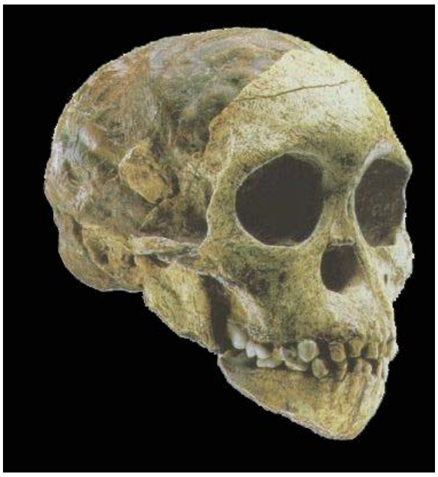


ANAT 2521

BIOLOGICAL ANTHROPOLOGY: PRINCIPLES AND PRACTICES

Laboratory Manual

Term 2, 2022

School of Medical Sciences

Faculty of Medicine & Health

Table of Contents

1. Course schedule

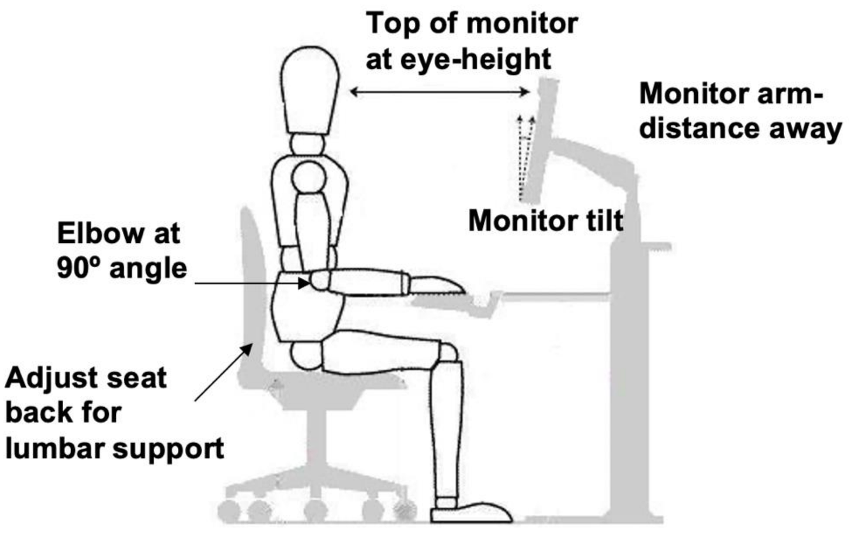
	ACTIVITY	READING	LECTURE	DROP-IN SESSION	LAB
	DAY & TIME	Self-paced	Self-paced	Tuesday 1-2pm	Thursday 2-4pm
Week	MODE OF DELIVERY		MOODLE	TEAMS	IN PERSON Biological Sciences North D26, Level 1, Anat Lab 07
0	23/05-29/05	Compulsory Week 0 activities on Moodle			
1	30/05-05/06	Textbook: Ch 1 Lab Manual: Week 1	Introduction to Biological Anthropology		Osteology
2	06/06-12/06	Textbook Ch 2-5 Lab Manual: Week 2	Evolutionary Theory		Aging & Sexing
3	13/06-19/06	Textbook Ch 14-15 Lab Manual: Week 3	Modern Human Variation		Osteometry
4	20/06-26/06	Textbook Ch 6-7 Lab Manual: Week 4	Living Primates		Primate Comparative Anatomy
5	27/06-03/07	Textbook Ch 8 Lab Manual: Weeks 1-4	Fossil Primates		**Spot Test 1**
6	04/07-10/07	FLEXIWEEK			
7	11/07-17/07	Textbook Ch 9-10 Lab Manual: Week 7	Early Hominins		Early Hominins
8	18/07-24/07	Textbook Ch 11 Lab Manual: Week 8	The Genus *Homo*		The Genus *Homo*
9	25/07-31/07	Textbook Ch 12-13 Lab Manual: Week 9	Emergence of Modern Humans		**Oral Presentations**
10	01/08-05/08	Readings on Moodle Lab Manual: Week 10	Bioarchaeology & Forensic Anthropology		Bioarchaeology & Forensic Anthropology
	06/08-11/08	STUDY PERIOD			
	12/08-25/08	**EXAM PERIOD: Spot Test 2 & Final Theory Exam**			

2. Student Risk Assessment

Medicine and Science Teaching Laboratory **Student Risk Assessment**	Practical Classes (Dry and Computer) for Medicine and Science Students

Hazards		
Ergonomics	Musculoskeletal pain	• Correct workstation set-up • Check electrical equipment is in good condition before use
Electrical	Electrical shock/Fire	• All portable electrical equipment tested and tagged • Disinfectants and wipes available for use before and after the practical
Biological	Infection	

Workstation set-up



Personal Protective Equipment

Face masks may be required. Please following the instructions provided at the time of entry.

Emergency Procedures

In the event of an alarm, follow the instructions of the academic in charge. The initial sound (beep) is advising you to prepare for evacuation. During this time pack up your personal belongings. The second sound (whoop) gives instruction to leave. The assembly point is on the lawn in front of the Chancellery. In the event of an injury inform the academic in charge (and/or lab staff). First aider and fire warden contact details are on display by the lifts on the floor and in each room. There is a wall mounted First Aid Kit located at the end of the G06 or 08A Laboratory.

Clean up and waste disposal
No apparatus or chemicals used in these rooms.

I have read and understand the safety requirements for this practical class, and I will observe these requirements. **Signature**: …………………………………………………… **Date**: …………………………… **Student number**: ....

ANAT-SRA-Med&SciStudent relates to RA-MED-06. Date for review: 01/02/2023

Medicine and Science Teaching Laboratory

Student Risk Assessment

Anatomy Practical Classes for Medical and Science Students

D26 Ian Jacobs Building Level 1 LAB07 & 08A

Hazards	Risks	Controls
Chemical Formaldehyde Methylated spirits 2-phenoxyethanol	Corrosive Flammable Irritant	• Low concentrations of chemicals used • Adequate air changes and ventilation are provided • Safety Data Sheets for chemicals available
Physical Cold temperature Heavy and sharp models (e.g. bone/plastic)	Cold Penetrating wound Foot injury	• Ensure appropriate immunisation is current • Always wear a laboratory coat • Always wear enclosed shoes with full coverage of the dorsum of the foot • Wear protective eyewear or glasses
Biological Fungi Bacteria (tetanus) Hepatitis B and C	Infection	• Wear a face mask (if required) • Wear disposable gloves when handling wet specimens and do not cross-contaminate models or bones with wet specimens • Do handle food or drinks • Do not place anything into your mouth • Use disinfectant provided for cleaning models and surfaces • Use the provided hand sanitisers regularly • Wash hands with soap and dry thoroughly before leaving

Personal Protective Equipment required

Emergency Procedures

In the event of an alarm, follow the instructions of the academic in charge. The initial sound (beep) is advising you to prepare for evacuation. During this time pack up your personal belongings. The second sound (whoop) gives instruction to leave. The assembly point is on the lawn in front of the Chancellery. In the event of an injury inform the academic in charge (and/or lab staff). First aider and fire warden contact details are on display by the lifts on the floor and in each room. There is a wall mounted First Aid Kit located at the end of the G06 or 08A Laboratory.

Clean up and waste disposal

- Cover wet specimens with the towels provided. Make sure that towels do not hang over the edge of the table as this may result in fluid dripping onto the floor. Fluids on the floor are a major safety hazard and should be reported to staff immediately.
- Replace stools under the tables (if applicable).
- Remove your gloves and dispose in the biowaste bins provided.
- Wash your hands thoroughly with the soap provided.
- Remove your laboratory coat as you leave the room.

Ethics Approval

This type of practical has been previously considered and approved by the UNSW Human Research Ethics Advisory Panel (HC180115).

Declaration

I have read and understand the safety requirements for this practical class, and I will observe these requirements.

Signature:……………………………………………………… **Date**:……………………………

Student number: ....

ANAT-SRA-Med&SciStudent relates to RA-MED-06. Date for review: 01/02/2023

3. Ethical behaviour and human remains

The learning activities in this course is centred around the study of human anatomical specimens that have been preserved and prepared from people who have donated their bodies to UNSW via a Bequeathal Program. Their donation makes it possible for you and your peers to study the human body. This is an extraordinary, generous act of these donors and their families and is a special priviledge. Treating these remains with the utmost care and respect is mandatory, and our responsibility. It is good ethical practice and is mandated by NSW Law. The University operates the Bequeathal Program under the Code of Practice noted below, which all students are required to adhere to.

UNSW Department of Anatomy Code of Practice:

The University and Department of Anatomy recognises the magnitude of the contribution made by those who donate their bodies for the teaching of anatomy. We are committed to treating the human remains entrusted to our care with the utmost respect and professionalism. In keeping with this commitment, the University requires its employees and students to uphold all legal, public health, and ethical standards and guidelines associated with the handling of human bodies and human tissue samples.

Any activity which undermines its ability to meet UNSW's legislative obligations, or which devalues the contribution made by those who donate their bodies for the purposes of the teaching of anatomy to students will be in breach of this policy and subject to further action.

The Department of Anatomy hosts a thanksgiving service to commemorate those people who donated their bodies to enable our students to study anatomy. Families of donors are invited to attend this special ceremony. Staff and students participate in this event through readings of poetry, music and song, and in the laying of flowers as the name of each donor is read. If you would like to participate in this ceremony, please record your interest by emailing our Bequethal Administrator (bequethal@unsw.edu.au)

Week 1 Practical: Osteology

1. LEARNING OBJECTIVES

Identify, classify and orientate the bones of the appendicular and axial skeleton.

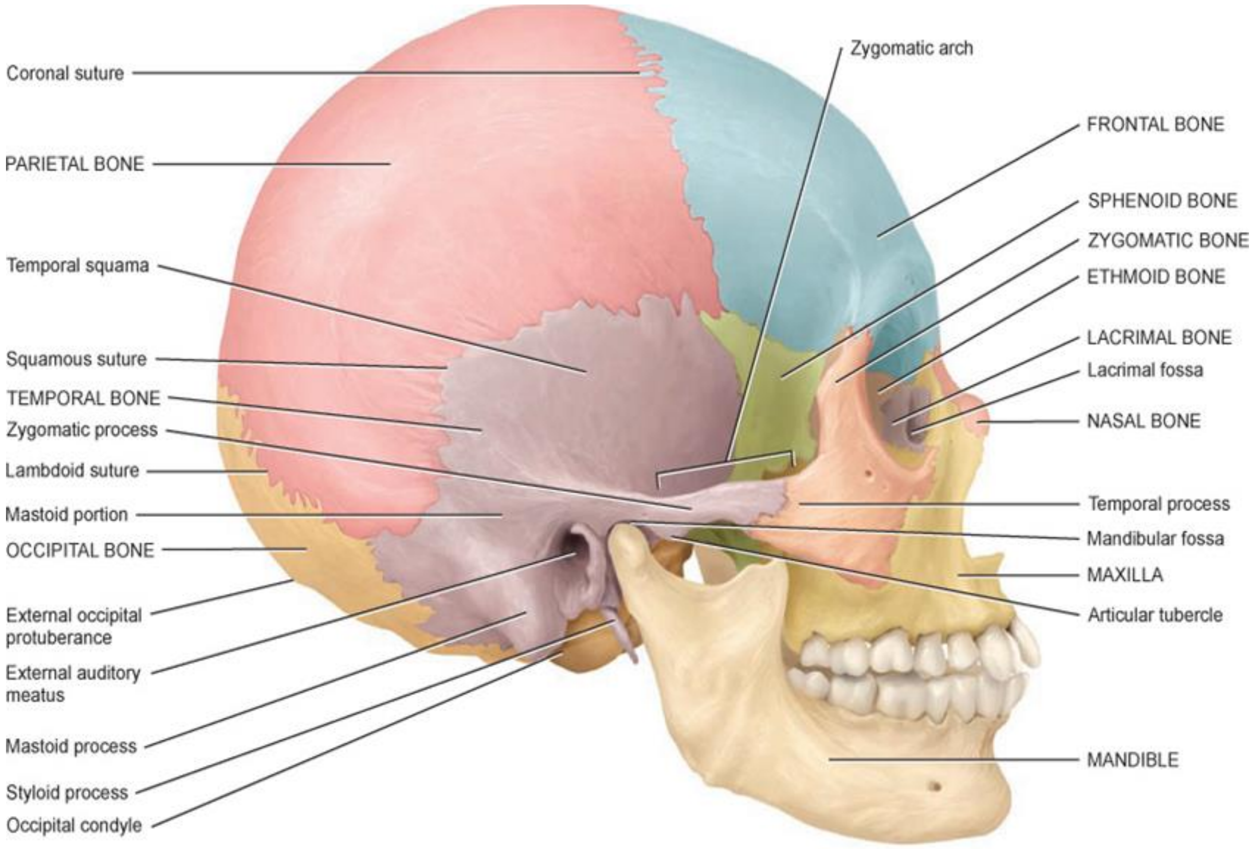
Identify and classify human teeth and apply the dental formula.

ACTIVITIES

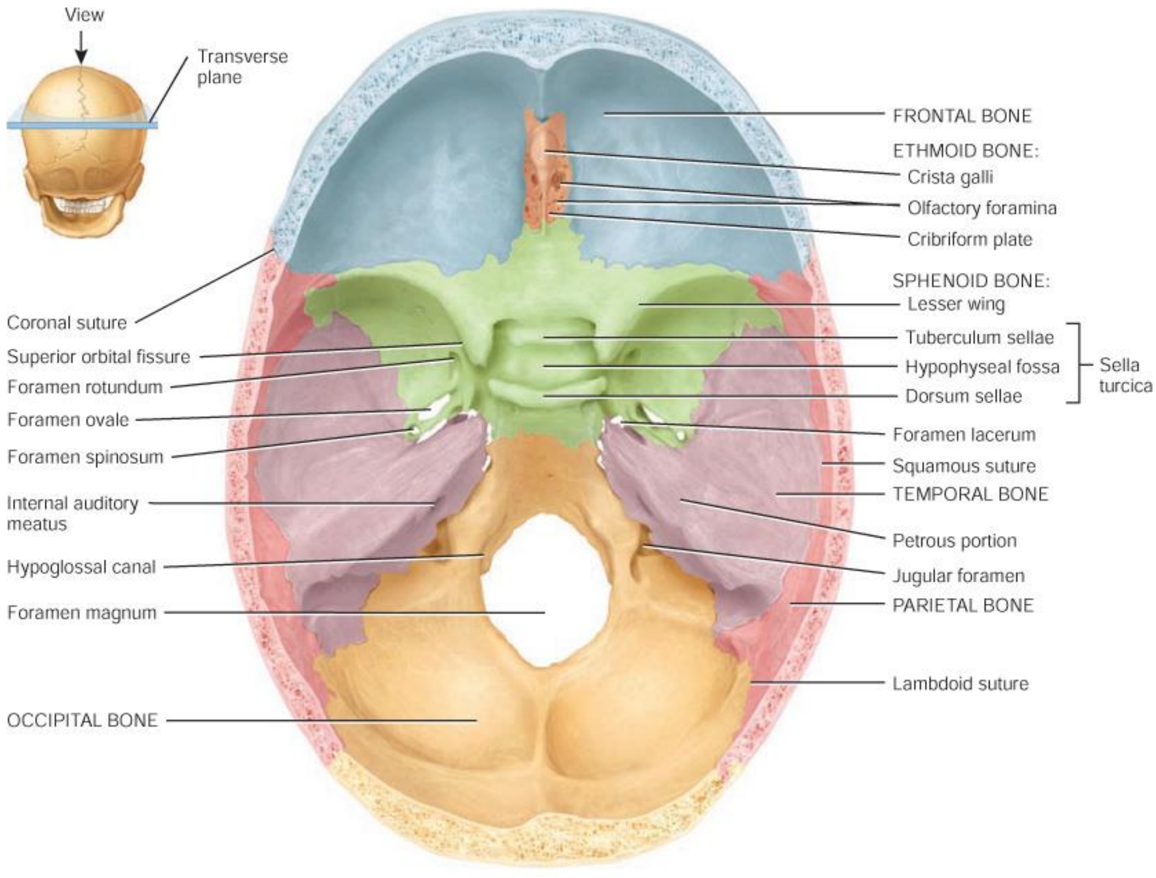
1. Axial skeleton: bone identification and orientation

1.1. Skull and Teeth

Identify the bones and their features represented in the images below on the skulls at your station: facial (nasal, maxillae, zygomatic, mandible, lacrimal, palatine, inferior nasal concha, vomer) and cranial (frontal, parietal, temporal, occipital, sphenoid, ethmoid).

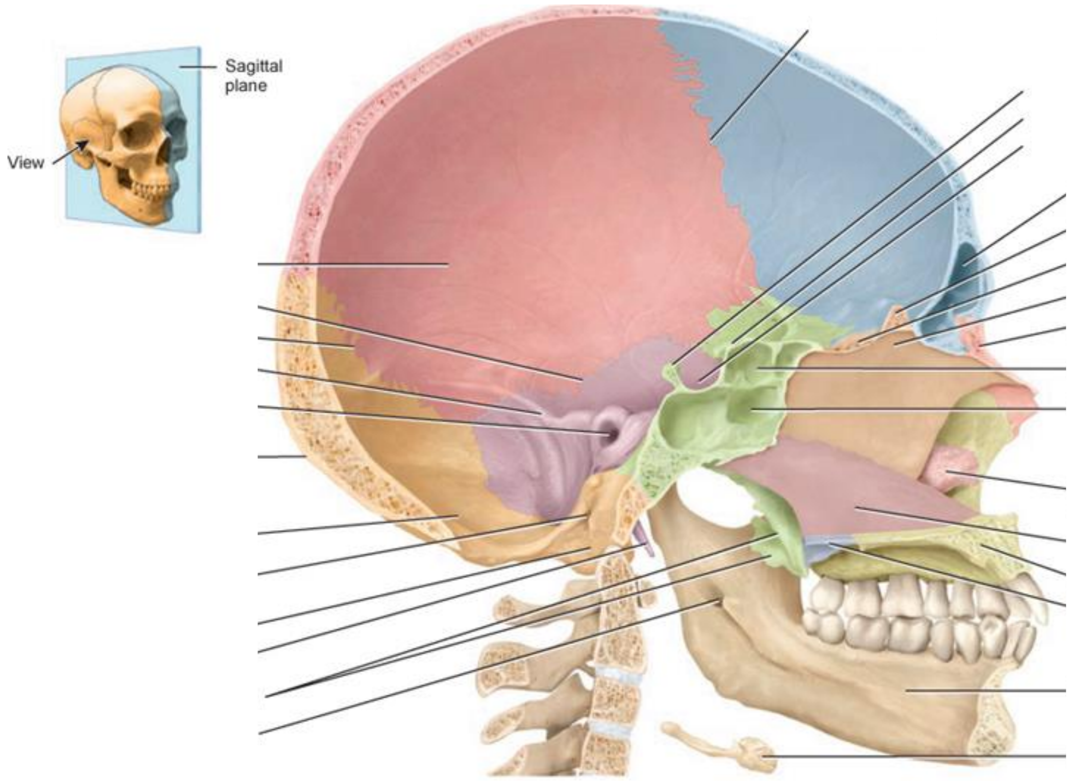


Right lateral view



(a) Superior view of sphenoid bone in floor of cranium

Identify the bones and sutures in the image below.



Medial view of sagittal section

Examine the sphenoid bone. Looking at various angles, list at least four other bones that articulate with the sphenoid.

