

LAB ANSWER SHEET – Hominid Labs

DEM BONESDifferences in male & female pelvic girdles:Male

Iliac blades more nearly vertical
 Subpubic angle smaller
 Pelvic opening smaller
 Narrow sciatic notch
 Overall shape smaller/narrower

Female

Iliac blades splayed outward
 Subpubic angle larger
 Pelvic opening larger
 Wide sciatic notch
 Overall shape larger, more rounded

The differences observed in male and female pelvises relates to childbirth.

Differences in male & female skulls:Male

- | | <u>Male</u> | <u>Female</u> |
|--------------------|---|----------------------------------|
| a. Angle of jaw | Less pronounced (about 90° angle) | Sharper angle (about 125° angle) |
| b. Chin | Square | Rounded, pointed |
| c. Forehead | Sloping | Bulging |
| d. Brow ridge | More pronounced, developed | Less pronounced |
| e. Occipital bone | External occipital protuberance (bump @ back) | Smooth, no protuberance |
| f. Mastoid process | Large, sharp | Small, not as sharp |

Female

Limb bone analysis:

- Bones of the legs are *longer* and *more robust* than those of the arms (more developed due to mode of locomotion)
- **Femur** (upper leg bone – thigh bone) is longest and heaviest of limb bones
- **Tibia** (shin bone) – long bone of lower leg, the more robust of the two lower leg bones
- **Fibula** is long bone of the lower leg, not as thick/robust as femur or tibia
- **Humerus** (upper arm bone) is biggest/heaviest of arm bones
- **Radius & Ulna** are bones of the lower arm, not as thick/robust as the humerus
 - **Radius** is the bone with a flat, disk like shape at top (proximal) end
 - **Ulna** is the bone with a notch at the top (proximal) end

EARLY ANCESTORSPage 2

1. A. afarensis Age range: 3.9 – 2.9 mya; Found in East Africa

A. afarensis compared to a chimp:

- Prominent, robust brow ridges – like chimp
- Virtually no forehead – like chimp
- Small cranial capacity in relation to skull size; frontal area shows constriction
- Sagittal crest not present on lab specimen, but is present on fossil males of the species
- Occipital bone has a short, trapezoid shape – like chimp
- Wider dental arcade (shape of mouth) than chimp

- All molars are relatively large
- Canines not as sharp or prominent as a chimp's

A. africanus Age Range: 3.5 – 2.3 mya; Found in South Africa

A.africanus (compared to chimp):

- brow ridges are slightly robust
 - bit of a forehead
 - Cranial capacity; appears nearly equal to skull; more rounded braincase
 - no sagittal crest wide dental arcade
 - occipital is short & trapezoid shaped like chimp
 - wider dental arcade than chimp
 - Molars are relatively large to other teeth
 - canines are not very prominent
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- Ape-like features include lower facial prognathism, cranial shape, no forehead & heavy browridges
 - Ape-like features & behaviors exhibited by *Au. afarensis* include longer arms than legs, slightly curved finger & toe bones (indicating strong grasping ability in both). Based on anatomy, *Au. afarensis* likely spent time in trees and on the ground. Based on brain size, probably had same tool use capabilities and dietary patterns as chimps.

Page3 – Robust australopithecines

1. Features that robust australopiths have in common include wide face with flaring zygomatic arches (cheek bones). Sagittal crest with massive jaws and teeth, especially molars with wear on all teeth indicating diet of hard food items. Small brain in relation to overall skull.

