Laboratory 1
Primate skulls

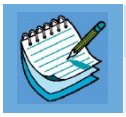
Laboratory Sessions

Date	27 January 2021 (Thursday)			
Time	1000-1200 Group 1	1200-1400 Group 2	1400-1600 Group 3	1600-1800 Group 4
Venue	Life Sciences Teaching Laboratory 3, Lee Wee Kheng Building, Block S1A, Level 4			

Safety Requirements

1. You are required to put on **close-toed** footwear. **You will not be allowed to enter the laboratory if you are wearing sandals, slippers or any other open-toed footwear**.
2. You are also required to wear pants that **cover your legs**. **You will also not be allowed to enter the laboratory if you are wearing shorts, including bermuda shorts or skirt**.

Key Personnel



1. Teaching Assistant – Ms Law Sze Joo Sylvia (dbslsjs@nus.edu.sg)
2. Laboratory Officer – Ms Chua Ling Lih (dbscll@nus.edu.sg)

Attendance

1. Please be **punctual**. **You will not be allowed to enter the laboratory if you arrive later than 5 minutes after the time the laboratory session is scheduled to begin**.
2. Please ensure that your attendance is marked. Failure to do so will result in a **50% penalty**.
3. Please attend the group that you have been allocated to. For logistical reasons, you will not be allowed to make an **arbitrary switch** to another group
4. If you are unable to attend the session due to illness or compassionate reasons, please **contact the Teaching Assistant** as soon as possible. Please ensure that you produce an acceptable official documentation, e.g. doctor's letter, relative's death certificate, etc. Under such circumstances, the weightage of the laboratory assignment will be evenly distributed to the other components of the continuous assessment (CA).

ASSIGNMENT

Weightage	5%
Deadline	**2359hrs, 3rd February 2022**
Missed Deadline	**No marks**

INSTRUCTIONS

1. Please download the file named '**Laboratory Assignment 1.docx**' from the '*Handouts for tutorial/practicals'* in the subfolder *'Lab - Primate skulls'*.
2. Before submission, please rename your file according to the following format, **NUSNET ID-lab01**. If your NUSNET ID is *e0234567*, the filename should be *e0234567-lab01*. Files that are not renamed according to the stated format will be subjected to a **10% penalty**. Upload to *'Lab I -Primate skulls'*.

3. Please note that marking **will not** be based on **keywords alone** but will also depend on how the explanations and descriptions are expressed.

INTENDED LEARNING OUTCOMES

The main aims of this assignment are to identify the anatomy and their function of extant great apes. At the end of this laboratory session, you must be able to (1) identify the morphological similarities and differences between chimpanzee and human skulls, (2) know the function of identified morphological structures, (3) identify intermediate morphological characters in fossil hominid skulls, and (4) compare anatomical characters in hominid skulls and suggest the function for these characters. All the best and have fun!

INTRODUCTION

This assignment will offer you an opportunity to understand anatomical features and correlate these with their functions. In addition, it will also introduce you to one of the methods scientists employ to understand evolution and evolutionary processes. You will examine skull casts of some extant and extinct primates to understand morphological changes over time. In examining the osteological features of an extant organism, and correlating these forms to functions and behaviour in the species, you will be able to form educated postulations for extinct species. You are to observe changes in skull structures and discuss how these changes affect the functions of these structures over time. Correlate these clues with what you know/understand of behavioural aspects of these organisms, postulating on extinct species based on your understanding of extant ones.

PART I: CHIMPANZEE AND HUMAN SKULLS

The order Primates is defined by Linnaeus in 1758, and consists of over 400 species. Monkeys, great apes and humans belong to this order. There are great variations within this order, for example in size (from the small mouse lemurs to the gorillas), morphology (presence and absence of prehensile tails and opposable thumbs) and behaviour (arboreal or terrestrial).

Within this order is the family Hominidae that comprises all extant great apes and several extinct species. The genome of two of the extant species, chimpanzees and humans, have been cited in scientific studies to be similar. The percentages vary from 96% to 99% depending on the genes in question and if events such as substitutions within the genes are considered. Scientists also use morphology to study the differences and similarities. Osteology is the study of bones and skeletal structures, and has been used to understand fossil skulls and skeletons.