Using the dental formula below identify all the teeth in the skulls at your station:

Human secondary (permanent) dentition:

(I:C:P:M = 2:1:2:3) x 4

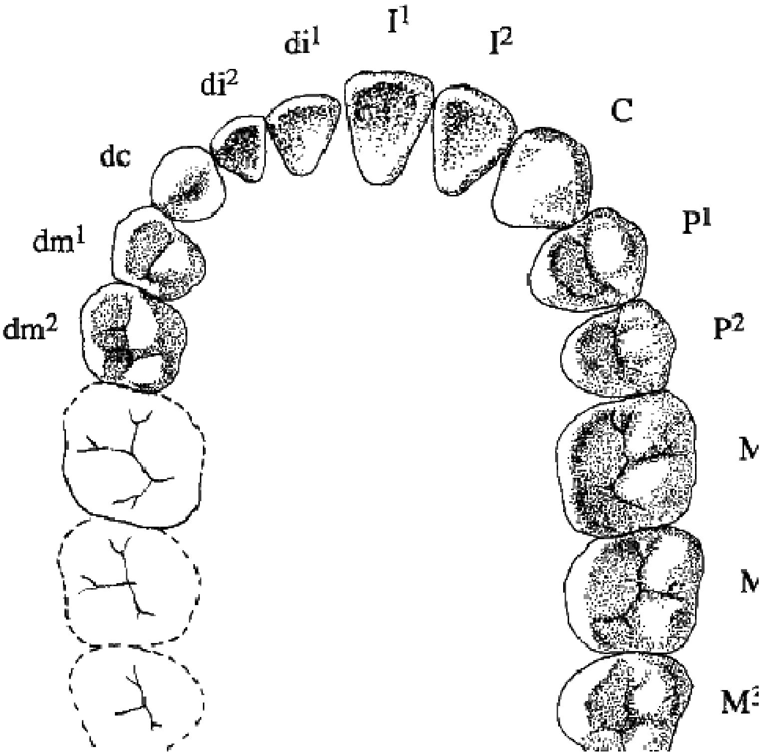
Total: 32

Human primary (deciduous) dentition:

(I:C:P:M = 2:1:0:2) x 4

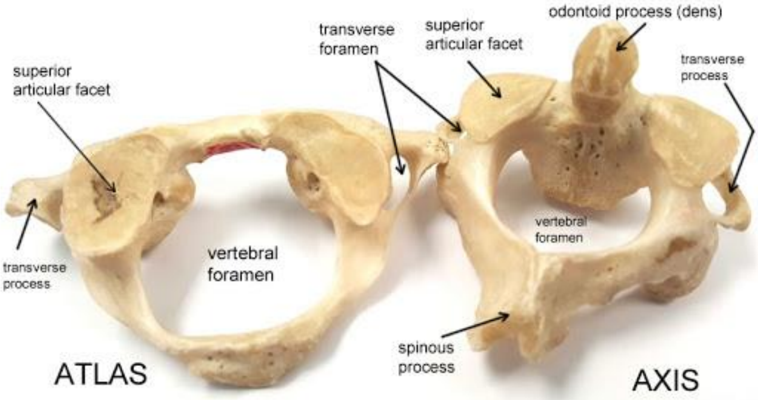
Total: 20

I: incisor; C: canine; P: premolar; M: molar

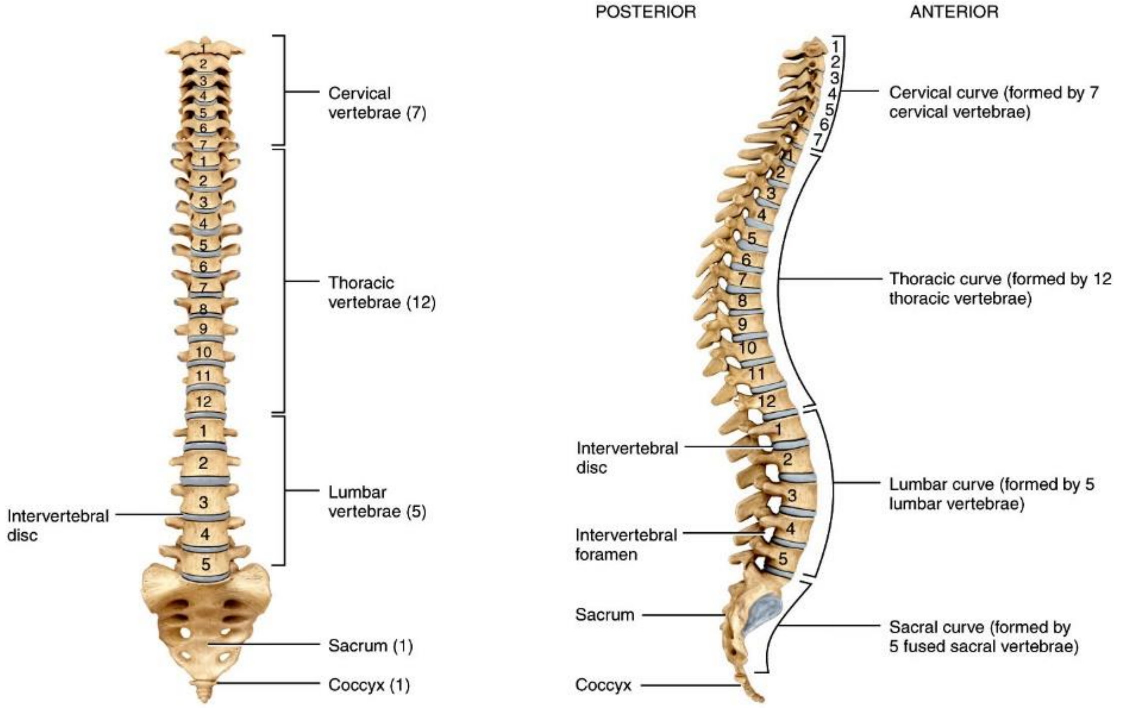


1.2. Vertebrae and Vertebral Column

Identify the atlas and the axis.



Vertebral column



(a) Anterior view showing regions of the vertebral column

(b) Right lateral view showing four normal curves

Identify the main bony features of the typical vertebrae (body, arch and the processes: spinous, transverse and superior and inferior articular) and the region of the spinal column to which the vertebrae belong

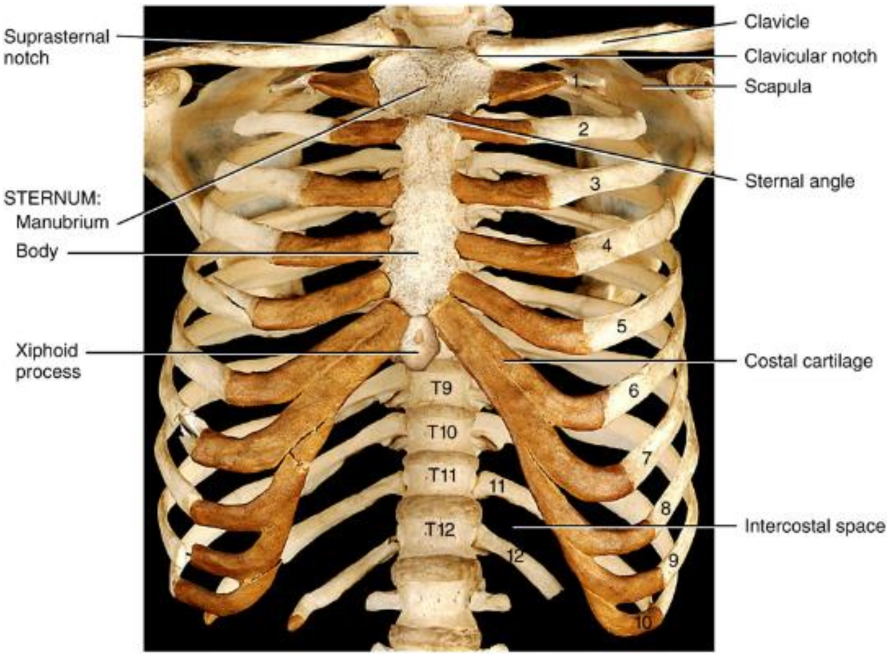
TABLE 7.4

Comparison of Major Structural Features of Cervical, Thoracic, and Lumbar Vertebrae

CHARACTERISTIC	CERVICAL	THORACIC	LUMBAR
Overall structure			
Size	Small	Larger	Largest
Foramina	One vertebral and two transverse	One vertebral	One vertebral
Spinous processes	Slender and often bifid (C2–C6)	Long and fairly thick (most project inferiorly)	Short and blunt (project posteriorly rather than inferiorly)
Transverse processes	Small	Fairly large	Large and blunt
Articular facets for ribs	Absent	Present	Absent
Direction of articular facets			
Superior	Posterosuperior	Posterolateral	Medial
Inferior	Anteroinferior	Anteromedial	Lateral
Size of intervertebral discs	Thick relative to size of vertebral bodies	Thin relative to vertebral bodies	Massive

1.3 Ribs and Sternum

Identify the different types of ribs and the parts of the sternum.



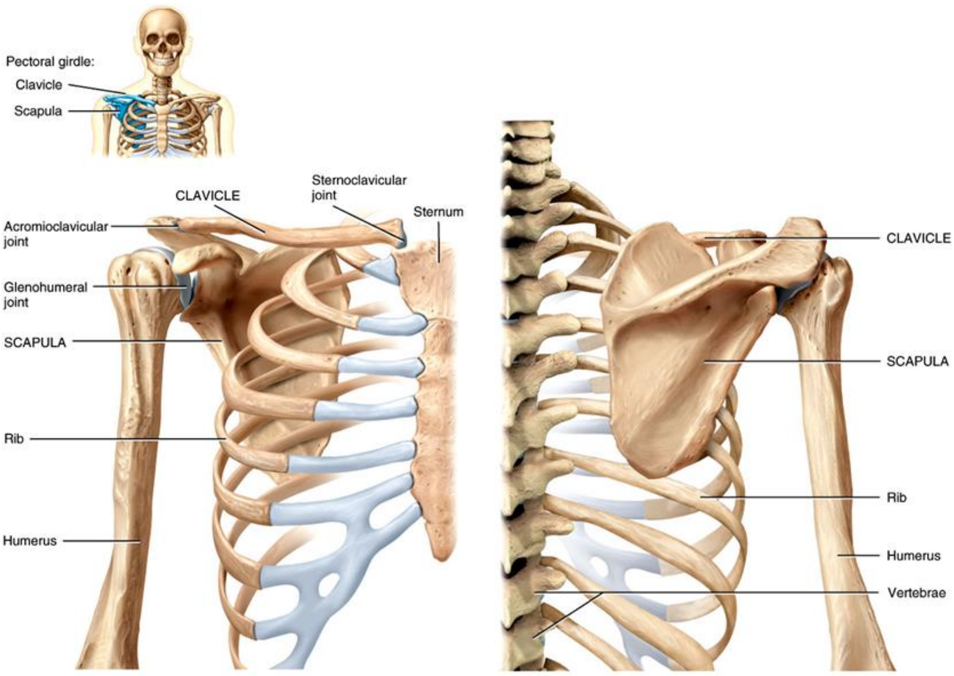
2. Appendicular Skeleton

2.1. Bones of the Upper Limb

2.1.1. Shoulder (pectoral) girdle

Identify the bones of the shoulder girdle (on the skeleton and individually): clavicle and scapula.

Shoulder girdle



(a) Anterior view of pectoral girdle (b) Posterior view of pectoral girdle

Figure 08.01ab Tortora - PHA 11/e

Identify the main bony features of the scapula: angles, borders, glenoid fossa, spine, acromion and coracoid process. Use these features to side the scapula in your station (establish to which side of the body it belongs).

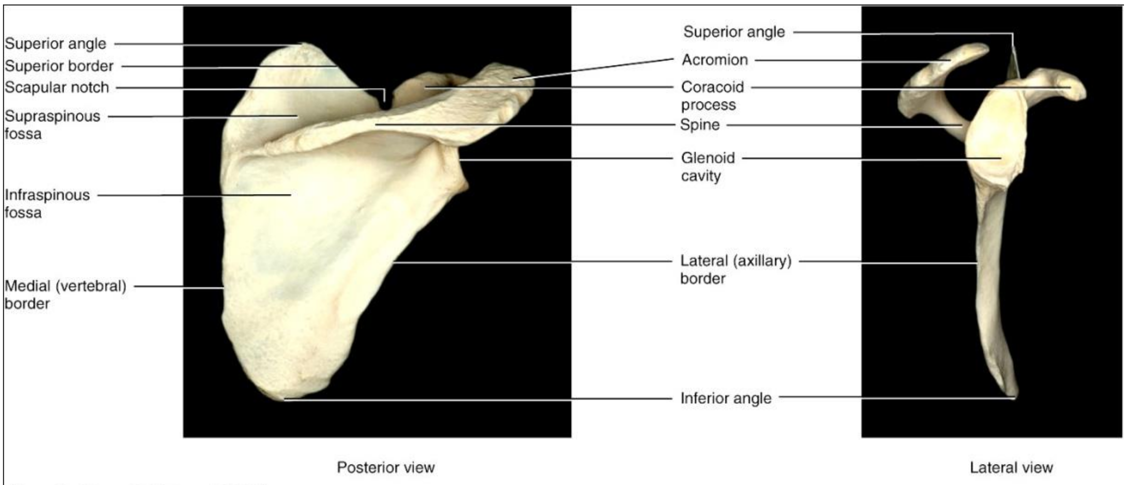
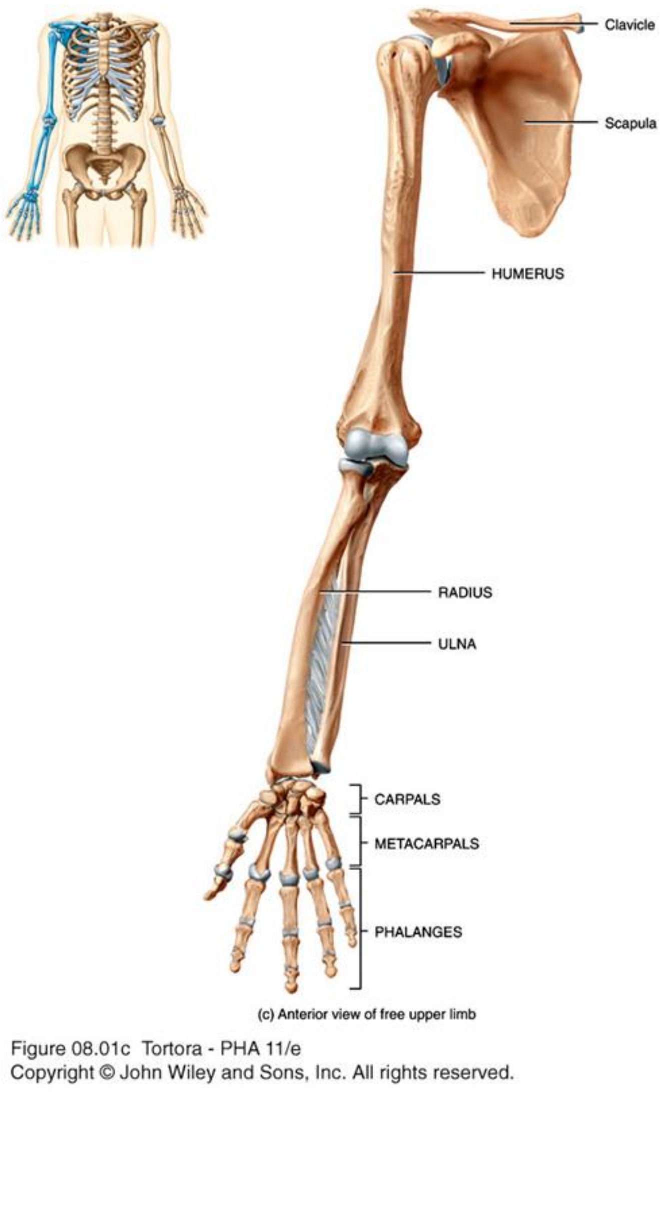


Figure 08.03bc part 2 Tortora - PHA 11/e

2.1.2. Free upper limb (extremity)

Identify the bones and groups of bones making the free upper limb (on the skeleton and individually): humerus, radius, ulna, carpals (8 bones), metacarpals (5) and phalanges (14).



(c) Anterior view of free upper limb

Figure 08.01c Tortora - PHA 11/e

Identify the main features of the humerus: head, anatomical and surgical necks, greater and lesser tubercles, medial and lateral epicondyles, trochlea and capitulum. Side the humerus in your station.

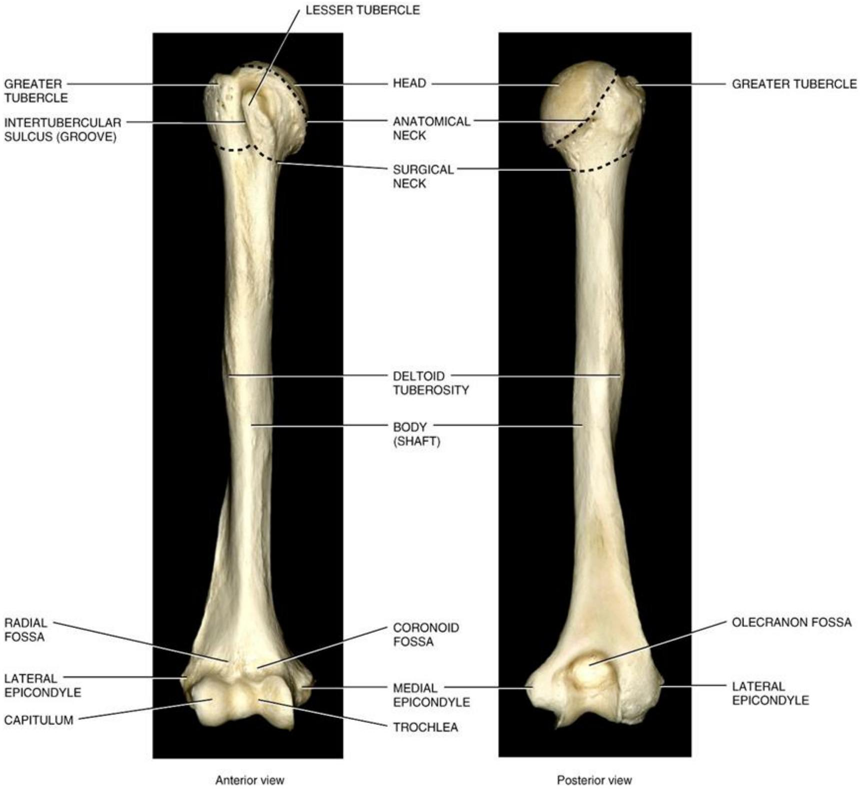


Figure 08.04 part 2 Tortora - PHA 11/e

Identify the main bony features of the ulna (olecranon, coronoid process, head, styloid process) and radius (head, neck, styloid process). Side the ulna and radius in your station.

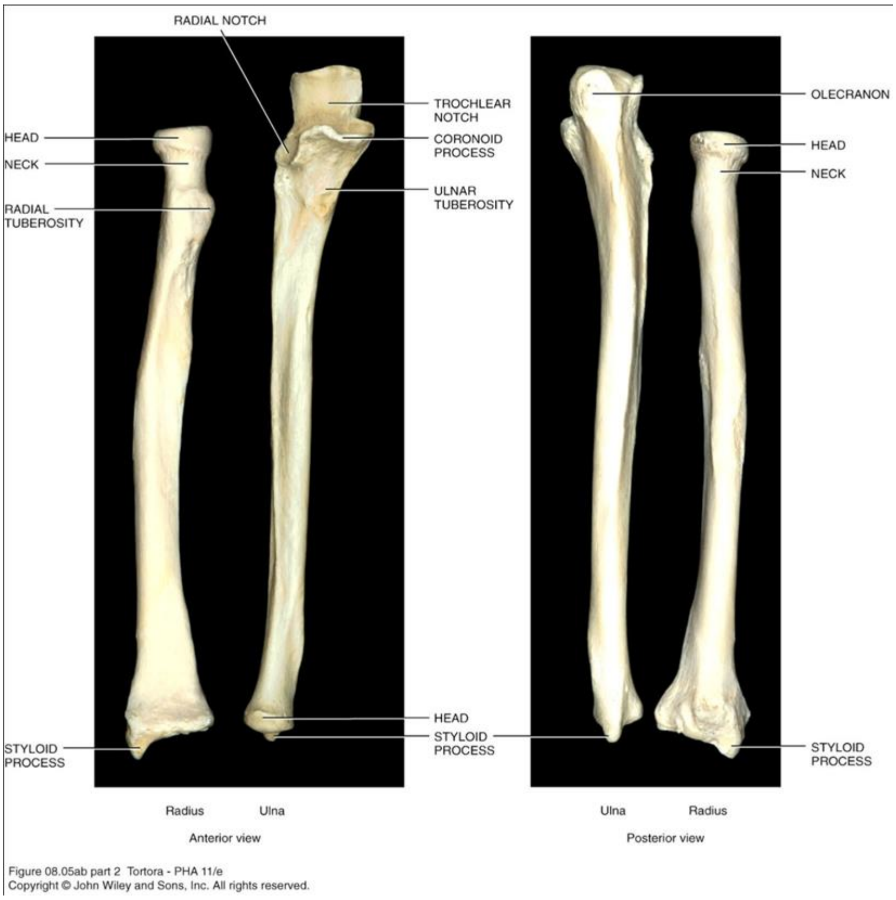
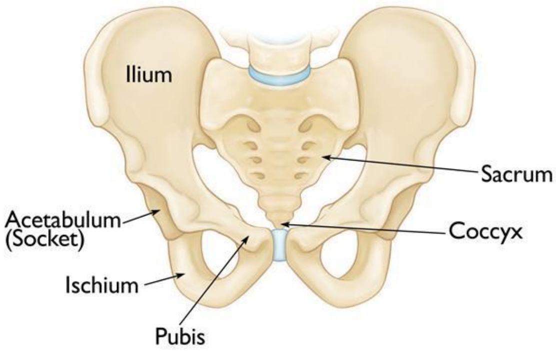


Figure 08.05ab part 2 Tortora - PHA 11/e

2.2. Bones of the Lower Limb

2.2.1. Pelvic girdle.

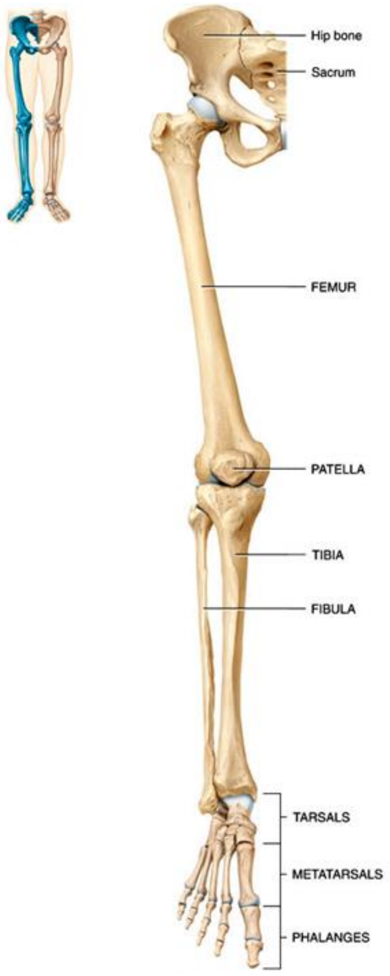
Identify the pelvic bone and the three parts that form it. Identify the obturator foramen, greater and lesser sciatic notches, ischiopubic ramus, iliac crest, gluteal surface, ischial tuberosity, pubic tubercle, pubic symphysial surface and the acetabulum. Side the pelvic bones at your station. Name all bones forming the bony pelvis.



2.2.2. Free lower limb (extremity)

Compare the shoulder and pelvic girdles. What are the main differences between the two girdles?

Identify the bones and group of bones of the free lower limb: femur, tibia, tarsals (7), metatarsals (5), phalanges (14).



(b) Anterior view of free lower limb

Figure 08.07b Tortora - PHA 11/e

Identify the main features of the femur: head, neck, greater and lesser trochanters. Medial and lateral condyles and epicondyles. Side the femur in your station. Why is the shaft of the femur curved?

