**Biology 322 Human Anatomy**

  **GROSS ANATOMY OF THE SKELETAL SYSTEM**

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References:

Kenneth Saladin, *Human Anatomy* (3rd edition), Chapters 7-9

Eric Wise, *Human Anatomy Laboratory Manual,* Exercises 6-10

**INTRODUCTION**

 The skeletal system has a number of important functions in the human body. It is the framework around which the body is organized, it provides the levers for muscles to pull against, and it surrounds and protects many soft organs. Equally important, our bones serve as a "buffer" in which calcium and other ions can be deposited and withdrawn according to the changing needs of the body, and they are the site of almost all blood cell production. Contrary to our popular conceptions, bones are not rigid, inflexible structures: they are constantly changing, and can have a remarkable degree of flexibility before they break.

 The **organs** of the skeletal system are the bones and joints, and like all organs are composed of different types of **tissue.** Although we tend to classify them into "types" such as "long bones", "flat bones", etc., each is in fact unique and ideally suited to its particular location and function. We classify bones as belonging to either:

 a) the **axial skeleton** (head and trunk)

 b) the **appendicular skeleton** (arms and legs),

but you should always bear in mind that the entire skeletal system functions as a unit.

 If you look at any bone, you will see that it is rarely flat. Bones have a variety of bumps, grooves, holes, etc. which allow them to serve their specific functions. In fact, it is these **markings** which will allow you to identify specific bones, including which side of the body they come from. In general, a bone has a hole (or **foramen,** plural = **foramina**) wherever something like a blood vessel or nerve must pass through. Enlargements at the ends of a bone allow it to meet, or **articulate**, with other bones in the proper manner, while bumps indicate where muscles, tendons, and ligaments attach.

 We will use three lab periods to learn the names of the bones which comprise the human skeletal system and their major markings. Since this is more-or-less a matter of simple memorization, there will not be step-by-step instructions: instead, it will be an independent study exercise in which you can proceed at your own pace, using your textbook (Chapters 7 and 8) and lab manual as references. You may need to make use of open lab times as well as scheduled lab periods.

 Study the skeletons hanging in the lab and the individual bones found in the cupboard at the back of the lab, and learn the names of the bones and major markings listed below. As you do this, it is important to remember that you are looking at dead, preserved examples of once living tissues, and not everything will still be present. Missing will be the cells, cartilages which are normally found at the ends of many bones, and a layer of connective tissue called the *periosteum* which surrounds living bones.

 You will also be asked to identify certain parts of bones on yourself or another living person. This may require the removal of clothing and if so should, obviously, not be done in the lab. Do not attempt to identify bones through clothing.

**BONE PARTS AND MARKINGS:**

BODY - The main part of a bone

CANAL - A tube-like opening

CONDYLE - A rounded projection for articulation

CREST - A narrow ridge

EPICONDYLE - A bump on a condyle, for muscle attachment

FACET - A smooth, flat area for articulation

FISSURE - A narrow opening, may be irregular in shape

FORAMEN - A round or oval hole, not as long as a canal or meatus

FOSSA - A large flat area, often shallowly depressed

GROOVE - A narrow depression through which some other structure runs

HEAD - An enlargement carried on a neck, takes part in forming a joint

LINE - A narrow ridge, smaller than a crest

MEATUS - A tube-like opening

NECK - A narrowed region at one end of a long bone, attached to head

PROCESS - The general term for a long projection from a bone

RAMUS - A round or flattened extension from the body, usually for articulation

SINUS - An air-filled cavity within a bone, lined by mucous membrane

SPINE - A sharp, slender projection for muscle attachment

TROCHANTER - A large, irregularly shaped projection

TUBERCLE - A small rounded projection

TUBEROSITY - A large, rounded projection for muscle attachment, usually rough

WING - A flat region, often with some curvature

**SKULL**

 The skull really consists of two separate sets of bones: the bones of the **cranium** surround and protect the brain, while the bones of the **face** support the eyes, nose, and mouth and provide attachment for what we call the **muscles of facial expression.** Of course, these two sets of bones must attach to each other in many places, and all bones in the head include a large number of foramina because of the large numbers of nerves and blood vessels which must pass through.