Page 5 – Early Homo

Compared to *H. erectus* and *H. sapiens*

- Brain size relative to overall skull has increased, but not as much as *erectus* or *H. sapiens*
 - More of a forehead than australopith species, but only slightly & similar to *H. erectus*, but not nearly like *H. sapiens*
 - No sagittal crest on any genus *Homo* hominids
 - Occipital bone is becoming fuller, not constricted like australopiths, approaching *H. erectus* proportion, but not yet like *H. sapiens*
 - Wider cranial base indicating enlarged cranium/brain growth overall similar to *H. erectus* & *sapiens*
 - Heavy browridge like *H. erectus*, but not *H. sapiens*
 - A bit of prognathism, but not as pronounced as in australopiths, definitely becoming more similar to later *Homo* hominids
 - Dental arcade is wider like later *Homo* hominids (indicating changes to jaw structure)
 - Canines are large, but not sharp & pointed
 - Molars are decreasing in size, closer to later *Homo* hominids
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- Overall, *Homo habilis* is more human like in appearance
 - Main features that distinguish it from australopiths are more rounded and enlarged cranium, flatter face

PART TWO: Analysis and Review (Page 6)

1. Cranial/Dental differences between apes & humans (Answers will vary):

- Apes have large, sharp canines; humans do not
- Dental arcade of apes is narrow; human dental arcade is broader
- Apes have a more robust mandible with no chin; Humans have a prominent chin and less robust jaw
- Apes have pronounced lower facial prognathism; humans are flat faced
- Small cranium relative to face in apes; Large cranium relative to face in humans
- Apes lack a forehead; Humans have bulging, pronounced foreheads
- Human cranium has more vertical sides, and is more globular (rounded) in shape than apes
- Teeth are smaller, more thickly enameled in humans than in apes

2. Trends in primate order (answer will vary)
 - a) Reduced canines with wider dental arcade
 - b) Flatter face
 - c) Larger brains

3. The skull of *A. afarensis* has more ape-like than human features.
 - Jutting lower face, small cranium in relation to face, shape of dental arcade, massive jaws
 - *A. afarensis* is considered to be a hominid because it was fully bipedal, as indicated by the position of the foramen magnum

4. *Homo habilis* has a much larger, rounded braincase (front to back), flatter face, browridges still heavy, but not like a chimp's

5. Use of stone tools – allowed *Homo habilis* to obtain new food resource (meat and marrow from limb bones of prey animals); Incorporation of meat into diet – allows brain to grow bigger.

EVOLUTION OF THE GENUS HOMO – Later *Homo* hominids

Part Three – Analysis & Review (Page 3)

1. New behaviors that appeared with *Homo erectus* include the control of fire which allowed *H. erectus* to keep predators away, cook their food (making it easier to chew and digest), and to extend day time activities as well as have a source of warmth. *Homo erectus* scavenged meat, but also hunted for meat as evidenced by the animal bones found at *Homo erectus* sites.

2. Cultural/Behavioral changes led to changes in dental and cranial morphology. Cooked food makes it easier to chew so less pressure is put on the teeth to be used for food processing. This is reflected in the nearly modern looking dentition of *Homo erectus*. As *H. erectus* incorporated more meat into its diet, the brain began to grow as evidenced by a larger cranium.

3. As the video pointed out, intelligence is becoming the key adaptive strategy. *Homo erectus* was the MOST intelligent creature on the landscape in its time. It took intelligence to carefully observe and track animal activity patterns in order to exploit hunting and scavenging opportunities. Also, the use of fire allowed *Homo erectus* to dominate the landscape in a way no other hominid had before it. *Homo erectus* is the first hominid to truly start altering the world around it. As they ventured out of Africa, intelligence would be necessary to face the challenges of new environments.

BONES OF CONTENTION

Part One – Cranial Comparisons (Page 3)

Intended to familiarize you with the important differences in the crania between Neanderthals and Modern Humans (i.e. these will be important features on which to focus for the purpose of the exam)

Part Two – Postcranial Comparisons (Page 4)

- a) Limb proportions: Femurs of Neanders and *H. sapiens* are relatively similar, lower leg bones differ slightly in length with *H. sapiens* having just slightly longer tibia & fibula. Tibia and fibula of Neander a bit more robust than *H. sapiens*. Neanderthal humerus (upper arm bone) is smaller than modern humans, but more robust.