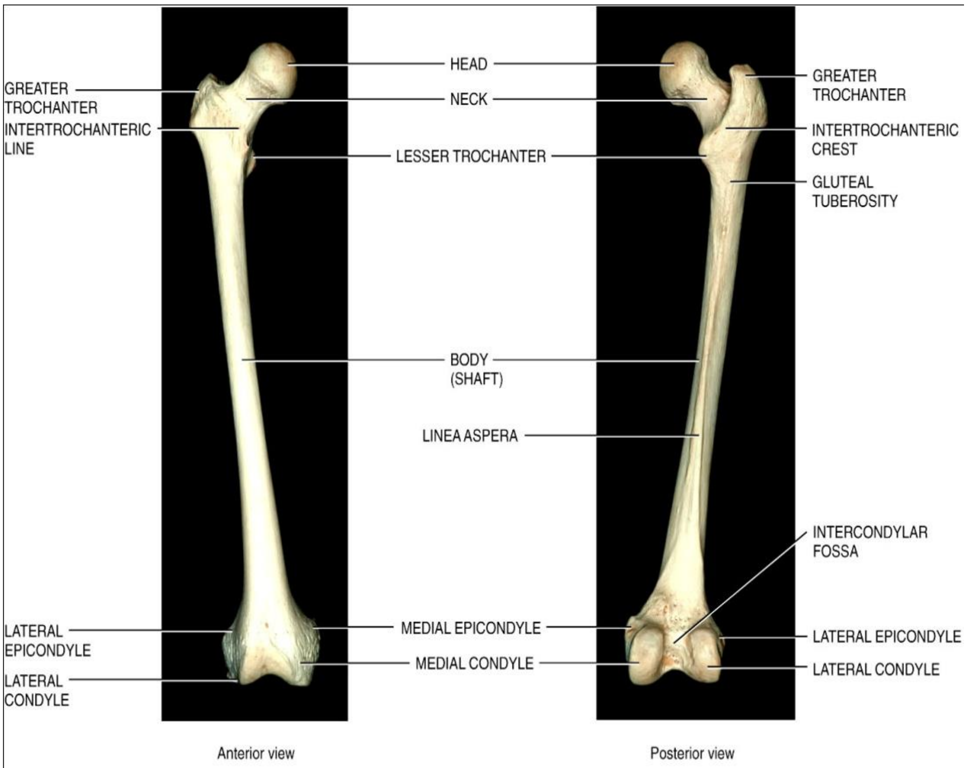


Figure 08.10ab part 2 Tortora - PHA 11/e

Identify the main body features of the tibia (medial and lateral condyle, tibial tuberosity, medial malleolus), and fibula (head lateral malleolus). Side the tibia and fibula on your table.

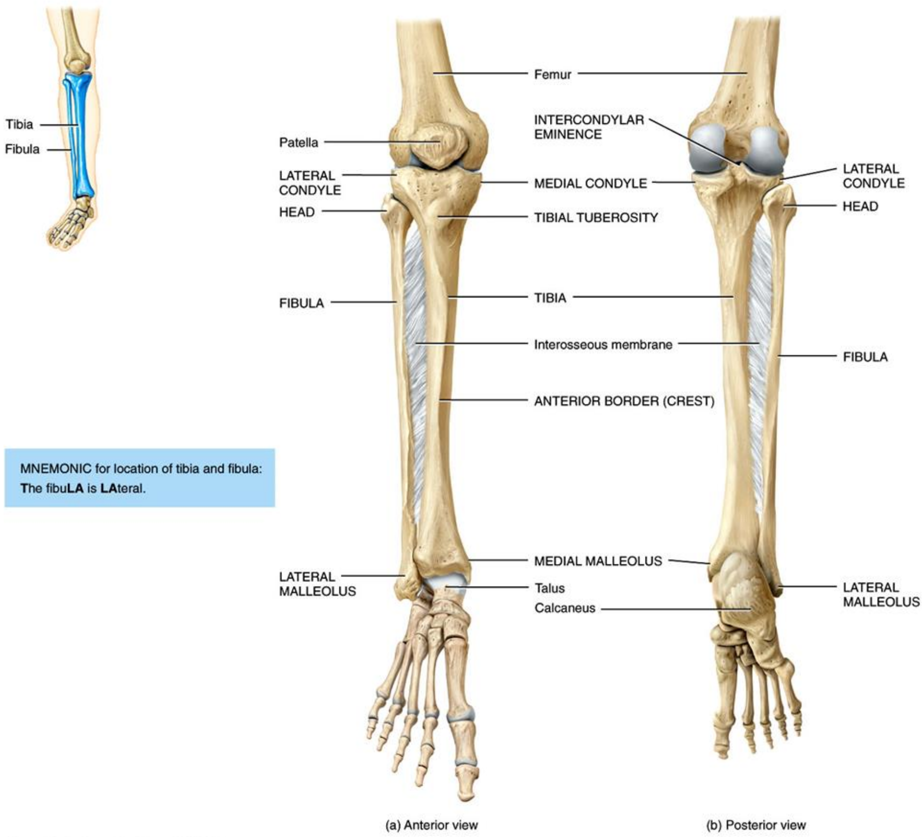


Figure 08.11ab part 1 Tortora - PHA 11/e

Week 2 Practical: Aging & Sexing

2. LEARNING OBJECTIVES

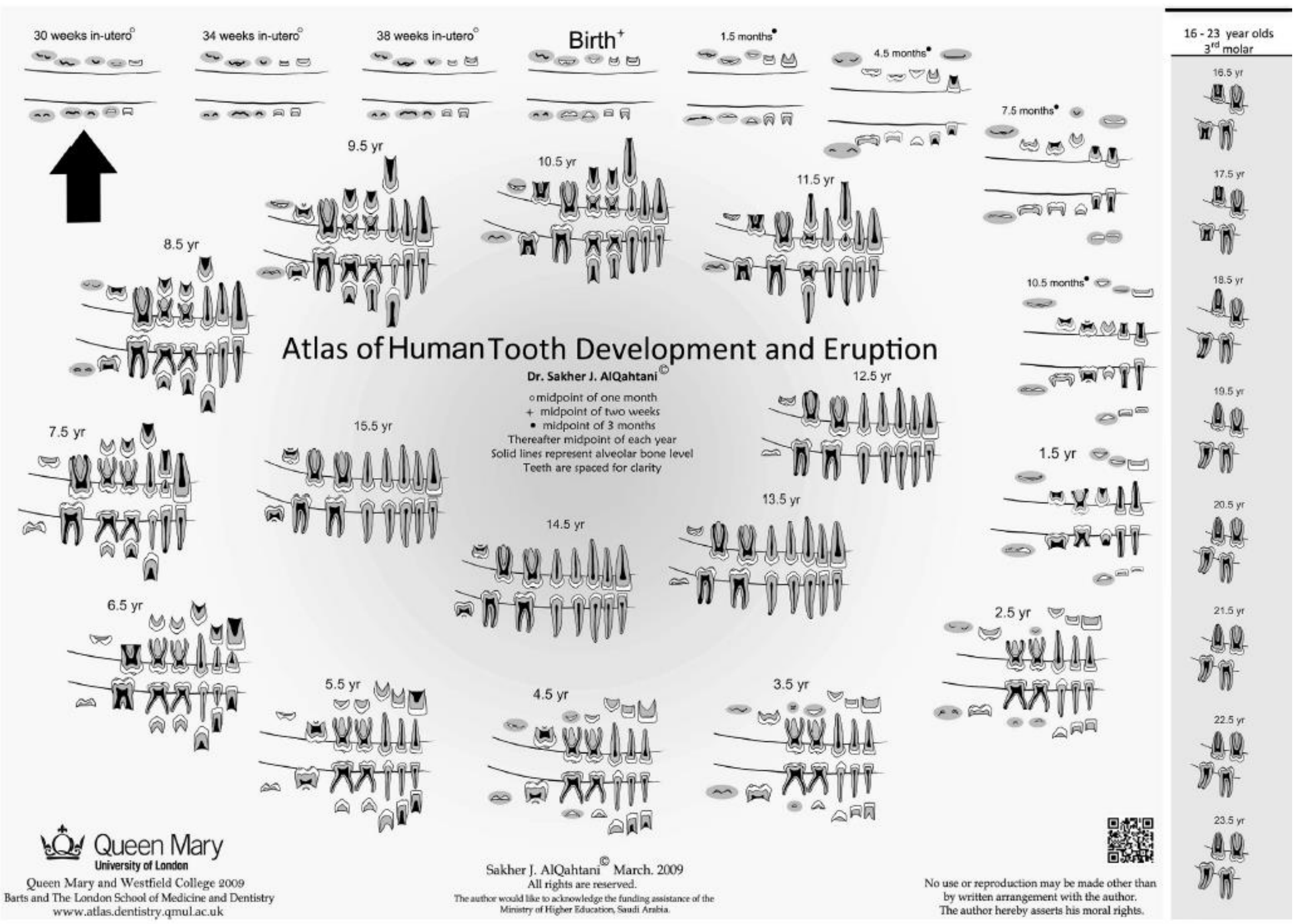
Understand how age and sex are determined in individuals from skeletal remains.

ACTIVITIES

1. Age Estimation in Juveniles

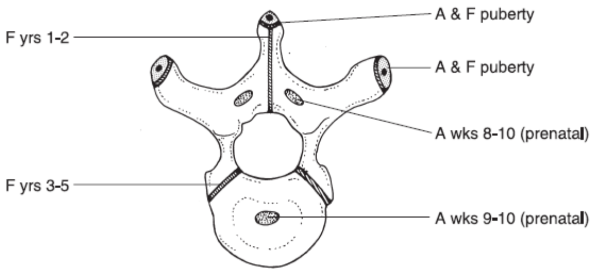
1.1. *Age Estimation in Juveniles: Dentition*

The development of the dentition is a continuous process that extends from embryonic to early adult life, terminating with the eruption of the third molars at around 18–20 years. By birth, all the teeth of the deciduous dentition and the first permanent molars have started to mineralize. By the age of about 3 years the deciduous dentition has emerged into the mouth and completed root formation. During the first year, the permanent first molar and anterior teeth begin formation and between the ages of 2 and 4 years, mineralization in the premolars and second molars is initiated. The third molars commence formation between 6 and 12 years of age. The emergence of all the permanent teeth, except the third molars, takes place in two stages, between the ages of about 6 and 8 years and again between 10 and 12 years, separated by two relatively inactive periods.

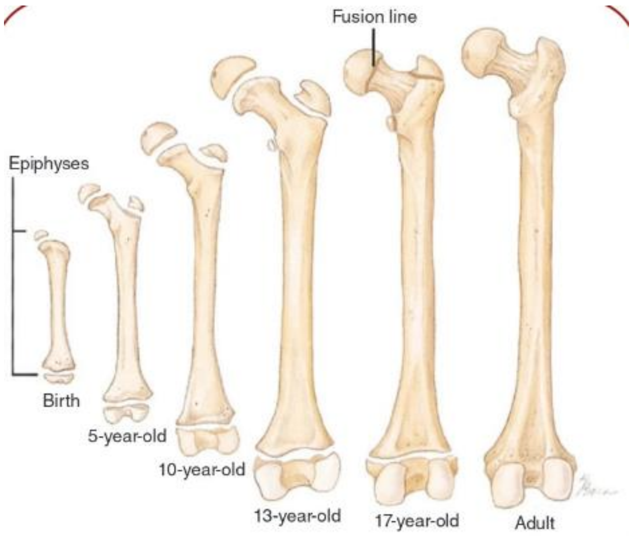


1.2. *Age Estimation in Juveniles: Skeleton*

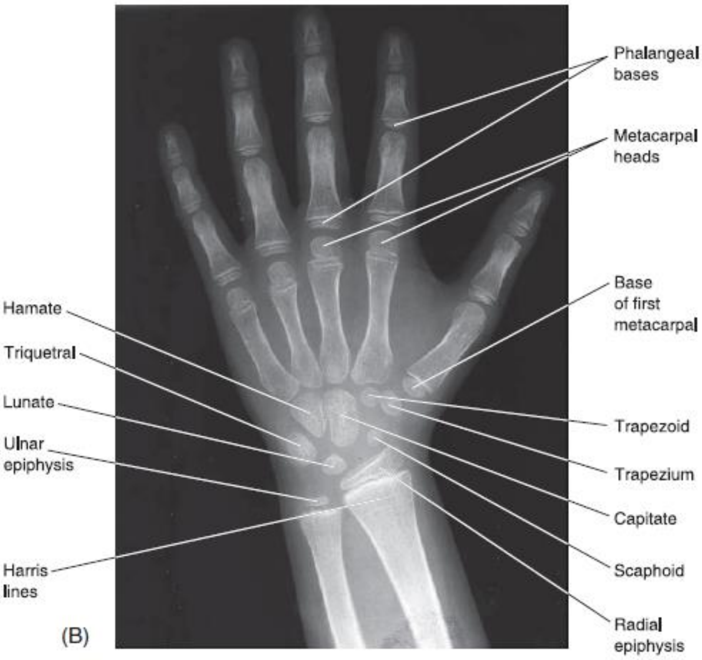
Identify the main parts of a developing vertebra and the ages at which they fuse.

 Appearance (A) and fusion (F) times of typical thoracic vertebrae.	 A typical thoracic vertebra from a child of approximately 1.5 years.

Identify the main parts of a developing femur and the ages at which they fuse.



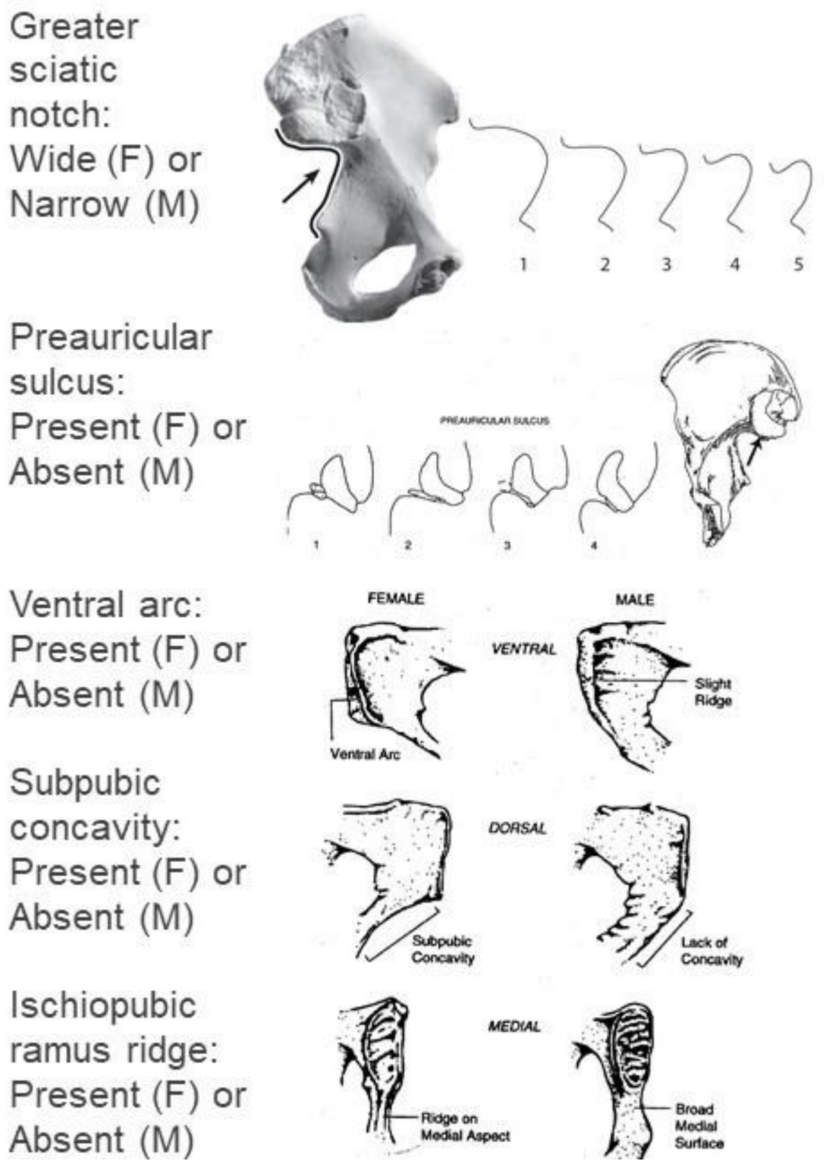
Examine the radiographic appearance of the hand and wrist from a child of approximately 7 years.



2. ***Sex Determination in Adults***

2.1. *Sex Determination in Adults: Pelvis*

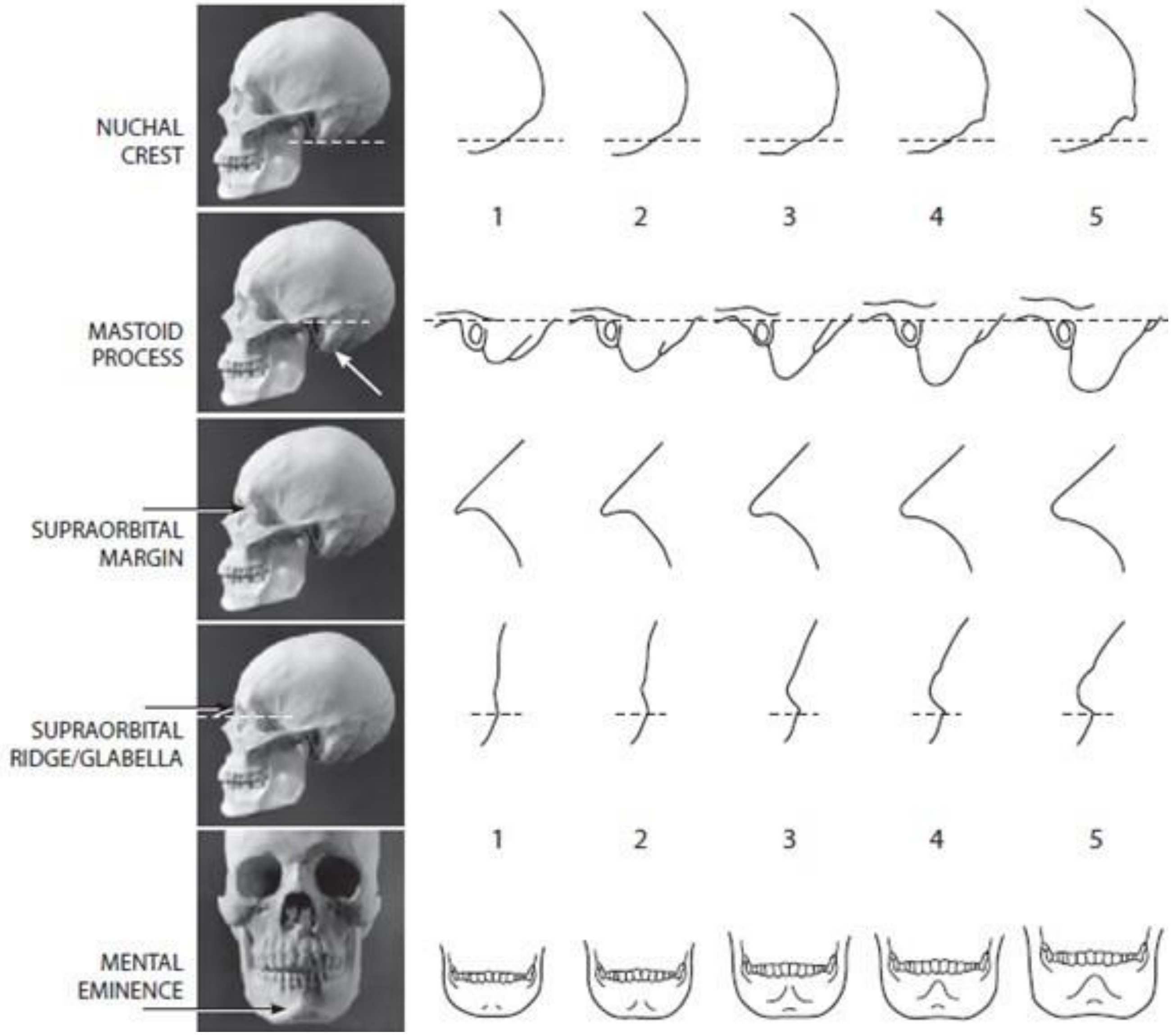
Examine the ossa coxae available in the laboratory. After examining them carefully, fill in the table below. What is the sex of each specimen? Note: for the purposes of this course, ‘male’ and ‘female’ refer to sex categories assigned at birth.



Os coxae	Side	Score (F or M) for individual traits and overall					
		GSN	PS	VA	SC	IRR	Overall
1							
2							
3							
4							
5							

2.2. *Sex Determination in Adults: Skull*

Examine the skulls available in the laboratory. After examining them carefully, fill in the table below. What is the sex of each individual?