 With only one exception, the joints between the bones of the skull are a type which prevents, rather than allows, motion between the bones. These nonmovable joints are called **sutures**, and they are found only in the head. The exception to this pattern is the joint between the condyle of the mandible and the temporal bone, which allows the mandible to move freely when eating, speaking, yawning, etc.

**Identify the following bones of the skull and their processes:**

 FRONTAL BONE:

 Supraorbital margin

 Supraorbital foramen

 PARIETAL BONE

 OCCIPITAL BONE:

 Foramen magnum

 Occipital condyle

 External occipital protuberance

 Hypoglossal canal

 Superior nuchal line

 TEMPORAL BONE:

 Squamous region

 Tympanic region

 Petrous region

 Mastoid region

 Mandibular fossa

 External auditory (acoustic) meatus

 Internal auditory (acoustic) meatus

 Zygomatic process

 Styloid process

 Mastoid process

 Jugular foramen

 Foramen lacerum

 Stylomastoid foramen

 Carotid canal

 ETHMOID BONE:

 Crista galli

 Cribriform plate

 Perpendicular plate

 Orbital plates

SPHENOID BONE:

 Body

 Sella turcica

 Greater wing

 Lesser wing

 Pterygoid process

 Superior orbital fissure

 Optic foramen

 Foramen ovale

 Foramen rotundum

 Foramen spinosum

 MAXILLA:

 Alveolar margin

 Palatine process

 Frontal process

 Zygomatic process

 Infraorbital foramen

 MANDIBLE:

 Body

 Ramus

 Condyle

 Mandibular angle

 Mandibular notch

 Coronoid process

 Alveolar margin

 ZYGOMATIC BONE

 NASAL BONE

 LACRIMAL BONE

 VOMER

**On the skull, identify the following: In the orbit, identify the following:**

 Coronal suture Superior orbital fissure

 Sagittal suture Inferior orbital fissure

 Lambdoid suture Optic canal (foramen)

 Squamous suture Identify where each of these go:

 Occipitomastoid suture two of them lead back into the cranial cavity

 Anterior cranial fossa while one leads onto the face

 Middle cranial fossa behind the zygomatic arch

 Posterior cranial fossa

 Orbit  **In the nasal cavity, identify the following:**

 Nasal cavity Nasal septum (composed of parts of

 Temporomandibular joint vomer and ethmoid bones)

 Middle nasal concha

 Inferior nasal concha

**On yourself and/or another person, locate the following structures of the skull:**

Orbit

Supraorbital margin

External auditory (acoustic) meatus

External occipital protuberance

Mastoid process

Zygomatic arch

Nasal bone

Body, angle, and ramus of mandible

Temporomandibular joint

**VERTEBRAE**

 The spinal column consists of 33 individual vertebrae. They surround the spinal cord and the nerves which arise from it, and they provide places for muscles to attach. The size and shape of each vertebra depends on where it is located, which muscles and ligaments attach to it, etc. Five of them are fused together to carry the weight of the upper body and transfer this weight to the bones of the lower limb.

**Identify the following VERTEBRAE:**  **On a thoracic or lumbar vertebra, identify the**

 Cervical (7)  **following structures:**

 Atlas Body

 Axis Lamina

 Transverse foramen Pedicle

 Thoracic (12) Transverse process

 Lumbar (5) Spinous process

 Sacrum (5, fused) Superior articular process

 Coccyx (4, fused) Inferior articular process

 Vertebral foramen

 Superior notch

 Inferior notch

 Note how these two notches on adjacent

 vertebrae form an intervertebral foramen

**On yourself and/or another person, locate the following vertebral structures:**

Spinous processes of thoracic and lumbar vertebrae

Border between lumbar vertebrae and sacrum

Sacrum and coccyx

Notice the curvatures of the cervical, thoracic, lumbar, and sacral regions of the vertebral colum

 **PELVIS**

 The bones of the pelvis surround and protect the organs of the pelvic cavity, transmit weight from the vertebrae to the legs, and provide attachment for muscles which move both the legs and the body.