In this practical session, you will be examining casts of skulls of some primates. Casts skulls are copies of real ones. From the real skulls, moulds are made. A liquid then poured into the mould. Upon solidifying, it takes on the shape and character of the mould. Casts are available in varying quality; the degree of incorporated detail depends largely on its cost. The skull casts you are about to examine were purchased from one of the best manufacturers and are considerably expensive. Please exercise care when handling them. If you wish to compare the cast to the real skulls, please approach your teaching assistants at the end of the laboratory session. We have two real human skulls that you can examine to observe the differences between real and cast skulls.

Casts are made from moulds of real skulls. Exercise care when handling these skulls.

TASKS

1. Working as a group, take 15 minutes to examine the casts of skulls (henceforth 'skulls') of two extant primate species from the family Hominidae; *Pan troglodytes* (chimpanzee) and *Homo sapiens* (human). All members of the group should be allowed the opportunity to examine the skulls closely.
   Please maintain adequate safe distancing at all times.
2. Compare these skulls and identify differences in their morphological features. Do not worry about using the correct terminology at first. The teaching assistant will help with the correct terminology during the discussion.
3. Take measurements if you feel that this will help you in your discussions.
4. Individually, make a list of the differences that you have discussed.
5. With the help of the teaching assistant, discuss the significance of the morphological features that you have identified, as well as their functions.
6. Suggest how these characters may relate to observed behaviour/ecology of the species.

PART II: SKULLS OF THREE EXTINCT HOMINID SPECIES

You will now examine the skull casts of three extinct species of hominid primates: *Paranthropus boisei*, *Homo ergaster*, and *Homo neanderthalensis*.

Paranthropus boisei (Leakey, 1959)

This species lived from 2.3 to 1.2 million years ago (mya) in eastern African grassland habitats. The brain volume of this species is considered small at 500 to 550 cm^3. There is a distinct variation in height and weight between males and females. Items found in the vicinity of excavation sites imply the use of stone tools. Skull structure suggests that they feed primarily on hard vegetative matter but minor dental abrasions suggest that they did not do so all the time.

Homo ergaster Groves and Mazák, 1975

This is a tall and slender species that lived from 1.9 to 1.5 million years ago in Africa and Eurasia. The specific epithet 'ergaster' means 'workman', given because large stone tools were found near some of its fossils.

Homo neanderthalensis (King, 1864)

This species lived from 200,000 to 28,000 years ago in Europe and some parts of Asia. The brain volume of this species is larger than humans. They are believed to have used sophisticated tools, built shelters, hunted large animals and made and wore clothing. Evidence found at some excavation sites have led scientists to believe that this species performed and participated in symbolic events such as burial of the dead.

TASKS

7. Examine the skulls of the three extinct species of hominid primates.
8. Concentrate on the structures you have identified to be different when comparing the chimpanzee and human skulls.
9. Are these characters absent, present, intermediate, or cannot be determined, in the latter three species?

QUESTION

1. State six morphological structures you have observed when comparing all the skulls in the table provided in the answer sheet. For each species, include the character state (absent or present) of the structures you observed. If these structures are intermediate or cannot be determined, do note them as such. Next, comment on the adaptive significance of at least 3 characters.

PART III: SKULLS OF OTHER EXTINCT HOMINID SPECIES

Please refer to the remaining primate hominid skulls on display (includes *Paranthropus robustus*, *Homo habilis*, *Homo erectus*, *Homo heidelbergensis*, *Homo sapiens* 'Cro-Magnon' and *Gorilla gorilla*). How do you describe the state of morphological structures used in Parts I and II for these skulls? Observe these characters to gain a holistic appreciation of evolution of specific anatomical structures over time and between species.

In constructing evolutionary trees, scientists use many more characters in addition to skulls; bones from other parts of bodies, information from DNA if possible and other information pertaining to the behaviour of these species. Scientists are also able to glimpse into the behaviour of extinct hominids by studying the area where fossilized bones are uncovered – and may find tools, contraptions and utensils. They also may find evidence of fire, and bones of animals that were hunted and consumed.

Each phylogenetic tree is a hypothesis based on current evidence. These hypotheses may change when new information is recovered. Study the suggested tree of hominid evolution. Hominid evolution is not linear. Realize that each character you have identified today can occur in various species in varying degrees in the evolutionary tree.

SUPPLEMENTARY FURTHER READING

http://humanorigins.si.edu/evidence/human-fossils/species

https://australianmuseum.net.au/human-evolution

http://www.nhm.ac.uk/discover/human-evolution.html