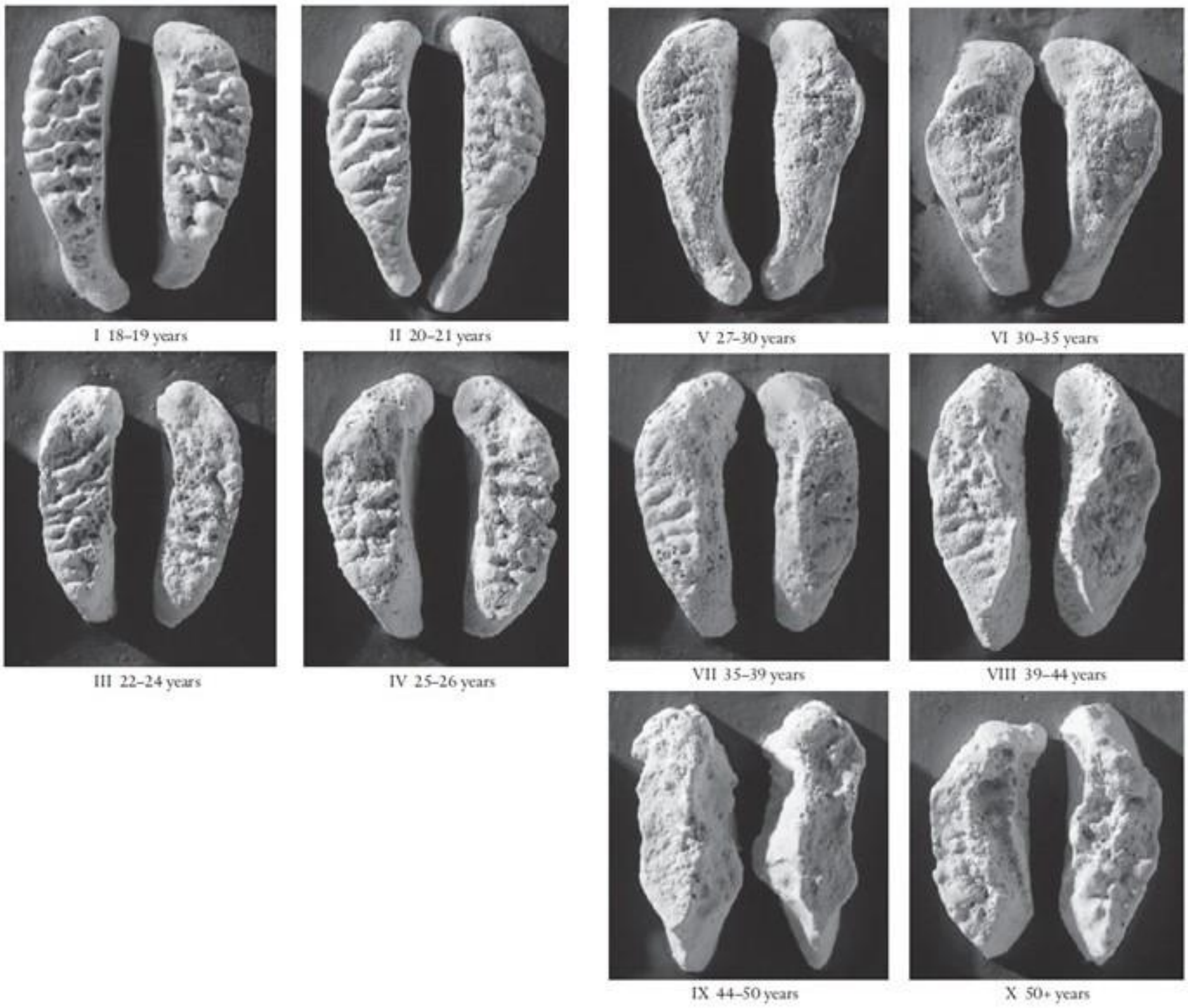


Skull	Score 1 (F) to 5 (M) for individual traits and overall					
	NC	MP	SOM	GLA	ME	Overall
1						
2						
3						
4						
5						

3. Age Estimation in Adults

3.1. *Age Estimation in Adults: Pubic Symphysis*

Examine the pubic symphyseal surfaces of the ossa coxae available in the laboratory. After examining them carefully, fill in the table below. What is the age of each specimen?



Os coxae	Side	Pubic Symphysis Phase (I-X)	Age-at-death (years)
1			
2			
3			
4			
5			

3.2. *Age Estimation in Adults: Auricular Surface*

Examine the auricular surfaces of the ossa coxae available in the laboratory. After examining them carefully, fill in the table below. What is the age of each specimen?

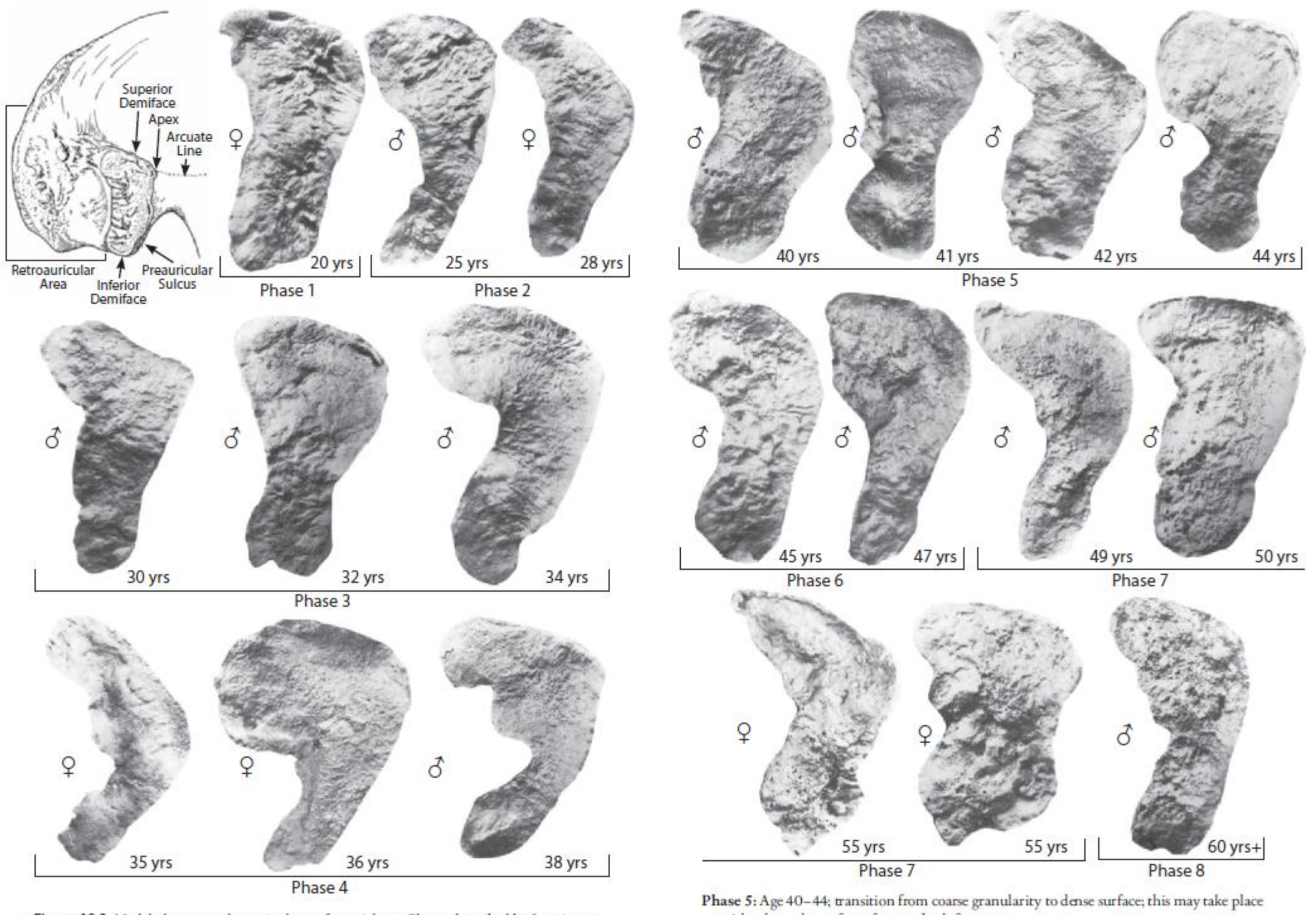


Figure 19.9 Modal changes to the auricular surface with age. Phases described by Lovejoy *et al.* (1985b) as follows:
Phase 1: Age 20–24; billowing and very fine granularity
Phase 2: Age 25–29; reduction of billowing but retention of youthful appearance
Phase 3: Age 30–34; general loss of billowing, replacement by striae, coarsening of granularity
Phase 4: Age 35–39; uniform coarse granularity
Phase 5: Age 40–44; transition from coarse granularity to dense surface; this may take place over islands on the surface of one or both faces
Phase 6: Age 45–49; completion of densification with complete loss of granularity
Phase 7: Age 50–59; dense irregular surface of rugged topography and moderate to marked activity in periauricular areas
Phase 8: Age 60+; breakdown with marginal lipping, microporosity, increased irregularity, and marked activity in periauricular areas

Os coxae	Side	Auricular Surface Phase (1-8)	Age-at-death (years)
1			
2			
3			
4			
5			

3.3. *Age Estimation in Adults: Rib Sternal End*

Examine the sternal ends of the ribs available in the laboratory. After examining them carefully, fill in the table below. What is the age of each specimen?

CHILD (YOUNGER THAN MID-TEENS)

The rib end begins as a fairly flat surface. The edges are smoothly rounded and the surface is only slightly undulating (Stage 0).


stage 0

TEENAGER+ (MID-TEENS TO EARLY TWENTIES)

The edges are sharper and have a scalloped appearance. The inner surface is beginning to look V-shaped (Stage 1–2).


stage 1


stage 2

YOUNG ADULT (MID-TWENTIES TO EARLY THIRTIES)

The edges are less regular and the centers project further than the superior and inferior edges. The V is deepening (Stage 3–4).


stage 3


stage 4

OLDER ADULT (AGE MID-THIRTIES TO MID-FIFTIES)

The superior and inferior edges have grown to the length of the centers. The V has expanded into a cup-shaped center (Stage 5–6).


stage 5


stage 6

ELDERLY ADULT (OLDER THAN MID-FIFTIES)

The edges are elongated, ragged, and sometimes have a crab-claw appearance. The center is porous and irregular (Stage 7–8).

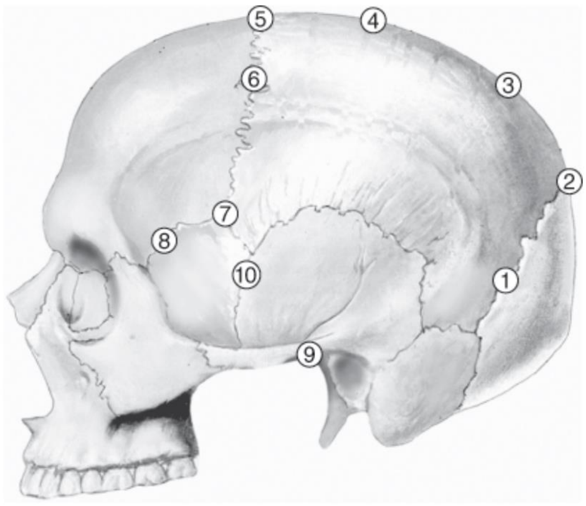

stage 7


stage 8

Rib	Side	Stage (1-8)	Age-at-death (years)
1			
2			
3			
4			
5			

3.4. *Age Estimation in Adults: Cranial Suture Fusion and Dental Attrition*

Examine suture fusion in the crania available in the laboratory. After examining them carefully, fill in the table below. Score 1cm length of suture at each suture site. In the image on the left, A) score 0 = Fully open; B) score 1 = Partially fused; C) score 2 = Mostly fused; D) score 3 = Fully fused. What is the age of each individual? Now score dental attrition (0-4, none-heavy). Do your suture scores correlate with your dental attrition scores?



Total score	Mean age	Age range
1-2	31	19-44
3-6	35	23-45
7-11	39	28-44
12-15	45	31-65
16-18	49	35-60
19-20	52	34-63
21		43+

Skull	Score stage of fusion (0-3) for each suture site.					Total score	Mean age	Score dental attrition for each skull (0-4, none-heavy)
	1	2	3	4	5			
1								
2								
3								
4								
5								

Week 3 Practical: Osteometry

3. LEARNING OBJECTIVES

Identify the main osteometric points of the human skull and postcranial skeleton. Apply knowledge of osteometric points to calculate the principal indices of the skull and postcranial skeleton.

ACTIVITIES

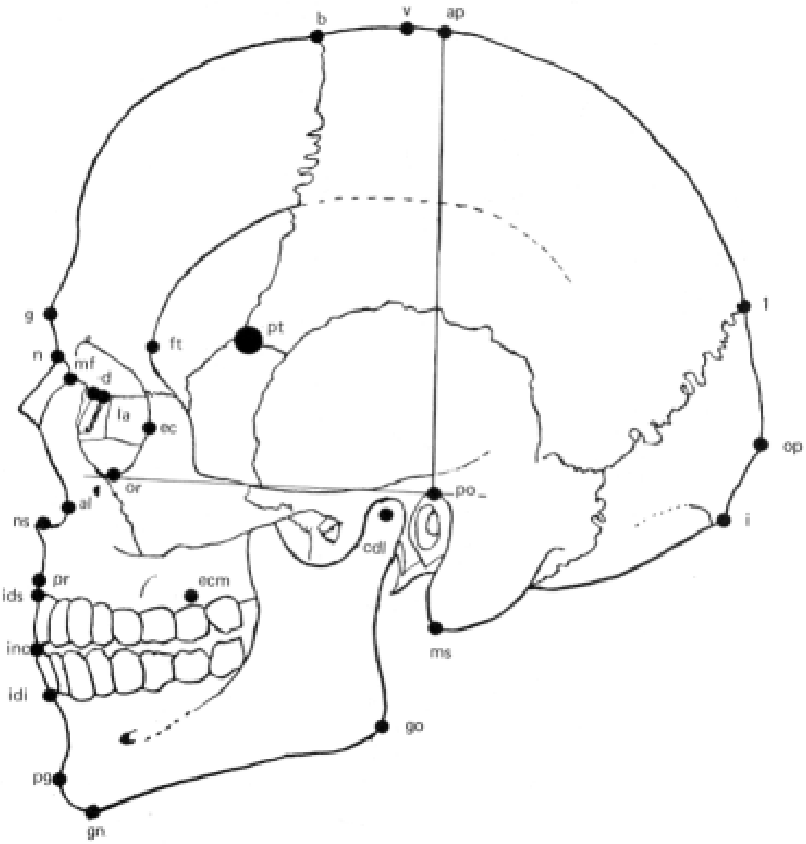
1. Osteometry: Measuring the Skull

1.1. Osteometric points.

Osteometric points are defined places on bones which enable measurements to be made in a standardised way. These points are unpaired (a single point found in the midsagittal plane) or paired (two points that are equidistant on either side of the midsagittal plane). They are also fixed or defined by the measuring instrument.

Work in groups using the bones, models and instruments at your station. Find the following osteometric points on the skulls at your station and mark them with the labels provided. Before you put the labels on the skull, mark them with the appropriate landmark abbreviations:

- Glabella (g): the most anterior projection point in the midline of the frontal at the level of the supraorbital ridges and above the nasofrontal suture.
- Opistocranion (op): The most posterior point on the skull on the external occipital protuberance. It is the posterior end point of the maximum cranial length measured form glabella and thus not a fix point but is instrumentally determined.
- Basion (ba): The midpoint of the anterior margin of the foramen magnum most distant form the bregma.
- Bregma (b): The intersection of the coronal and sagittal sutures in the midline.
- Euryon (eu): the two points on the opposite side of the skull that form the end of lines of the greatest breadth (the most widely separated points on the two sides of the skull).
- Nasion (n): intersection of the nasofrontal suture with the midsagital plane.
- Alveolare (ids; infradentale superius): the upper alveolar point; the apex of the septum between the upper central incisors.
- Zygion (zy): the most lateral point of the zygomatic arch.
- Alare (al): the most lateral point on the nasal aperture taken perpendicular to the nasal hight.
- Nasospinale (ns): the point where a line drawn between the lower margins of the right and left nasal apertures is intersected by midsagittal plane.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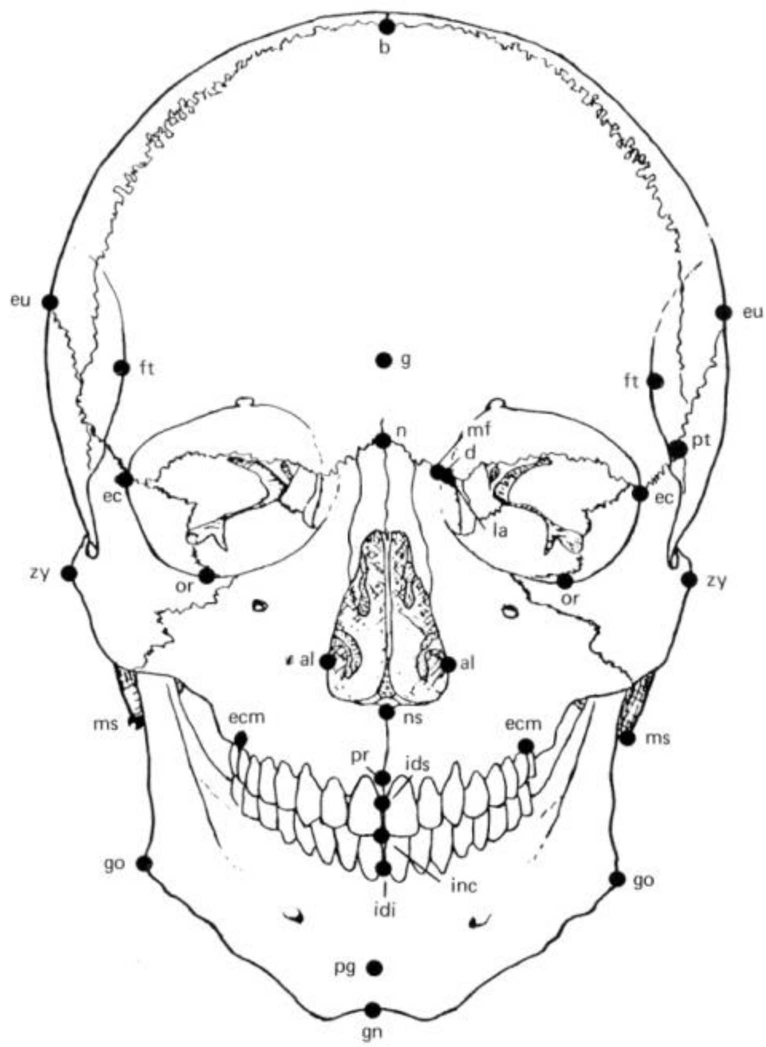
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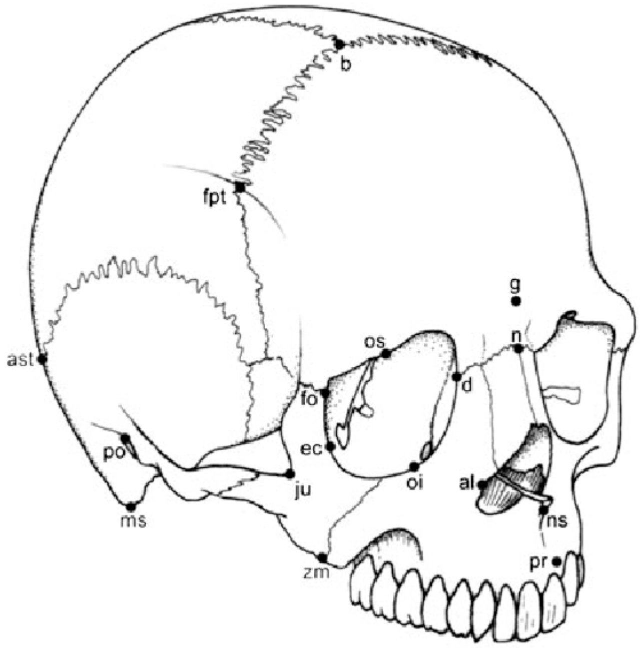
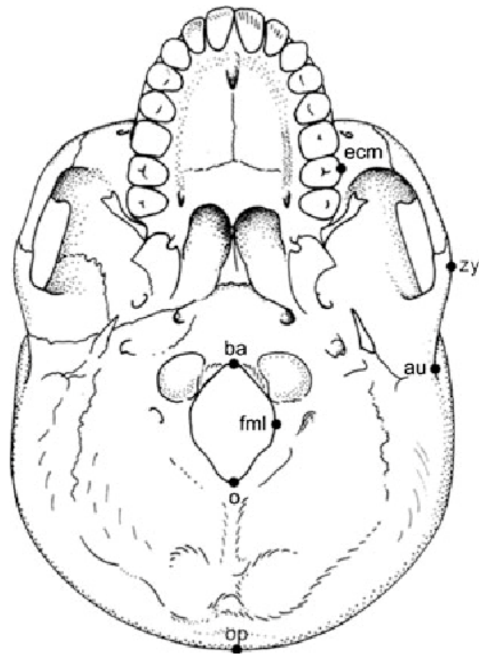
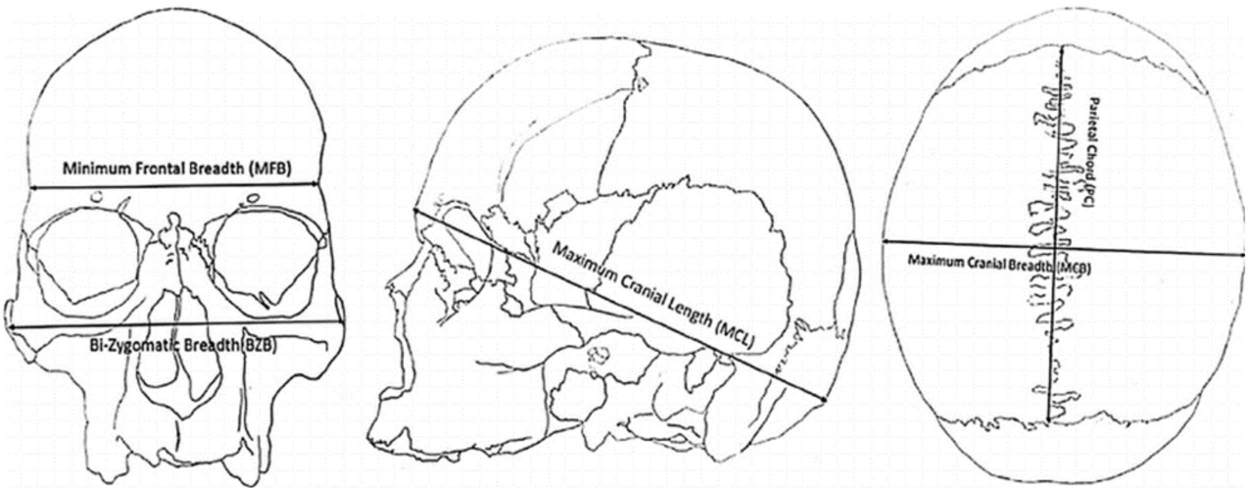






1.2. Measurements and indices of the skull

Measurements are made between points. Indices express the ratio of the width and length of an object.

1.2.1. Cranium

Take the following measurements and calculate the following indices for the skull at your station:

- Maximum cranial length (use the spreading caliper): g-op. Place one end of the caliper on g and support it with your finger. With the other end, locate op and record length in mm.