**Identify the following bones of the pelvis and their processes**:

 ILIUM:

 Iliac crest

 Iliac fossa

 Anterior superior iliac spine

 Anterior inferior iliac spine

 Posterior superior iliac spine

 Posterior inferior iliac spine

 Greater sciatic notch

ISCHIUM:

 Ischial ramus

 Ischial tuberosity

 Ischial spine

 Lesser sciatic notch

PUBIS:

 Superior ramus

 Inferior ramus

 Pubic tubercle

**Identify the** Acetabulum

 Pubic symphysis

 Obturator foramen

 Sacroiliac joint

**On yourself and/or another person, locate the following structures of the pelvis:**

 Anterior superior iliac spine

 Pubic symphysis

 Pubic tubercle

Ischial tuberosity

Iliac crest

Sacroiliac joint

**THORAX**

On the articulated skeleton, **Identify** the STERNUM and its: Manubrium

 Body

 Xiphoid process

 Sternal angle

On the articulated skeleton, **Identify** RIBS 1 through 12 on each side, including their attachments

 to vertebrae and sternum.

 **Identify** the costal cartilages.

On an isolated rib, **Identify** its Head, Neck, Tubercle, Angle, and Costal Groove

**On yourself and/or another person, locate the following:**

 Sternum

 Sternal angle

 Xiphoid process

 Angles of ribs

 Costal cartilages

 Follow each rib from its posterior attachment to its anterior attachment

**UPPER LIMB**

 Bones of the upper limb provide attachments for the muscles which move the arm and which attach the upper limb (part of the appendicular skeleton) to the axial skeleton.

**Identify the following bones and their processes:**

 CLAVICLE:

 Medial (sternal) end

 Lateral (acromial) end

 SCAPULA:

 Spine

 Coracoid process

 Acromion process

 Subscapular fossa

 Supraspinous fossa

 Infraspinous fossa

 Glenoid cavity

 HUMERUS:

 Head

 Greater tubercle

 Lesser tubercle

 Intertubercular (bicipital) groove

 Deltoid tuberosity

 Medial epicondyle

 Lateral epicondyle

 Trochlea

RADIUS:

 Head

 Radial tuberosity

 Styloid process

 ULNA:

 Olecranon process

 Coronoid process

 Styloid process

**Identify the following CARPALS:**

 TRAPEZIUM

 TRAPEZOID

 CAPITATE

 HAMATE

 SCAPHOID

 LUNATE

 TRIANGULAR (TRIQUETRAL)

 PISIFORM

**Identify METACARPALS** 1 through 5.

**Identify** the **PHALANGES** for each digit (finger)

 PROXIMAL, MIDDLE, DISTAL

**On yourself and/or another person, locate the following bones and structures:**

Clavicle (entire length)

Acromion process of scapula

Coracoid process of scapula

Spine of scapula

Greater tubercle of humerus

Medial epicondyle of humerus

Lateral epicondyle of humerus

Olecranon process of ulna

Posterior border of ulna (entire length)

Styloid process of radius

Styloid process of ulna

All eight carpals on posterior wrist

All five metacarpals

All fourteen phalanges

**LOWER LIMB**

 Bones of the lower limb provide attachments for the muscles which move the leg and which attach the lower limb (part of the appendicular skeleton) to the axial skeleton.

**Identify the following bones and their processes:** **Identify the following TARSALS**:

 FEMUR: Head CALCANEUS

 Neck TALUS

 Greater & lesser trochanter CUBOID

 Gluteal tuberosity NAVICULAR

 Medial and lateral condyles MEDIAL CUNEIFORM

 Medial and lateral epicondyles INTERMEDIATE CUNEIFORM

 TIBIA: Medial and lateral condyles LATERAL CUNEIFORM

 Tibial tuberosity

 Anterior crest **Identify METATARSALS** 1 through 5:

 Medial malleolus

 FIBULA: Head  **Identify** the **PHALANGES:**

 Anterior crest PROXIMAL, MIDDLE, DISTAL

 Lateral malleolus

 PATELLA

**On yourself and/or another person, locate the following bones and structures:**

Greater trochanter of femur

Medial epicondyle of femur

Lateral epicondyle of femur

Patella

Medial condyle of tibia

Lateral condyle of tibia

Head of fibula

Medial malleolus of tibia

Lateral malleolus of fibula

All seven tarsals on posterior foot

All five metatarsals

All fourteen phalanges