**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 Equally important, our bones serve as a "buffer" in which calcium and other ions can be deposited and withdrawn according to the changing needs of the body, and they are the site of almost all blood cell production.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