- Maximum cranial breadth (spreading caliper): eu-eu. Instrumentally determined as both ends of the caliper are moved back and forth on the sides of the skull above the supramastoid crest until the maximum breadth is recorded.

- Maximum cranial height (spreading caliper): ba-b. Please the skull on side or back and hold one end of caliper on ba. Place other end on b. If b is depressed take the reading from the surface and not in the depression.

- Calculate the cranial index: CI = maximum cranial breadth x 100 / maximum cranial length

- Using the values of CI calculated above, classify skull shape using the following classificatory scheme:
    - Dolichocrany (narrow): 74.99 or less
    - Mesocrany (medium): 75-79.99
    - Brachycrany (broad): 80-84.99
    - Hyperbrachycrany (very broad): 85 or more

1.2.2. Face

Take the following measurements and calculate the following indices for the skull at your station.

- Upper facial height (sliding caliper): n-ids. This is the height of the face excluding the teeth and the mandible (used when mandible is missing; total facial height is measured from gnathion - the lowest median point on the lower border of the mandible).

- Facial width (spreading or sliding caliper): zy-zy. This is the greatest width between the zygomatic arches.

- Calculate the upper facial index = upper facial height x 100 / facial width

- Classify the face using the following ranges:
    - Hypereuryeny (very wide/broad): 44.99 or less
    - Euryeny (wide/broad): 45-49.99
    - Meseny (medium): 50-54.99
    - Lepteny (narrow/slender): 55-59.99
    - Hyperlepteny (very narrow/slender): 60 or more

- Why do people with different geographical ancestry differ in the shape of their heads/skulls?

1.2.3. Nose

Take the following measurements and calculate the following indices for the skull at your station.

- Nasal height (sliding caliper): n-ns. Place fixed point of the caliper at n and with movable point obtain the mean lowest points of the right and left ns.

- Nasal breadth (sliding caliper): al-al. Measured perpendicular to nasal height.

- Calculate the nasal index: nasal height x 100 / nasal width

- Classify the nasal aperture using the following ranges:
    - Leptorrhiny (narrow): 47.99 or less
    - Mesorrhiny (medium): 48-52.99
    - Platyrrhiny: 53 or more

2. Osteometry: Measuring the Postcranial Skeleton

2.1. Upper limb

2.1.1. Humerus

Take the following measurements and calculate the following indices for the humerus at your station.

- Maximum length (osteometric board): place the head against the fixed vertical of the board and adjust the moveable upright to the distal end. Raise the bone slightly, move it up and down and side to side until the maximum length is obtained.

- Vertical head diameter (sliding calipers). The direct distance between the most superior and inferior points on the border of the articular surface.

- Least circumference of shaft (measuring tape): Measurement is taken at about the second third, distal to the deltoid tuberosity. It is usually found 1 cm distal from the nutrient foramen.

- Calculate the robusticity index: least circumference of shaft x 100 / maximum length of humerus

- Determine the sex of the individual using this formula: humerus vertical head diameter x 0.3786 – 15.107 (this formula is population specific).

- Estimate the stature (standing height) of the person using the appropriate formula below:
    - Male: humerus maximum length x 3.08 + 70.45 +/- 4.05 mm (this formula is population specific).
    - Female: humerus maximum length x 3.36 + 57.97 +/- 4.45 mm (this formula is population specific).

2.1.2. Radius

Take the following measurements and calculate the following indices for the radius at your station.

- Maximum length (osteometric board): taken the same way as maximum length of the humerus.

- Calculate the brachial index: Maximum length of radius x 100 / maximum length of humerus

2.2 Lower limb

2.2.1. Femur

Take the following measurements and calculate the following indices for the femur at your station.

- Femur maximum length (osteometric board): distance from the most superior point on the head of the femur to the most inferior point on the distal condyles. Place the medial condyle against the vertical endboard while applying the movable upright to the femoral head.

- Femur maximum head diameter (sliding calipers). Measured on the periphery of the articular surface of the head. Found by rotating the femur while keeping the limbs of the calipers in place.

- Subtrochanteric anteroposterior diameter (sliding caliper): Taken on the shaft just below the lesser trochanter, avoiding the gluteal tuberosity.

- Subtrochanteric transverse (mediolateral) diameter (sliding caliper): Taken at the same level as the previous measurement but perpendicular to it.

- Calculate the platymeric index: subtrochanteric anteroposterior diameter x 100 / subtrochanteric mediolateral diameter

- Classify the femur you measured, using the following ranges:
    - Platymeric (broad front to back): 84.9 or less
    - Eurymeric (broad side to side): 85-99.9
    - Stenomeric (usually only in pathological cases): 100 or more

- Why do different human populations (past and present) display differences in platymeric index?

- Determine the sex of the individual using this formula: femur maximum head diameter x 0.4276 – 17.5969 (this formula is population specific).

- Estimate the stature (standing height) of the person using the appropriate formula below:
    - Male: femur maximum length x 2.89 + 78.1 +/- 4.57 mm (this formula is population specific).
    - Female: femur maximum length x 2.89 + 78.1 +/- 4.57 mm (this formula is population specific).

2.2.2. Tibia

Take the following measurements and calculate the following indices for the tibia at your station.

- Tibia length (osteometric board): Place the end of the medial malleolus against the vertical (fixed) wall of the board, with the bone resting on the posterior surface with its long axis parallel to the long axis of the board. Apply the movable upright to the proximal articular surface of the lateral condyle.

- Estimate the stature of the person using this formula: 2.42 x Tibial length + 81.93 +/- 4 mm (this formula is population specific).

- Calculate the crural index: Length of tibia x 100 / maximum length of femur.

EXERCISE

1. Among recent humans brachial and crural indices are positively correlated with mean annual temperature, such that high indices are found in tropical groups. Why might this be the case?

Week 4 Practical: Comparative Primate Anatomy

4. LEARNING OBJECTIVES

Identify and classify different primate taxa.

Identify and orientate the appendicular and axial bones of the selected non-human primate species.

Compare and contrast the skeletons of non-human primates and humans. Relate this to functional and behavioural differences between the primate species.

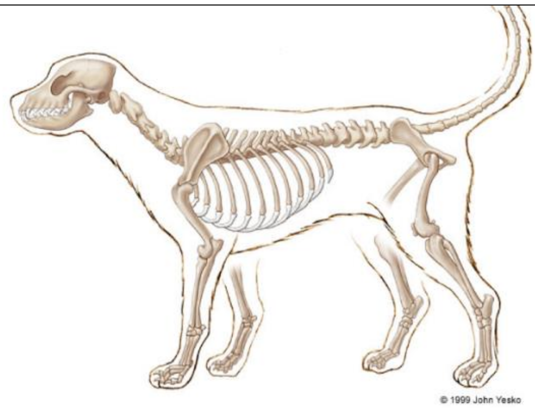
Describe the anatomical features that differ between chimpanzees and humans and that may help define the hominins.

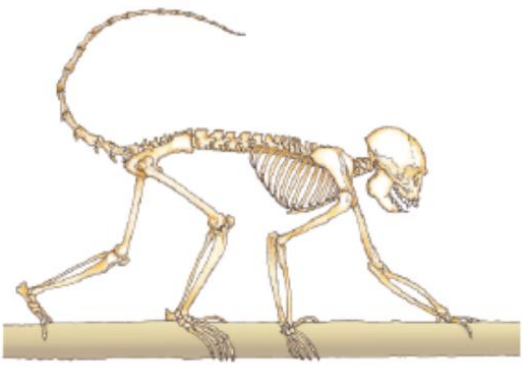
ACTIVITIES

1. Non-primate mammal and primate skeletons.

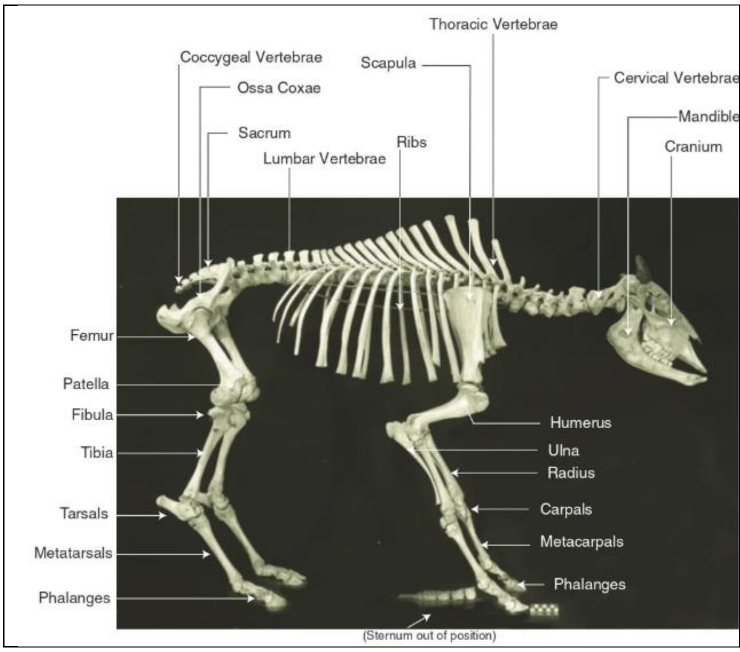
1.1. Examine the images below and skeletons in the laboratory comparing the anatomical traits of non-primate mammals to primates. Fill in the table below.

Skeletons of a non-primate mammal (dog) and a primate (New World monkey – bearded saki):





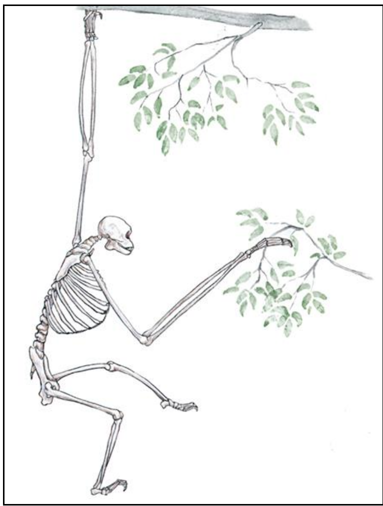
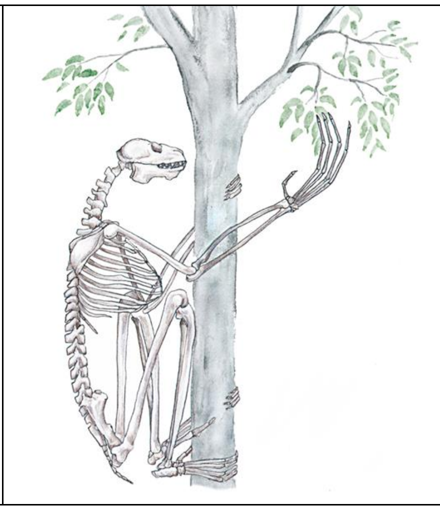
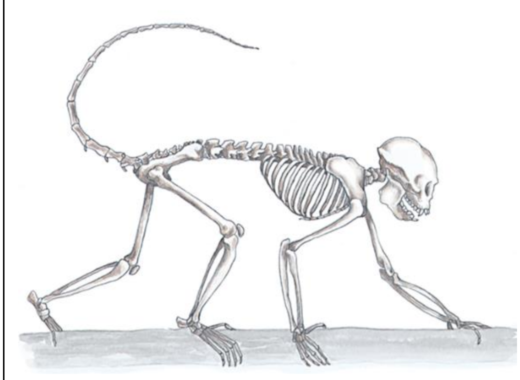
Skeleton (bison) and cranium (elk) of non-primate mammals and cranium of primate (gibbon):



	Non-Primate Mammal	Non-Human Primate	Human Skeleton
Grasping hands/feet?			
Opposable big toe/thumb?			
Nails or claws?			
Five digits?			
Clavicle?			
Ilium shape			
Orbital closure?			
Reduced snout?			
Spinous process length			
Foramen magnum position			

2. Comparative Primate Anatomy

2.1. Study the primate skeletons in the images below. Use your observations and the exercise on intermembral index calculations to establish the type of locomotion utilized by each species presented. Repeat this exercise with the complete skeletons in the lab.

Use a ruler or sliding calipers to measure the length of the long bones in the images above and in the primate skeletons in the lab.

Calculate the intermembral index for each skeleton using the following formula:

IM: (length of humerus + length of radius) x 100 / (length of femur + length of tibia)

The intermembral index is used in biological anthropology to help predict locomotor patterns. For scores lower than 100, the forelimbs are shorter than the hind limbs, a condition common in leaping primates and bipedal hominids. Quadrupedal primates tend to have scores around 100 as their limbs are of similar size, while brachiating primates have scores significantly higher than 100 (longer upper limbs).

	Quadrupedal	**Saltatorial**	**Brachiator**	**Bipedal**
Humerus				
Radius				
Femur				
Tibia				
Intermembral index				

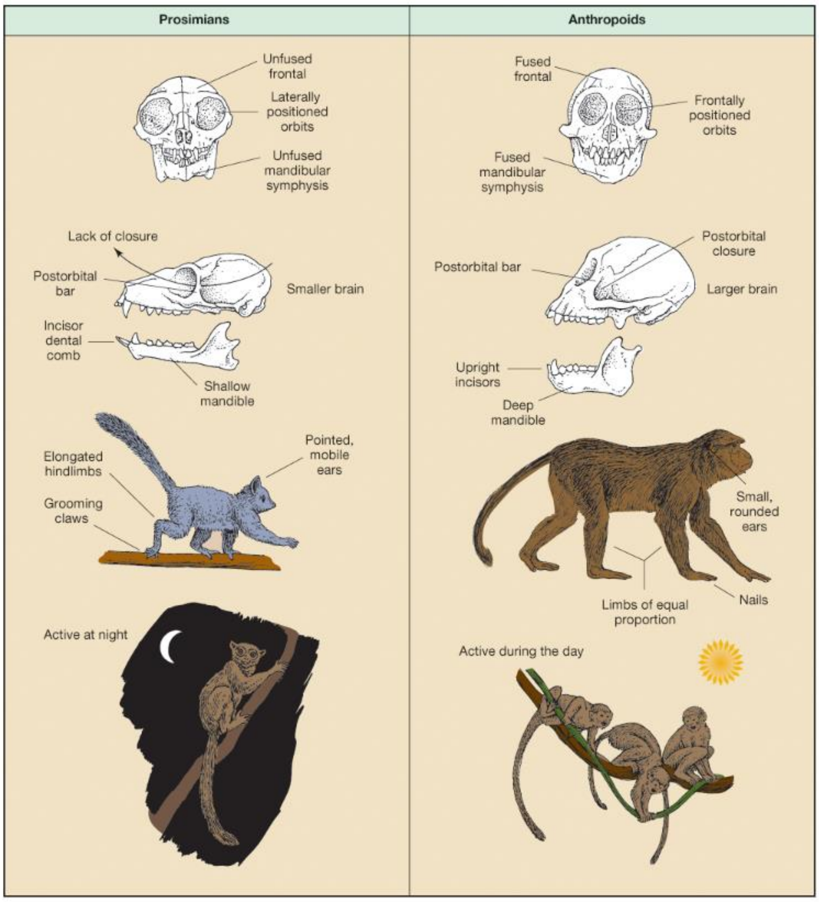
2.2. Diurnal and nocturnal primates.

Examine the images below. Which two animals are nocturnal? How can you tell?

A. Black and white colobus 	B. Galago (bush baby) 	C. Gorilla 
D. Tarsier 	D. Golden snub-nosed monkey 	E. Loris 

2.3. Strepsirhines and Haplorhines

Examine the primate pictures and/or skeletons in the laboratory comparing strepsirhine to haplorhines. Fill in the table below to describe the differences.

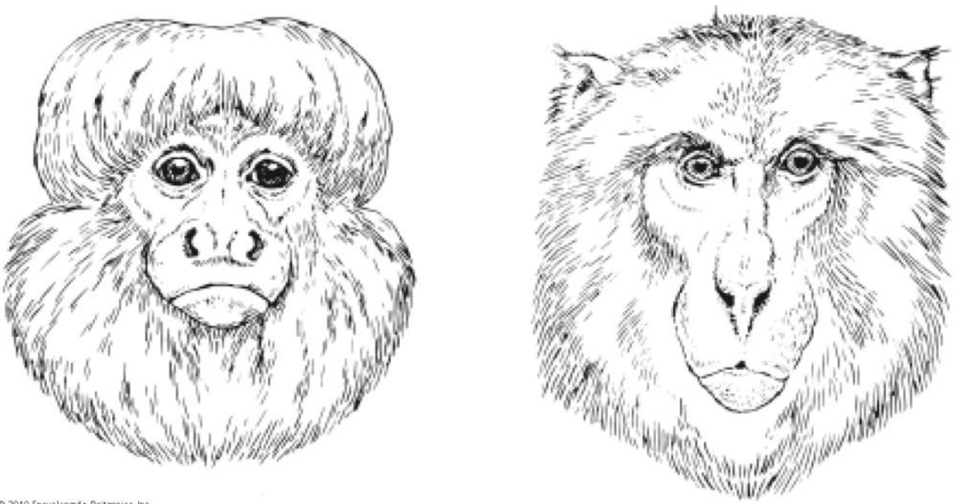


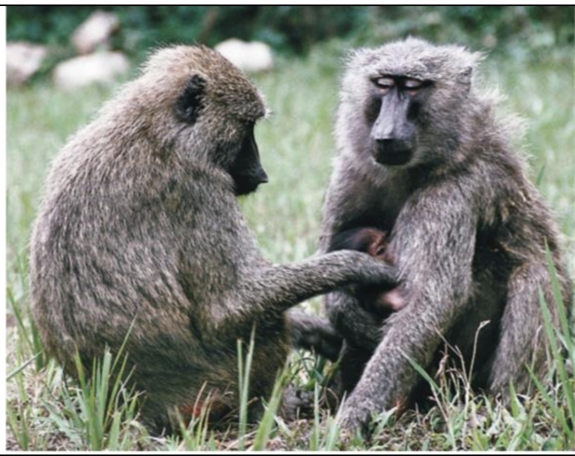
	Strepsirhine	Haplorhine
Prehensility?		
Opposability?		
Grooming claw?		
Five digits?		
Clavicles?		
Post-orbital bar/complete closure?		
Size of orbits?		
Snout length?		
Tooth comb?		
Molar tooth cusps?		
Fused mandible?		

2.4. New World Monkeys and Old World Monkeys

Examine the pictures and/or skeletons in the lab. Fill in the table below comparing New World monkeys to Old World monkeys.

New World monkey (left) and Old World monkey (right) faces and dentition

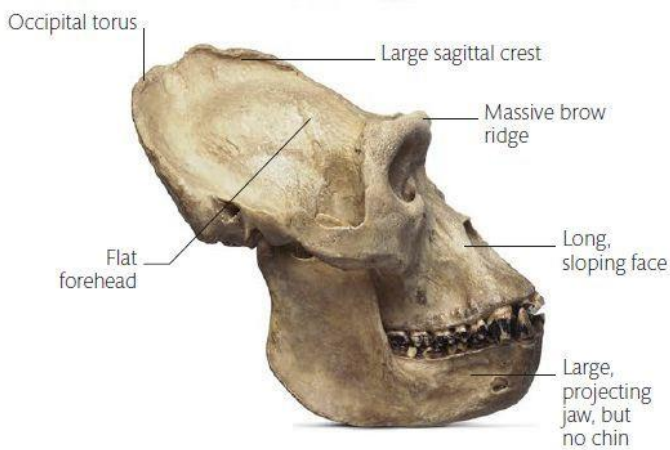




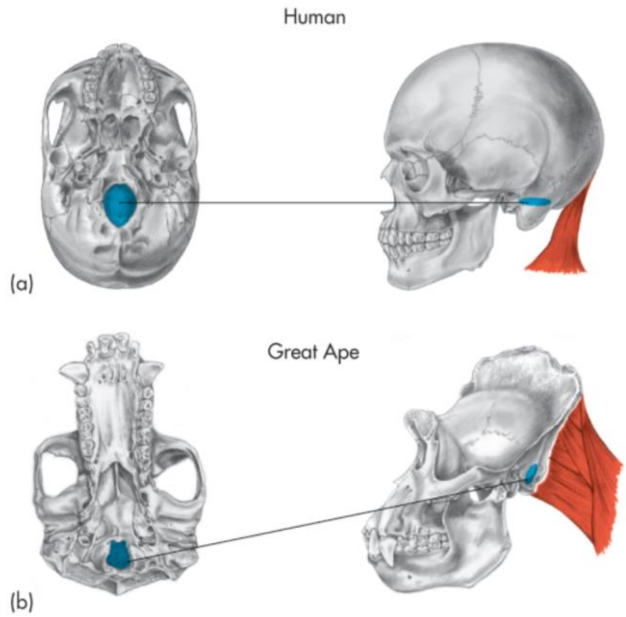
	New World Monkeys	Old World Monkeys
Nose shape/septum width		
Prehensile tail?		
Dental formula		
Arboreal/terrestrial?		
Diurnal/nocturnal?		