- b) Rib cage: Major difference between the two species in the rib cage, which results in a dramatic difference in stature. Neanderthals have a shorter and broader rib cage, sometimes described as being barrel chested. This is related to the fact that they had greater lung capacity which was advantageous for cold-weather living, allowing them to take in more oxygen. The Neanderthal's clavicle is also broader and extends further out from the sternum, giving them a broad shouldered appearance. *H. sapiens* have a longer more narrow rib cage with a shorter clavicle making them appear less broad in the shoulder area.

- c) Stature: Overall, the Neanders have a more robust skeleton, making them appear shorter and stockier. This body build is especially advantageous for heat conservation and is a physique common among peoples who live in extremely cold regions,

especially in high altitude areas such as the Andes Mountains in S. America or the Himalayas in Asia. *H. sapiens*, have much more gracile skeleton and far less robust cranium. Early moderns were very active, moving around a lot and required a strong, lean body build adapted for a high energy life style.

Analysis & Review (Page 4)

1. a) cranial features: The robust features of the skull go hand in hand with the robust features of the skeleton. Distinctive features of the Neander cranium such as the large nasal openings and heavy browridges are related to adaptations to the cold. Other distinctive features such as the occipital bun and the projecting mid-face are unique to this late species of hominid. By contrast, the *H. sapiens* skull has a high, dome shaped skull with nearly vertical sides and less robusticity in the cranial bones.

b) front vs. back teeth: Neanders had large front and back teeth, which were very handy for food processing despite the fact that they had rather sophisticated stone tools. Again, the larger dentition is related to the overall robusticity of the Neanderthal cranium & skeleton. By contrast, modern human dentition is comparatively smaller due to differences in the skeleton and crania, although back teeth are generally larger than front since the molars are used as our “multi-purpose” dental tool. Incisors & canines serve more specialized functions.

c) body size: On the whole, Neanderthals were shorter and stockier than the taller, leaner *H. sapiens*. These differences can be explained in terms of adaptations to different climates; the Neanderthals were supremely adapted to the harsh, Ice Age climate and *H. sapiens* much more adapted to temperate climates. In those areas where the climate was cooler, *H. sapiens* could rely on more sophisticated tools to manufacture more sophisticated clothing and shelters to shield themselves from the cold. In other words, their primary adaptations to the environment became CULTURAL, while the Neanderthals relied primarily on BIOLOGY, which may have eventually led to their demise as the Ice Age receded.

Lab Answers: Hominid Evolution in Review

1. a) Australopithecus afarensis
- b) Neanderthals
- c) Homo erectus
- d) Homo erectus
- e) Homo habilis
- f) Neanderthals
- g) Homo sapiens
- h) Homo erectus
- i). Homo habilis

Evolutionary trends in the hominid line worth reviewing:

2. a) **Brain expansion.** Most pronounced among the hominids between the australopiths and the appearance of early Homo (25% - 40% increase in cranial capacity), another big jump with *H. erectus* and finally, another major increase with the arrival of Neanderthals and modern *H. sapiens*. In each case, the increase in brain size brought along increased intelligence as expressed in the form of behaviors such as more sophisticated tools, organized hunting, use of fire, construction of shelters and eventually artistic expression.

b) **Flattening of the face.** The australopiths had very ape-like jutting jaws. Flattening of the lower face appears with *Homo habilis* and continues to the modern human condition. (Note: Neanderthals are an exception since they have a very prognathic mid-face, although this is not an ape-like feature – apes have jutting lower face).

c) **Reduction in tooth size** – Exhibited most dramatically by *Homo erectus* which has very modern like dentition, but the trend begins with *Homo habilis* and continues along the genus *Homo* line. Can be explained by the fact that the teeth are no longer as important for food processing as they have been replaced by stone tools and accompanied by other cultural innovations such as use of fire to cook and prepare food.