to sternum by costal c
  - Also referred to as vertebrosternal ribs

- False ribs (ribs 8-12) — do not join the sternum directly but a connected to the 7th rib by cartilage.
  - vertebrochondral (ribs 8, 9, 10) — Attach to cartilage s
  - vertebral or floating (ribs 11 & 12) — Have no cartilage

Study Questions

Q6.1 What are the unique structural features of the atlas?

Q6.2 What are the differences between a vertebrosternal, vertebrochondral and vertebral rib?

Q6.3 List the five major regions of the vertebral column.

Q6.4 List the four distinct curvatures that give the vertebral column an S-shape.

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Appendicular Bones – Upper Limbs

Pectoral girdle

Clavicle
- sternal end
- acromial end
- conoid tubercle

Scapula (*pl. scapulae*)
- acromion
- coracoid process
- scapular spine
- infraspinous fossa
- supraspinous fossa
- subscapular fossa
- glenoid cavity (glenoid fossa)
- supraglenoid tubercle
- infraglenoid tubercle
- superior angle
- inferior angle
- suprascapular notch
- superior border
- axillary (lateral) border
- vertebral (medial) border

Arm & Forearm

Humerus (*pl. humeri*)
- humeral head
- anatomical neck
- surgical neck
- greater tubercle
- lesser tubercle
- intertubercular sulcus (bicipital groove)
- lateral epicondyle
- medial epicondyle
- trochlea
- capitulum
- coronoid fossa
- olecranon fossa
- deltoid tuberosity
- radial groove
- ~~lateral supracondylar ridge~~
- ~~medial supracondylar ridge~~

Radius (*pl. radii*)
- Radial head
- Radial neck
- styloid process
- radial tuberosity
- ulnar notch

Ulna (*pl. ulnae*)
- olecranon process (olecranon)
- radial notch
- trochlear notch
- styloid process
- coronoid process
- ulnar tuberosity

Hands

Carpals (carpal bones)
- Memory device — *So long to pinky, here comes the thumb*
- Proximal row from lateral to medial – *So long to pinky*

  scaphoid, lunate, triquetrum, pisiform
- Distal row from medial to lateral – *Here comes the thumb*

  hamate, capitate, trapezoid, trapezium

Metacarpals
- numbered 1-5 from lateral to medial

Phalanges (*sing. phalanx*).
- Proximal, middle, and distal phalanges
- numbered 1-5 from lateral to medial
- the first digit (thumb, pollex) only has proximal & distal phalanges
- *Note: When naming a phalanx, be sure to indicate number (1-5), proximal/ middle/ distal, side (right/left), and hand/ foot. Example — "second distal phalanx of the left hand"*

PELVIC GIRDLE

Os coxae or Os coxa (*pl. Ossa coxae*) — hip bone, pelvic bone, or coxal bone

Ilium (*pl. ilia*)
- iliac crest
- auricular surface
- iliac fossa
- greater sciatic notch
- anterior superior iliac spine (A.S.I.S)
- anterior inferior iliac spine (A.I.I.S.)
- posterior superior iliac spine (P.S.I.S)
- posterior inferior iliac spine (P.I.I.S)

**please don't abbreviate on practical!*

Ischium (*pl. ischia*)
- ischial spine
- lesser sciatic notch
- ischial tuberosity
- Ischial ramus

Pubis (*pl. pubes or pubic bones)*
- superior pubic ramus
- inferior pubic ramus
- pubic symphysis - joint that joins the pubic bones
- pubic tubercle
- ~~pubic body~~
- ~~pubic crest~~

- Acetabulum
- Obturator foramen

Male and female pelves have distinct differences in morphology (form) — *Compare the male pelvis to the female pelvis for differences in:* bone thickness, pubic angle, pelvic inlet, pelvic outlet, acetabulum, ischial spine, ischial tuberosity, iliac spines.

THIGH & LEG

Femur (*pl. femurs or femora*)
- Femoral head
- Femoral neck
- fovea capitis
- greater trochanter
- lesser trochanter
- intertrochanteric line
- intertrochanteric crest
- patellar surface
- medial & lateral condyles
- medial & lateral epicondyles
- intercondylar fossa
- linea aspera
- ~~medial & lateral supracondylar lines~~
- ~~gluteal tuberosity~~

Patella (*pl. patellas or patellae*)

Tibia (*pl. tibias or tibiae*)
- lateral condyle
- medial condyle
- intercondylar eminence
- tibial tuberosity
- fibular notch
- anterior crest (border)
- medial malleolus

Fibula (*pl. fibulas or fibulae*) — *don't have to differentiate R. vs L.*
- head of fibula
- lateral malleolus

Foot

Tarsals (ankle bones - they also contribute to the heel & proximal half of the foot)

- talus
- calcaneus
- navicular
- medial cuneiform
- intermediate cuneiform
- lateral cuneiform
- cuboid

Memory devices for the tarsals — Tiger Cubs Need MILC

Metatarsals

- numbered 1 to 5 from medial to lateral

Phalanges

- As per the bones of the digits of the hand. The first toe (big toe, hallux) only has proximal and distal phalanges
- Toes 2 – 5 have proximal, middle, and distal phalanges.
- *Note: When naming a phalanx, be sure to indicate number (1-5), proximal/ middle/ distal, side (right/left), and hand/ foot. Example — "first proximal phalanx of the right foot"*

Study Questions

Q2.1 What forearm bone is involved in the formation of the elbow joint? _____

Q2.2 What shoulder girdle bone articulates anteriorly with the sternum? _____

Q2.3 What bones come together to at the acetabulum? _____

Q2.4 If a person has a "broken finger", which bone(s) could be fractured? _____

Q2.5 List the bones of the wrist. Which of these bones is most likely to suffer a fracture?

Q2.6 Which bones are found in the leg? (hint: not the lower appendage) _____ _____

Q2.7 To which tarsal does the "Achilles tendon" attach? _____