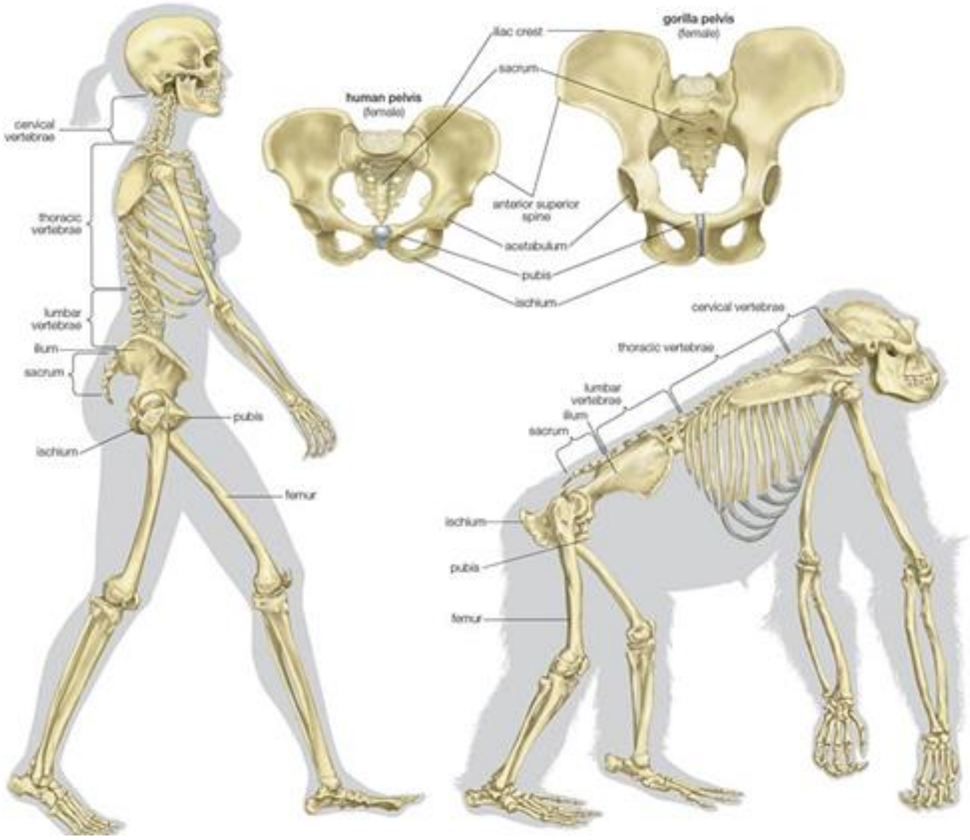
2.5. Apes

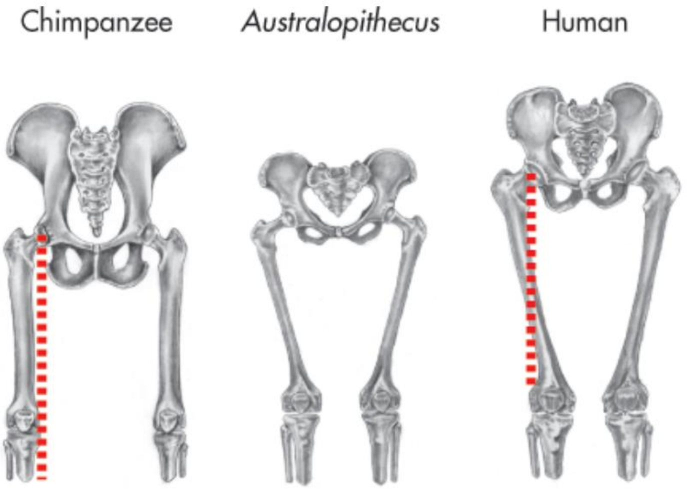
Examine the images and bones of prosimians, monkeys, apes and humans in the lab. Fill in the table below comparing them.

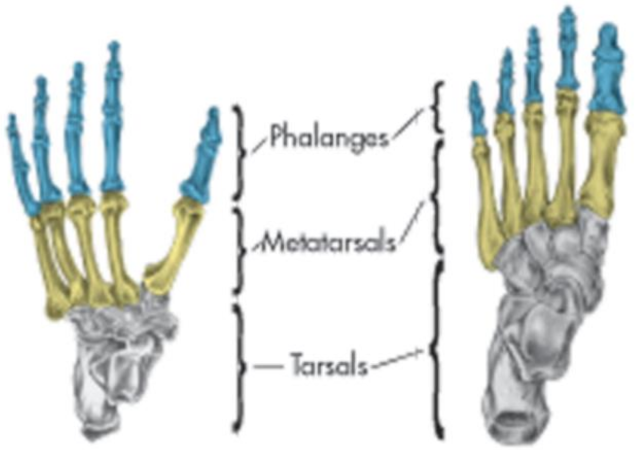


Gorilla skull









Chimpanzee foot

Human foot

	Prosimian	**NW Monkey**	**OW Monkey**	**Gorilla**	**Chimpanzee**	**Human**
Lumbar region (long, medium, short)						
Shape of rib cage (narrow, broad)						
Forelimb length (long, short)						
Finger length (long, short)						
Tail?						
Pelvis						
Knee						
Femur						
Foot						
Foramen magnum						
Sectorial premolar?						
Diastema for canine?						
C/P3 hone?						
Molar enamel?						
Tooth row shape						
Tooth cusp shape						
Diet						

Week 7 Practical: Early Hominins

5. LEARNING OBJECTIVES

Describe the various species of the early hominins, including their anatomical characteristics, temporal range, and geographic range.

Describe and discuss the evolutionary relationships among the species in the genus *Australopithecus* and explain their evolutionary radiation in Africa. Explain why some scientists recognize a second genus, Paranthropus, while others do not.

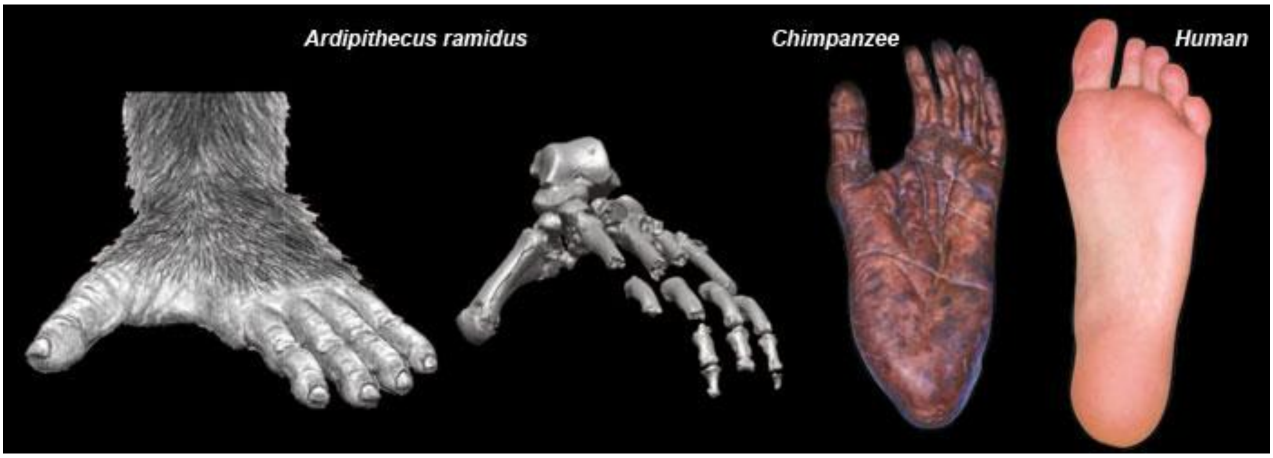
Identify Oldowan tools. Understand and explain the relationship between early tool use, hunting, and scavenging, including how Oldowan stone tools are made and used.

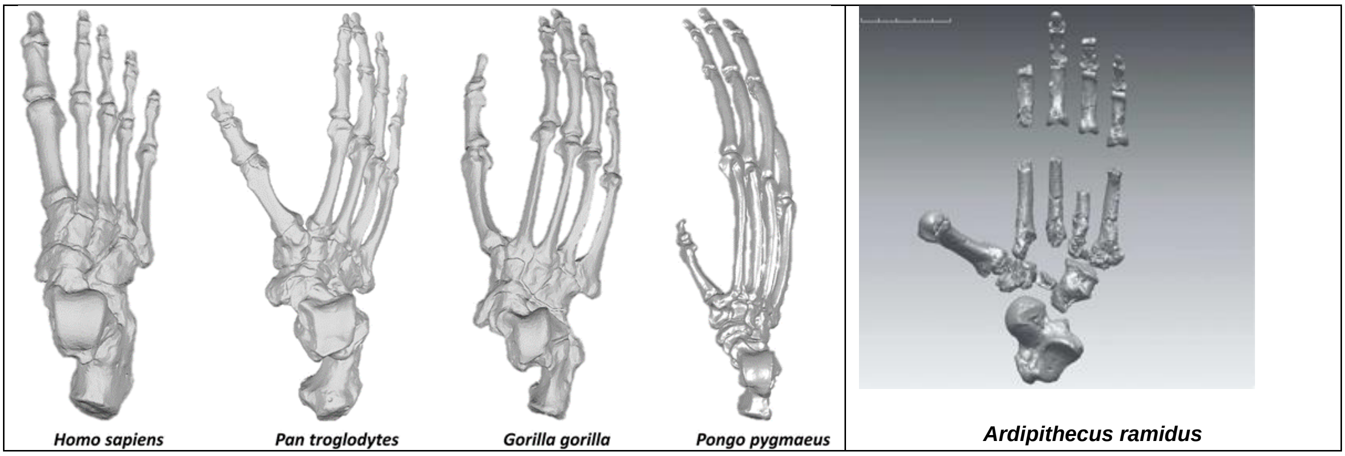
ACTIVITIES

1. Pre-australopithecines

1.1. *Ardipithecus ramidus*

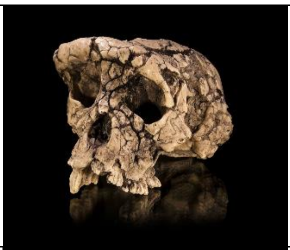
Compare the feet of an ape and modern human to that of *Ardipithecus*. What can you infer about Ardi's locomotion, possible hominin status and phylogeny (was it an ancestor of modern humans?).





1.2. Early hominins

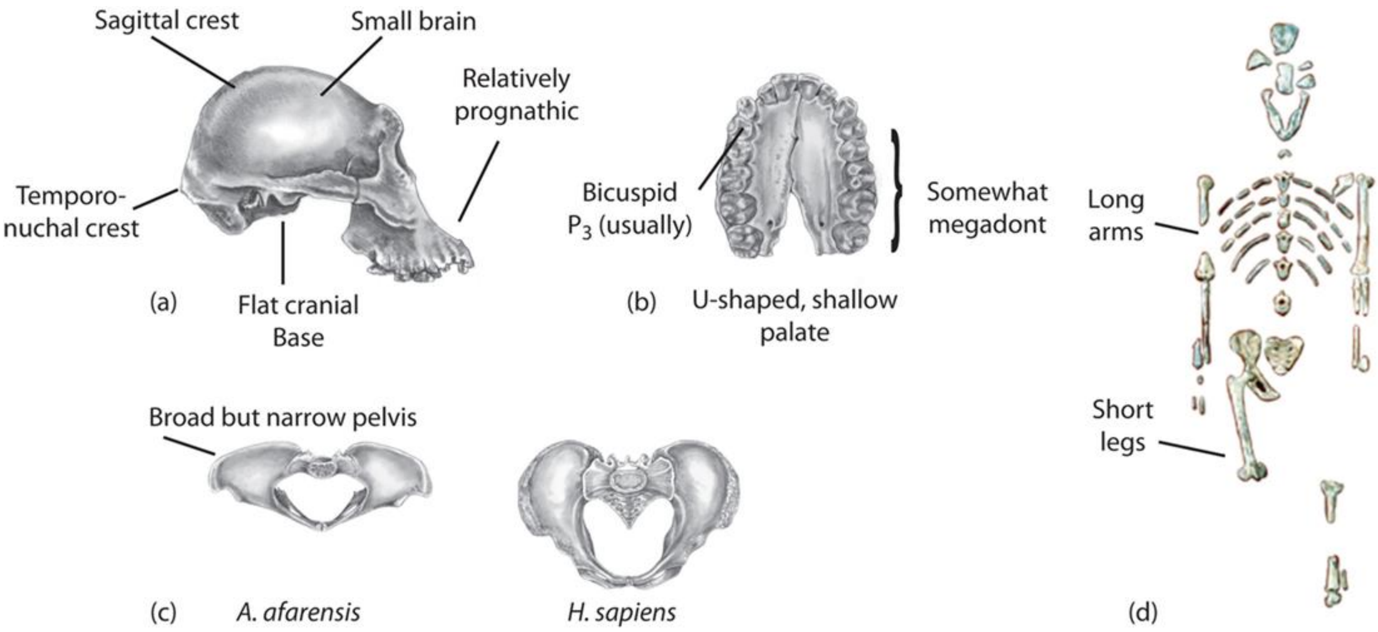
Fill in the table below showing the fossils of pre-australopithecines.

	Species name	Date	Locality
			
			

2. Australopithecines

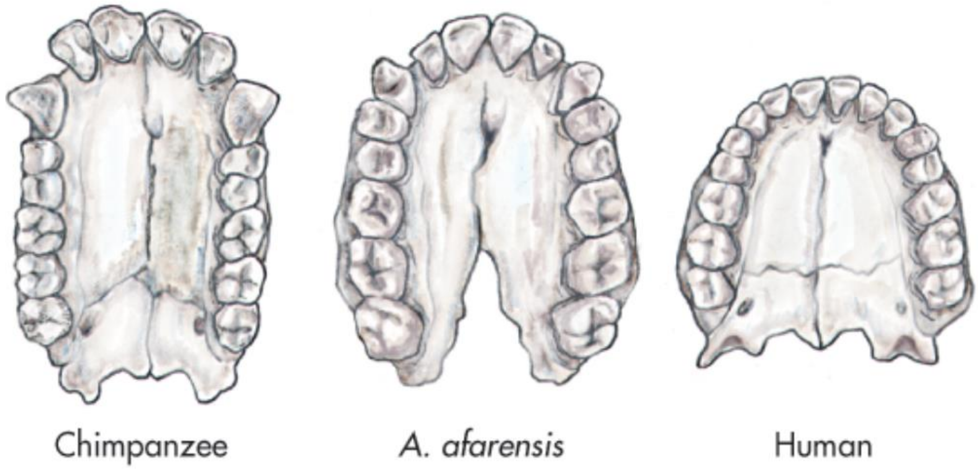
2.1. Homo sapiens and *Australopithecus afarensis* Comparison

Using the materials available to you in your laboratory, compare *Australopithecus afarensis* to a modern human. Circle the traits recorded on the image below which you identified in the casts at your station.



2.2. Dentition: Ape, Australopithecine and Modern Human Comparison

Using the materials available to you in your laboratory, compare the dentition of an ape, australopithecine and modern human. Record the traits that you observe that differ between these specimens.

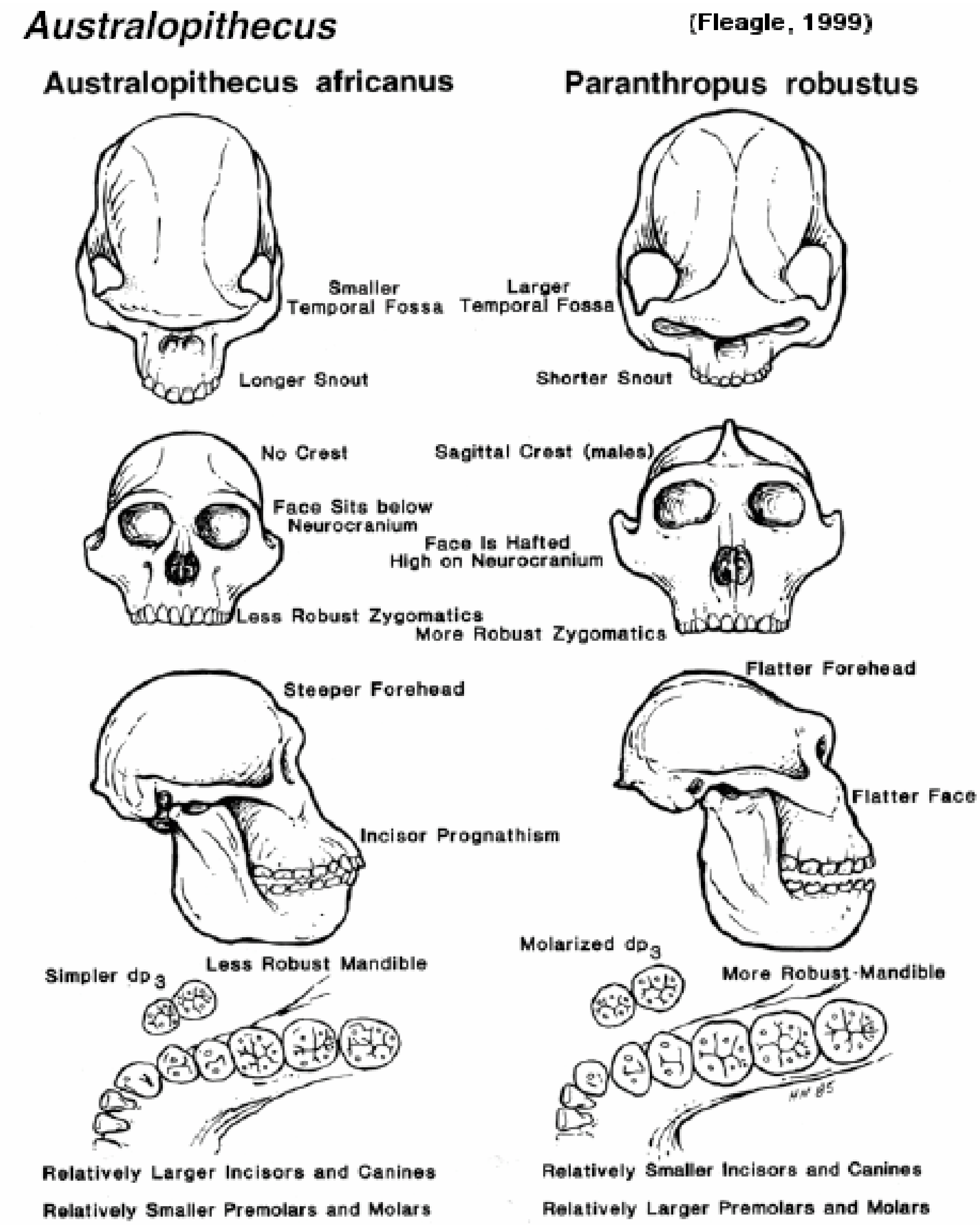


2.3. Dentition: Taung Child

Identify all teeth on the Taung Child cast below and classify them as deciduous or permanent. Use the image of a modern human child's teeth at the same developmental stage for comparison.

2.4. Gracile vs. Robust Australopithecines

Using the materials available to you in your laboratory, compare a gracile australopithecine to a robust australopithecine. Name at least three traits that you observe that differ between these specimens. What can you infer about dietary habits of these two groups based on their dental and skeletal anatomy?



2.5. Australopithecus: Diversity, Distribution, Main Traits

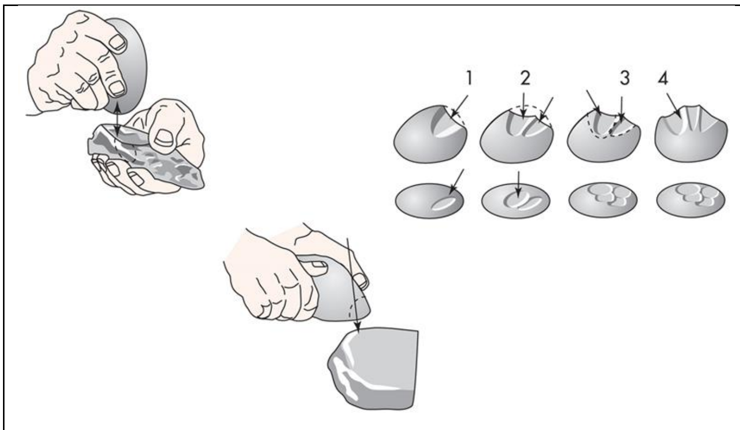
Casts or photos of several australopithecine species are available in your laboratory. After examining them carefully, fill in the table below.

Traits	***afarensis***	***africanus***	***aethiopicus***	***robustus***	***boisei***	**Chimp**	**human**
Dates	*3-4 ma*	*2-3.5 ma*	*~2.6 ma*	*1.5–2 ma*	*1-2.5 ma*	*present*	*present*
Sites							
Incisor size (small, large)							
Canine size (small/large)							
Premolar size (small/large)							
Molar size (small/large)							
Diastema? (yes/no)							
Cranial capacity	*400cc*	*400-450cc*	*~420cc*	*~500cc*	*~500cc*	*~300-350cc*	
Projecting face?							
Nuchal crest?	*yes, males*	*yes, males*	*yes*	*yes*	*yes*	*yes, males*	
Sagittal crest?							
Flaring zygomatics?							
Dished face?							

2.6. Examine the map of Africa below. Match the hominin species/groups to the localities.

3. Stone Tools

Examine Oldowan tools. How were they made and what were they used for? What is the earliest date when this type of tool appears in the archeological record? Which homini species was the first to use stone tools?



Week 8 Practical: The Genus *Homo*

6. LEARNING OBJECTIVES

Identify and discuss the anatomical characteristics used in defining the genus *Homo*.

Describe the anatomy and distribution of Early *Homo*, *Homo erectus* and archaic *Homo sapiens*.

Outline the history, anatomy, geographic distribution, and temporal range of the Neandertals.

Identify the main anatomical features of anatomically modern human fossils. Compare and contrast these features to the anatomy of the Neandertals.

Identify and compare Oldowan, Acheulean and Mousterian tools.

