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 Equally important, our bones serve as a "buffer" in which calcium and other ions can be deposited and withdrawn according to the changing needs of the body, and they are the site of almost all blood cell production.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
- Typanic 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:
Coronal suture
Sagittal suture
Lambdoid suture
Squamous suture
Occipitomastoid suture
Anterior cranial fossa
Middle cranial fossa
Posterior cranial fossa
Nasal cavity
Orbit
Temporomandibular joint

In the orbit, identify the following:
Superior orbital fissure
Inferior orbital fissure
Optic canal (foramen)
Identify where each of these go:
two of them lead back into the cranial
cavity while one leads onto the face
behind the zygomatic arch

In the nasal cavity, identify the following:
Nasal septum (composed of parts of
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:
Cervical (7)
  Atlas
  Axis
  Transverse foramen
Thoracic (12)
  Lumbar (5)
  Sacrum (5, fused)
  Coccyx (4, fused)

On a thoracic or lumbar vertebra, identify the
following structures:
Body
Lamina
Pedicle
Transverse process
Spinous process
Superior articular process
Inferior articular process
Vertebral foramen
Superior notch
  Note how these two notches on adjacent
Inferior notch 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 column
PELLVIS

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

**RADIUS:**
- Head

**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:

**FEMUR:**
- Head
- Neck
- Greater & lesser trochanter
- Gluteal tuberosity
- Medial and lateral condyles
- Medial and lateral epicondyles

**TIBIA:**
- Medial and lateral condyles
- Tibial tuberosity
- Anterior crest
- Medial malleolus

**FIBULA:**
- Head
- Anterior crest
- Lateral malleolus

**PATELLA**

Identify the following TARSALS:

- CALCANEUS
- TALUS
- CUBOID
- NAVICULAR
- MEDIAL CUNEIFORM
- INTERMEDIATE CUNEIFORM
- LATERAL CUNEIFORM

Identify METATARSALS 1 through 5:

Identify the PHALANGES:

- PROXIMAL, MIDDLE, DISTAL

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