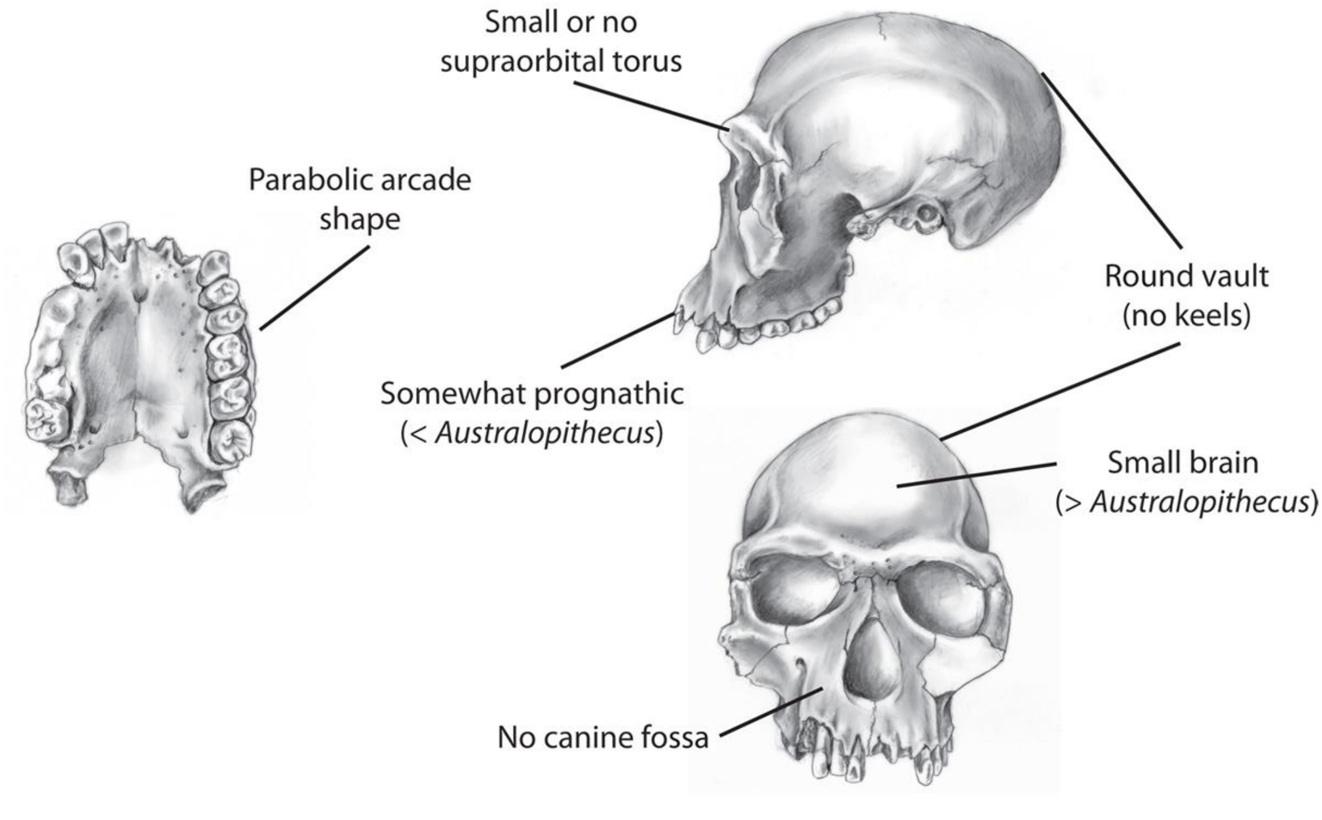
ACTIVITIES

1. *Homo habilis*

1.1. *Homo habilis* – Australopithecine comparison

Casts or photos of robust and gracile australopithecines and *H. habilis* are available in your laboratory. After examining them carefully, fill in the table below. Do you think the gracile specimens are a reasonable ancestor to early *Homo*?

Anatomical features of Homo habilis:



	Homo habilis	**Gracile** **australopithecine**	**Robust** **australopithecine**
Anterior tooth size			
Cheek tooth size			
Brain size			
Cresting?			
Dished face/wide zygomatics?			
Mandibular robusticity			

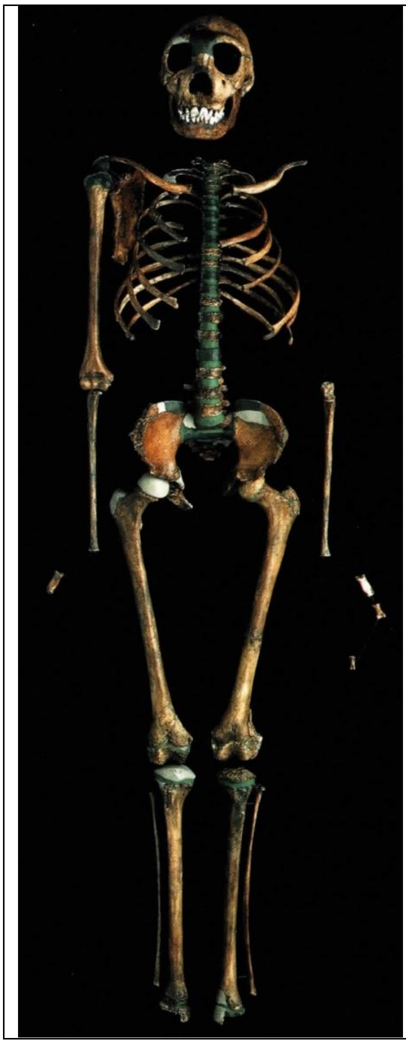
1.2. *Homo habilis* Diversity: How Many Species?

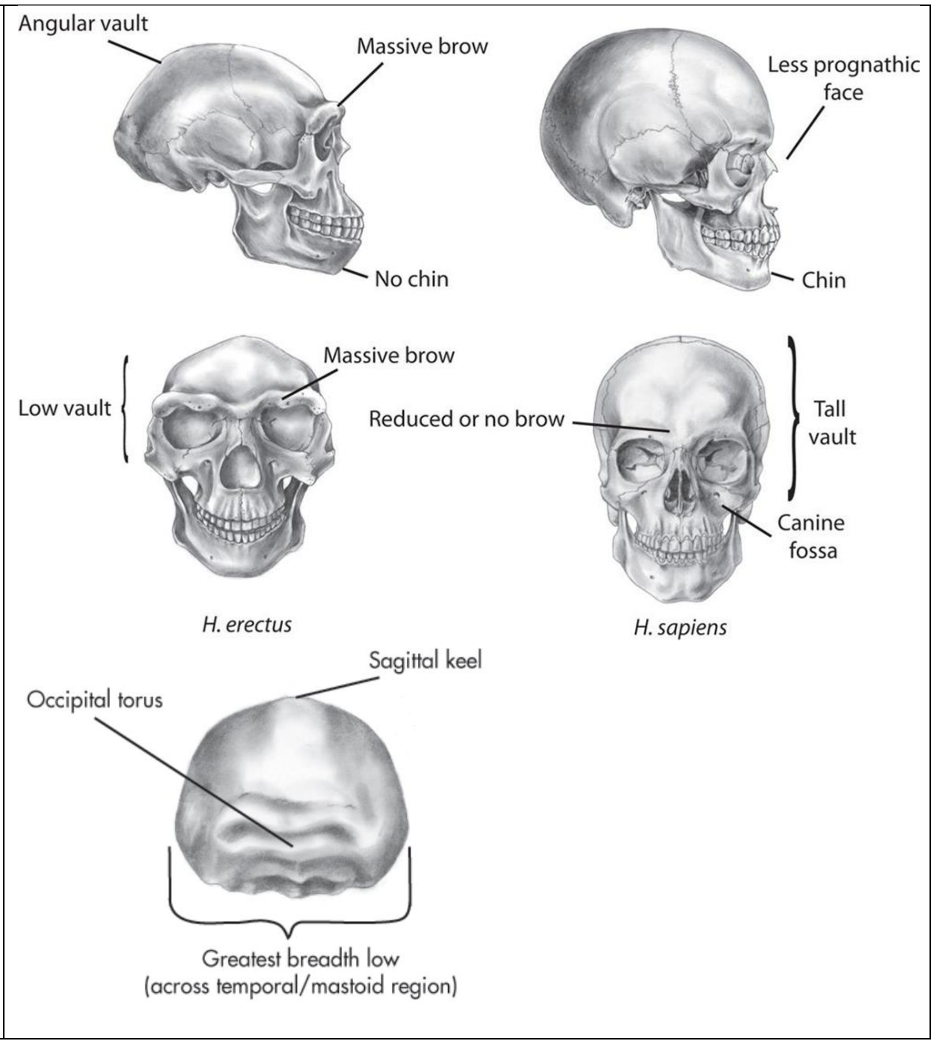
Finally, compare two *H. habilis* skulls, KNM-ER 1813 and 1470, side by side. Do you think these two fossils might be from the same sexually dimorphic species or do you think they are from two different species? Justify your answer.

KNM-ER 1813 (left) and 1470 (right):

2. *Homo erectus*

Casts or photos of *Homo erectus* specimens are available in your laboratory. Examine them carefully and compare to *Homo sapiens*. How would you describe the body proportions of *Homo erectus* compared with *Homo sapiens*? Locate the parts of the cranial buttressing system including: supraorbital torus, sagittal keel, nuchal torus, angular torus. Compare them to *Homo sapiens*. Can you distinguish between the African and Asian forms? If so, how?





3. Acheulean stone tool industry

Examine Acheulean stone tools. How were they made and what were they used for? What is the earliest date for this type of tool in the archeological record? Which hominin species made these stone tools?

4. *Homo floresiensis*

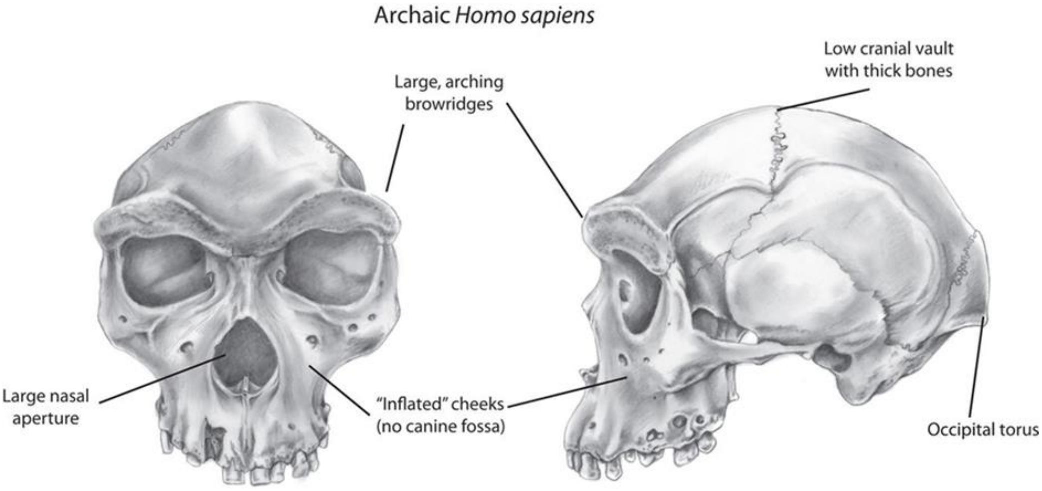
A controversial discovery in the Liang Bua cave on the Indonesian island of Flores suggests that a group of hominins may have survived until as recently as 18,000 years ago. Due to their tiny body size, the hominins from this locale have been nicknamed “hobbits.” Their postcranial skeletons are quite primitive, perhaps representative of early Homo or even Australopithecus! Others argue that the Flores specimens are examples of short modern humans with microcephaly—an abnormally small brain.Compare the skull of *Homo floresiensis* to that of *Homo erectus* and *Homo sapiens*. What are the main differences?

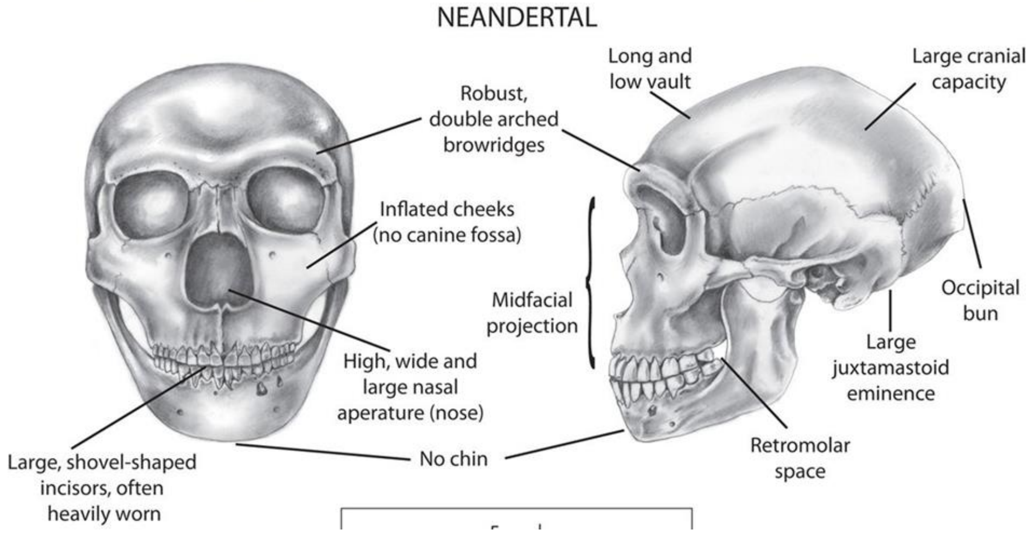
H. floresiensis skeleton (left) and skulls compared with *H. erectus* (above right) and *H. sapiens* (below right)

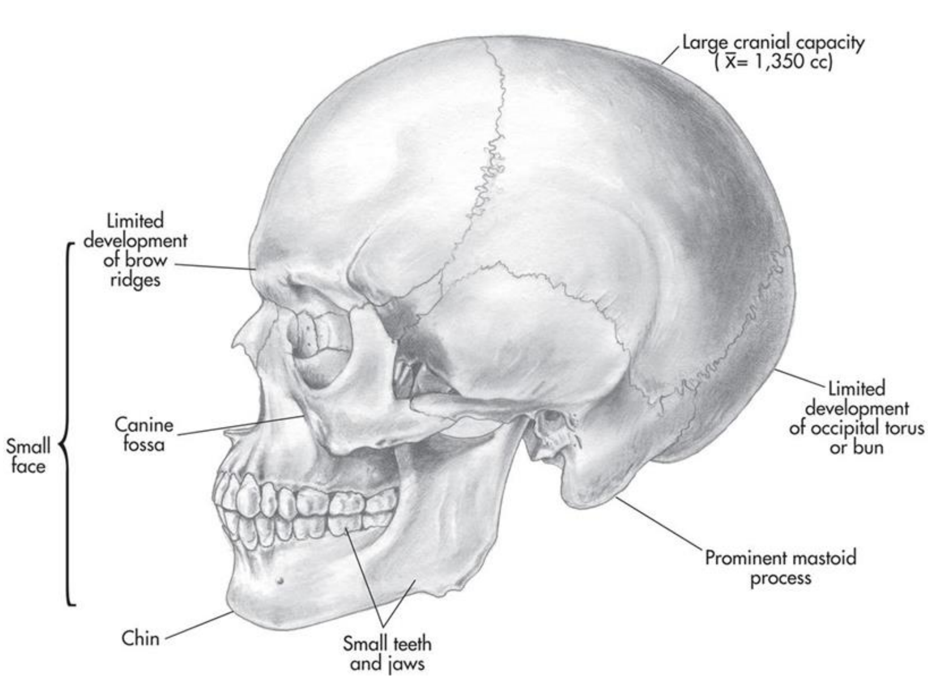
5. Archaic *Homo sapiens*, Neandertals and Anatomically Modern Humans

5.1. Archaic *Homo sapiens*, Neandertal and Anatomically Modern Human Comparison

Examine the skulls of archaic *Homo sapiens*, Neanderthals and anatomically modern humans (AMH) in the laboratory. After careful examination, fill in the table below. Which features are linked to cold adaptation?







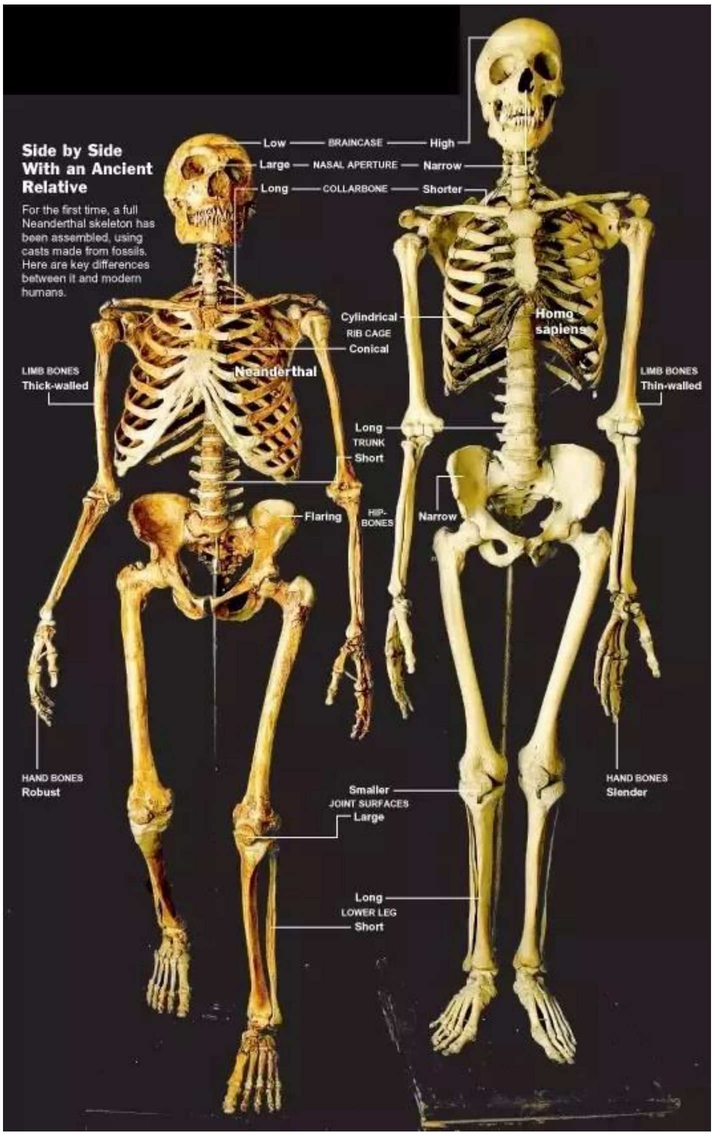
Traits	*Homo erectus*	Archaic	Neanderthal	AMH
Time period				
Geographic range				
Average Brain Size				
Supraorbital torus (large, med, small)				
Nuchal torus? (yes/no)				
Chin (yes, no)				
Forehead (sloping, vertical)				
Any Unique features				

5.2. Neandertal dentition.

Examine the teeth of Neandertals. What are their main features?

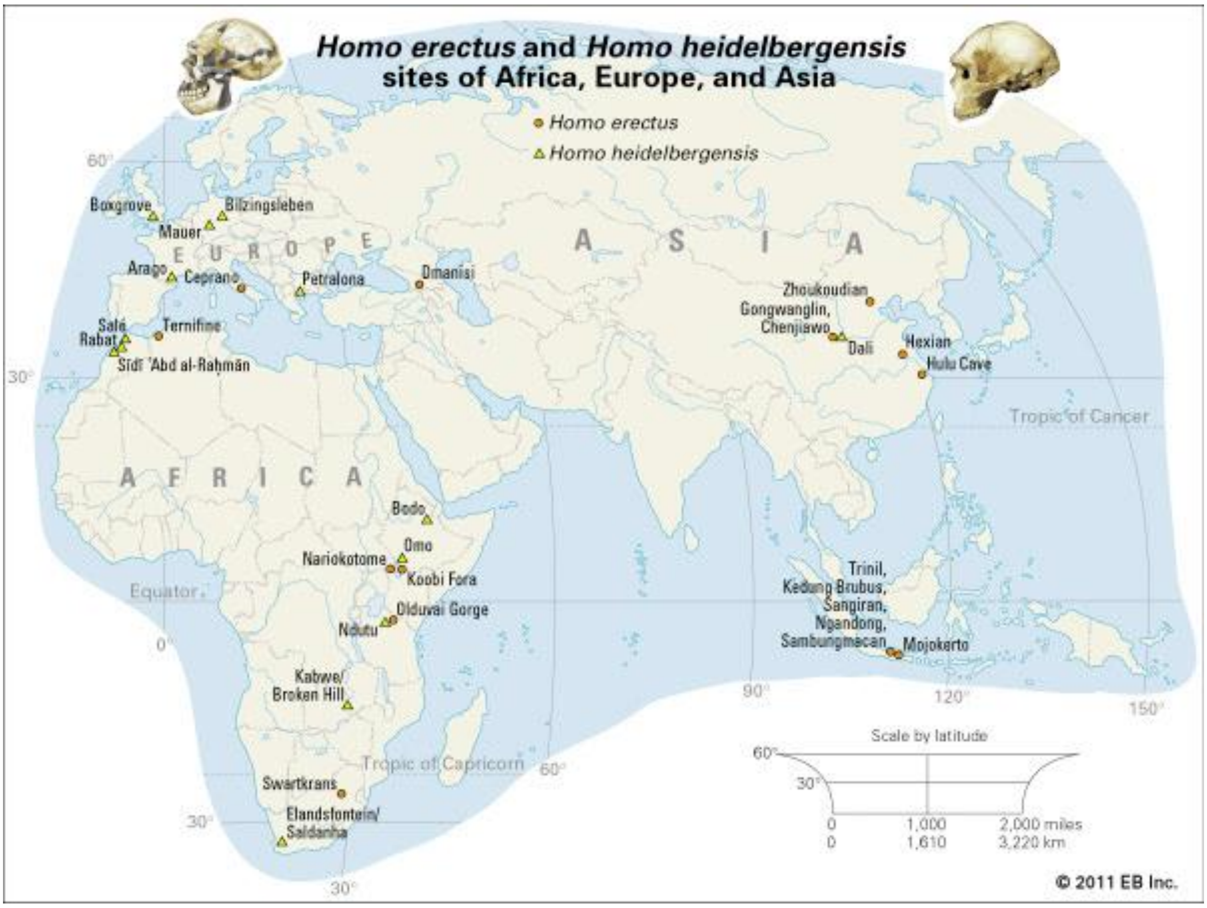
5.3. Postcranial Skeletons of Anatomically Modern Humans and Neandertals.

Examine the postcranial skeletons of anatomically modern humans and Neandertals. What are the main reasons for differences in postcranial anatomy?



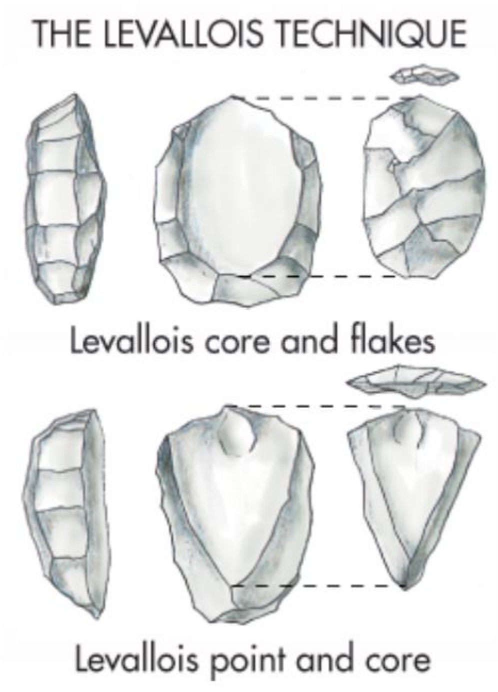
5.4. Homo Species Geographical Distribution.

Examine the map below showing the distribution of *H. erectus and H. heidelbergensis* sites. What is the geographic distribution of Neandertal sites and the earliest sites of anatomically modern humans?



5.5. Stone Tools.

Examine the examples of Oldowan, Acheulean and Mousterian stone tools available in the laboratory and in the image below. Which species used these industries and during which time periods?



Week 10 Practical: Bioarchaeology & Forensic Anthropology

7. LEARNING OBJECTIVES

Describe the types of pathology evident in teeth and bone.

Describe the three main types of skeletal trauma.

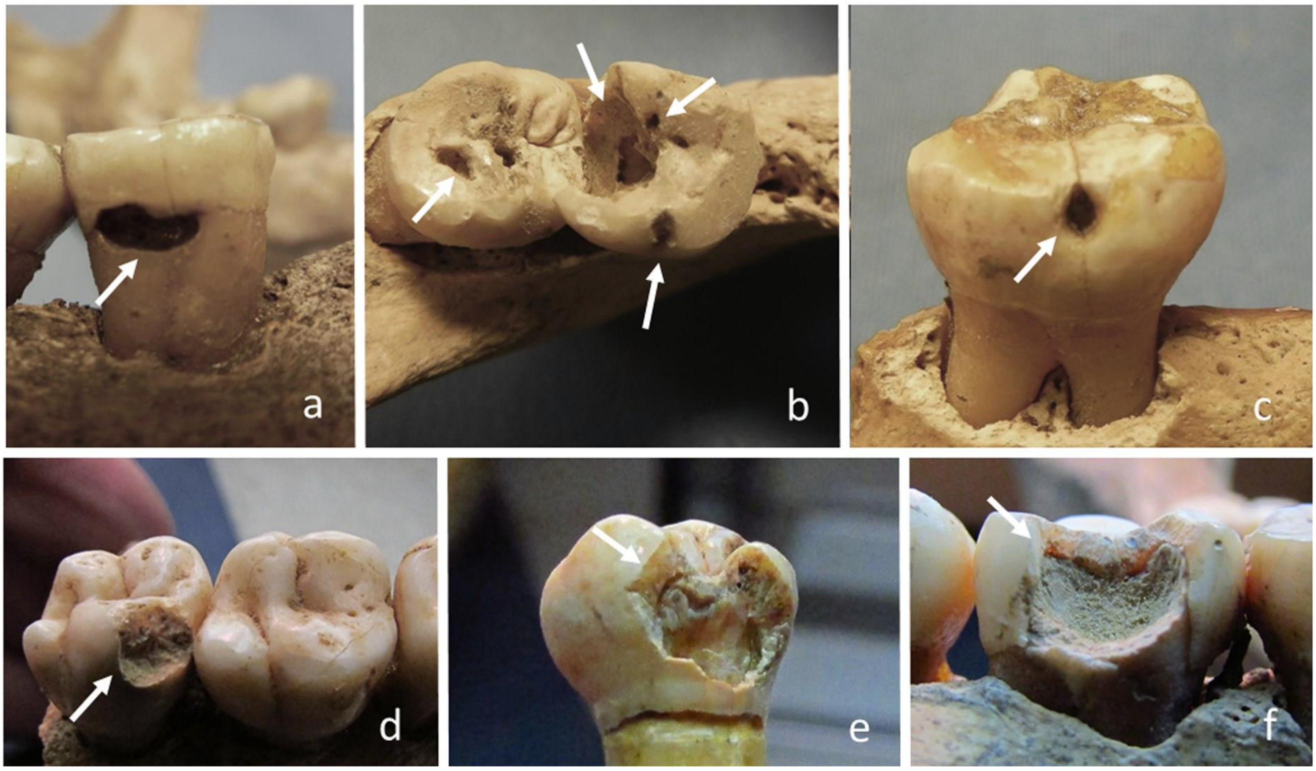
Describe how ancestry is determined from the skeleton.

ACTIVITIES

1. Paleopathology

1.1. *Dental Pathology: Caries*

Examine the teeth of the skulls available in your laboratory for caries. After examining them carefully, fill in the table below. Which individual has the highest percentage of teeth affected by caries? When pooling all individuals together, which tooth class is most commonly affected by caries? Bioarchaeologists commonly observe much higher caries frequencies in agricultural populations than in hunter-gatherer populations. Why might this be?

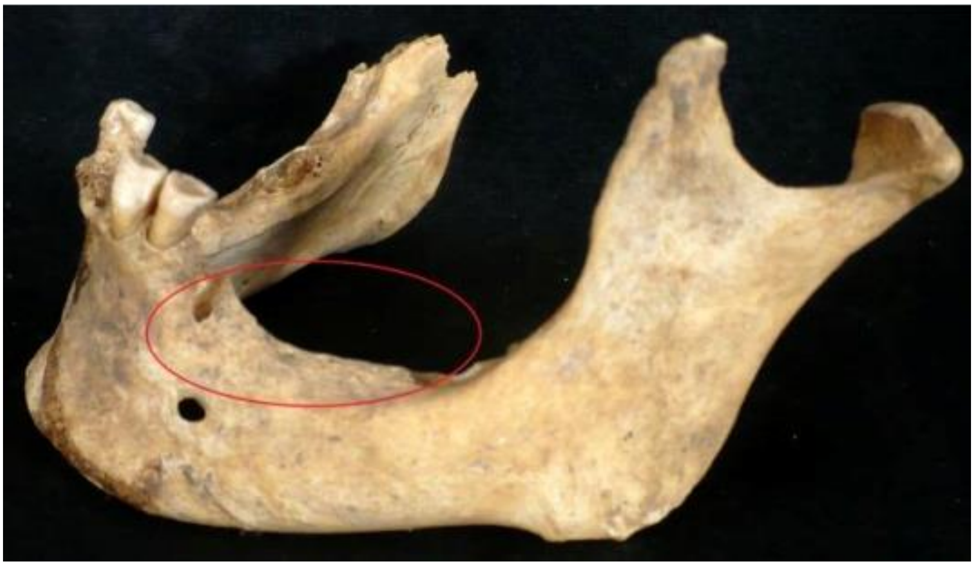


a) caries at the cemento-enamel junction, b) occlusal caries, c) caries of the buccal pit, d-f) non-carious antemortem tooth breakage (sharp perimeter, no demineralization).

Skull	Age	Sex	Incisors			Canines			Premolars			Molars			Overall		
			n	N	%	n	N	%	n	N	%	n	N	%	n	N	%
1																	
2																	
3																	
4																	
5																	
TOTAL																	

1.2. *Dental Pathology: Antemortem Tooth Loss*

Examine the teeth of the skulls available in your laboratory for antemortem tooth loss. After examining them carefully, fill in the table below. Which individual has the highest percentage of teeth affected by caries? When pooling all individuals together, which tooth class is most commonly affected? How is the thickness of the mandible affected in areas adjacent to teeth that have been lost antemortem? Why might this be?

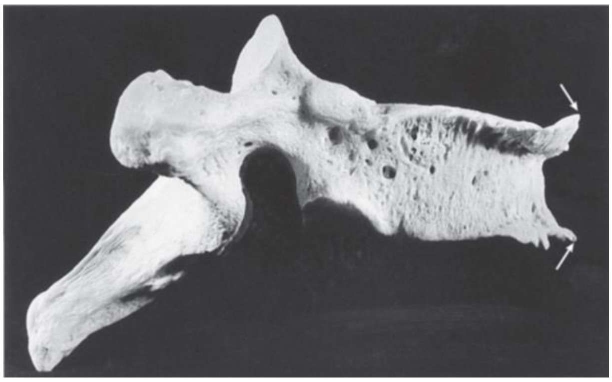


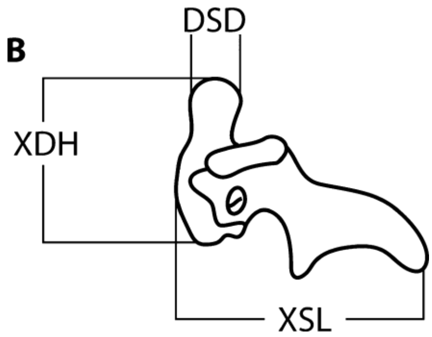
Skull	Age	Sex	Incisors			Canines			Premolars			Molars			Overall		
			n	N	%	n	N	%	n	N	%	n	N	%	n	N	%
1																	
2																	
3																	
4																	
5																	
TOTAL																	

2. Osteoarthritis

2.1. *Vertebral Column*

Examine each vertebral column in the laboratory. Determine the sex of each individual using this formula: C2 maximum sagittal length (XSL) x 0.6488 – 32.159. Score arthritis presence or absence (0 or 1, respectively) for each vertebra according to section of the spine. Are certain sections of the spine more commonly affected? Does the severity vary between individuals? Why might this be the case?





Individual	Age	Sex	Cervical			Thoracic			Lumbar			Total		
			n	N	%	n	N	%	n	N	%	n	N	%
1														
2														
3														
4														
5														
TOTAL														

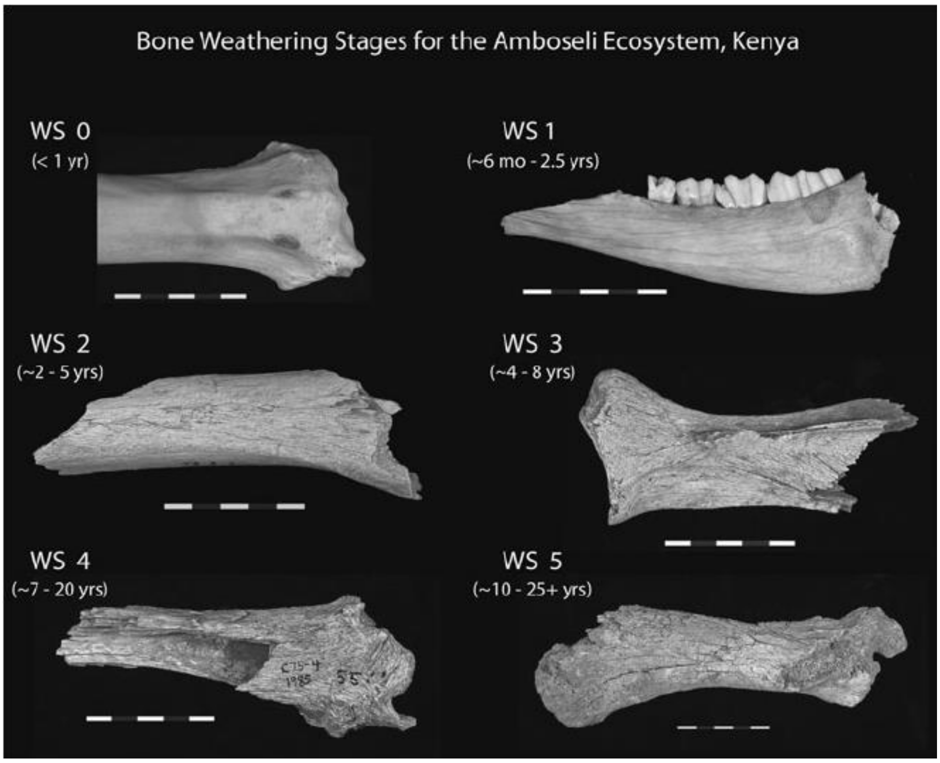
3. Taphonomy

3.1. *Rodent Tooth Marks*

Rodent tooth marks in bone (see image below) are typically paired and have a square cross-section.

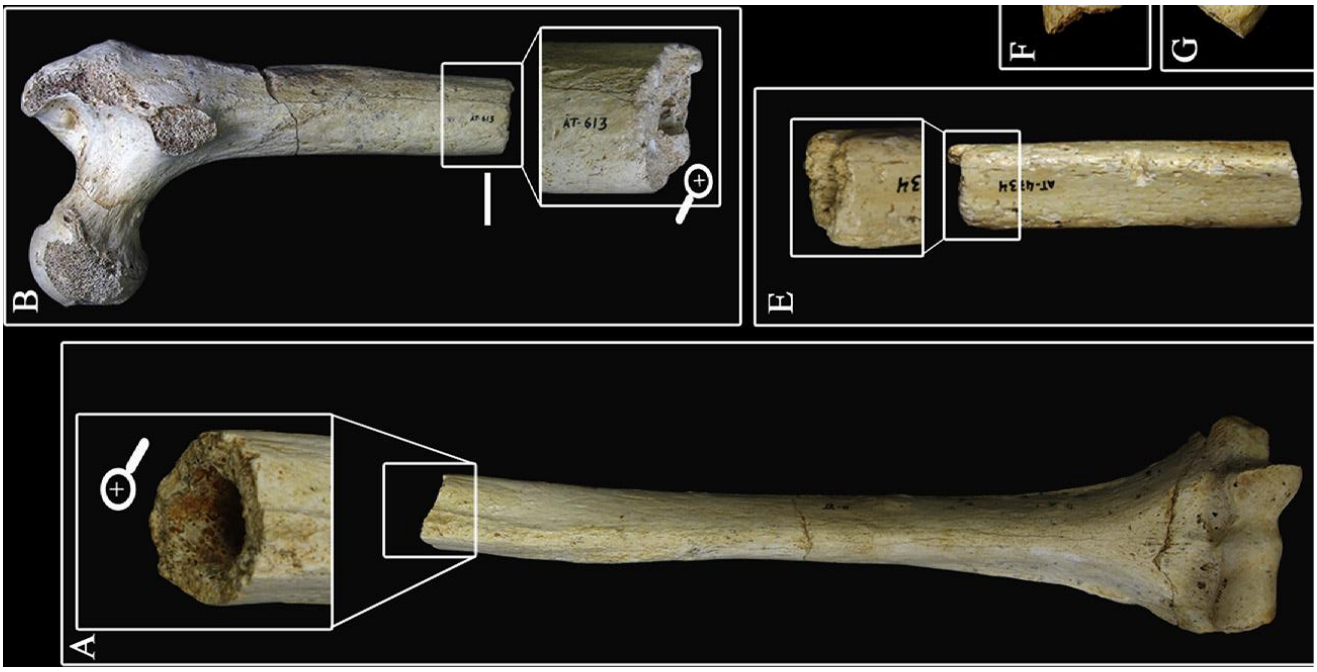
3.2. *Weathering*

Bone that is exposed to the elements (e.g., sun, wind, rain) undergoes progressive weathering (see image below)



3.3. *Postmortem Bone Breakage*

Bones are often broken when encountered by archaeologists due to natural factors such as sediment pressure. Transverse fractures with jagged fracture surfaces (see images below) are common in dry bone due. Why might this be the case?



3.4. *Burning*

Heat shrinkage fractures of a femur at the point where tissue borders the exposed bone. These fractures are concave on the tissue side (arrow).

4. Trauma

4.1. *Antemortem Nasal Fractures*

Examine the nasal bones of the skulls available in your laboratory for healed fractures. After examining them carefully, fill in the table below. Which side is more commonly affected? Is there a difference in frequency between the sexes? Do these findings match your expectations? Why or why not?

Healed fracture of the nasal bones. Notice the fracture lines and overlap of bony fragments.

Skull	Age	Sex	Left Nasal			Right Nasal			Overall		
			n	N	%	n	N	%	n	N	%
1											
2											
3											
4											
5											
TOTAL											

4.2. *Antemortem Ulna Fractures*

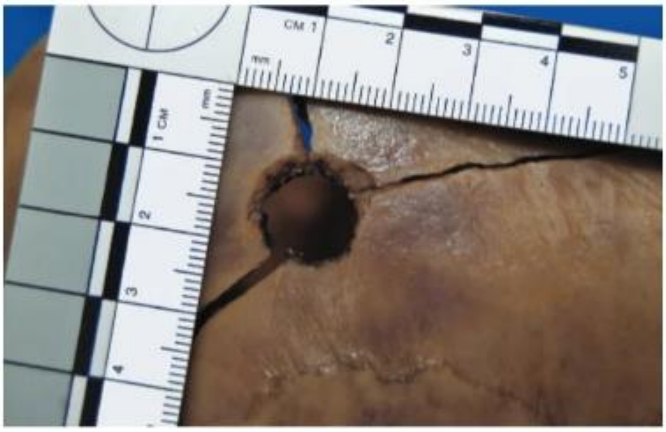
Examine the ulnas available in your laboratory for healed fractures. After examining them carefully, fill in the table below. Which side is more commonly affected? Is there a difference in frequency between the sexes? Do these findings match your expectations? Why or why not?

Healed fracture of left ulna in dry bone (A) and radiograph (B).

Ulna	Age	Sex	Left Ulna			Right Ulna		
			n	N	%	n	N	%
1								
2								
3								
4								
5								
TOTAL								

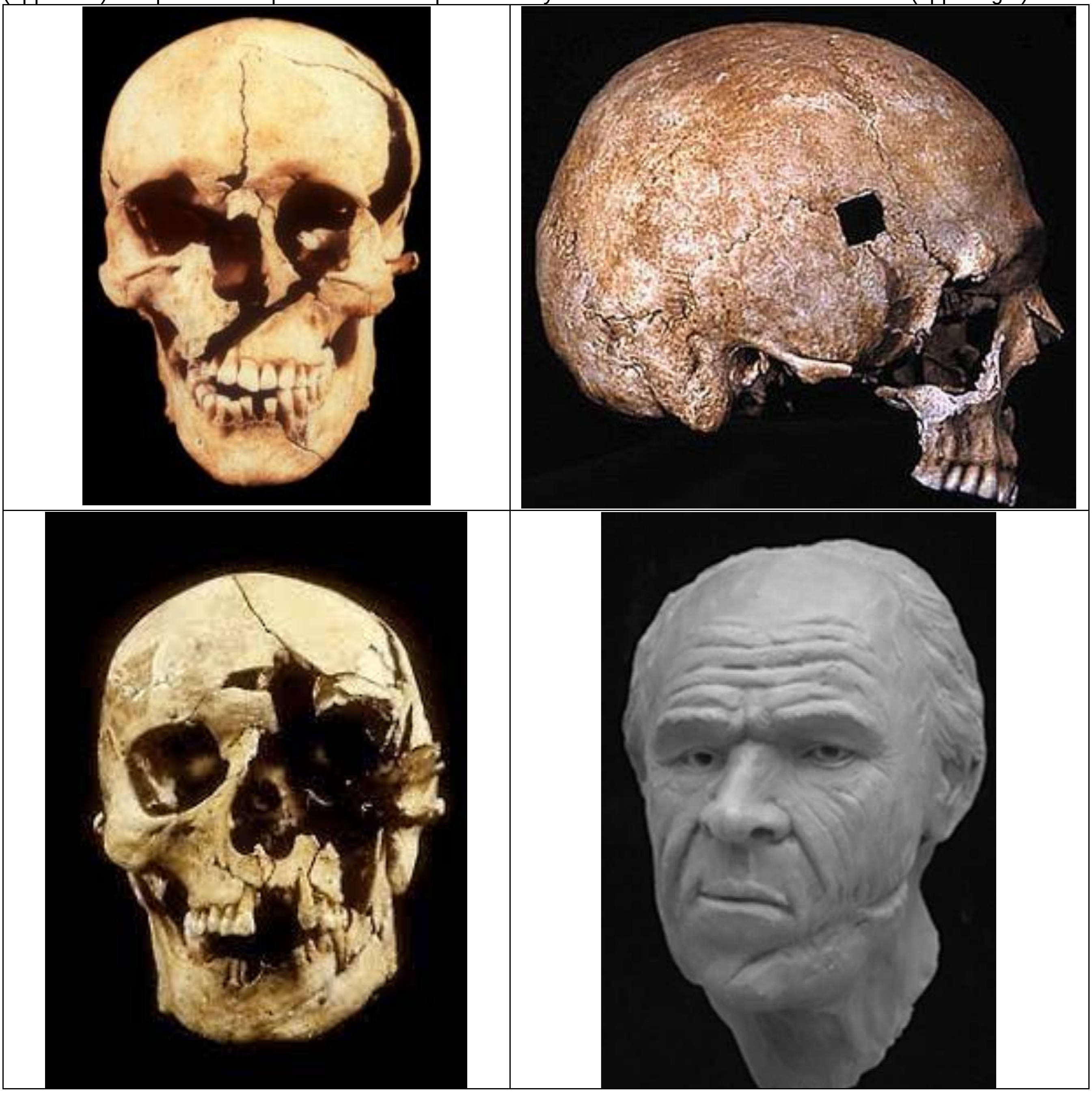
4.3. *Perimortem Gunshot Trauma*

Gunshot entry wounds (left) are smaller, rounder and have internally beveled edges compared with gunshot exit wounds (right) which have externally beveled edges.



4.4. *Medieval Weapon Wounds*

In 1996 a mass grave containing the remains of over 40 victims from the Battle of Towton were discovered. Trauma analysis revealed the weapons that had produced the numerous traumatic lesions exhibited by the skeletons, including antemortem sword trauma to the left mandible (lower images), perimortem sword injuries (upper left) and perimortem puncture trauma produced by the beak of a medieval war hammer (upper right).



5. Ancestry

Examine the skulls in the laboratory and describe the morphology of the traits listed for each.

Traits	**African American**	**Native American**
Nasal root/bridge (high or low; narrow, rounded or ridged)		
Nasal width (narrow, medium or wide)		
Nasal border (guttered or flat and sharp)		
Nasal spine (large or small)		
Facial profile (projecting, intermediate or straight)		
Facial shape (narrow, intermediate or wide)		
Zygomatic bone (projecting or receding)		
Upper incisors (shovel shaped or spatulate)		