

Skull Lab  
Honors Biology

Human evolution is the study of the family Hominidae — the family of man-like primates. Every member of this family is referred to as a hominid, including human beings. The following exercise is given to applicants for a summer internship program to work with a paleoanthropologist. In order to obtain the summer internship, you have been asked to interpret features of fossils in order to make judgments about where a given fossil-form lies in the hominid family tree. Features critical to inclusion in the hominid tree are tooth structure; evidence of bipedalism or upright walking and skull morphology. Be sure that you understand how to use these features to help identify various skulls.

The application exercise consists of taking measurements and observations of 12 various skull casts, identifying the skulls and correctly placing them on a family tree. You will have only three days to view the skulls. You will work with a partner during this exercise. You do not have to agree with your partner on their observations and interpretations.

On the first day of this lab, you should research the various hominids listed below. Gather as much information about each species as you can. You will receive descriptions of each hominid on the second day of this lab. Your first task is to identify, based on the descriptions given to you, the correct hominid. You should then match the hominid to the correct skull. Each skull has a letter associated with it. Write the letter of the appropriate skull that fits the description on your sheet. While observing the skulls on day 2, you should make observations on each skull. Look for any trends in the skulls. After you have correctly identified all 12 skulls, construct a family tree for your skulls. Provide an explanation of the placement of your skulls on your family tree. Do you have any trends that were obvious while you viewed the skulls? If so explain what these trends were and how they helped you construct your family tree.

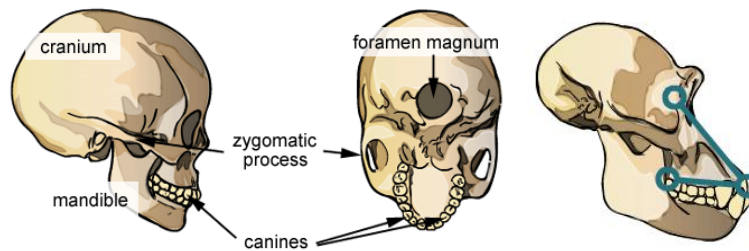
List of Hominids: *H. neanderthalensis*, *A. africanus*, *Homo heidelbergensis*, *Homo sapien cro-magnon*, *P. boisei*, *Homo erectus*, *Homo rudolfensis*, *P. aethiopicus*, *A. afarensis*, *Homo habilis*, *P. robustus*, *Homo sapien sapiens*

Sites that may be useful in your research:

<http://www.anth.ucsb.edu/projects/human/#>  
<http://www.archaeologyinfo.com/skullpage.htm>  
[http://www.pbs.org/wgbh/nova/neanderthals/skul\\_vrs.html](http://www.pbs.org/wgbh/nova/neanderthals/skul_vrs.html)  
<http://www.gwc.maricopa.edu/class/bio201/skull/infskul.htm>  
<http://www.talkorigins.org/faqs/homs/>  
<http://www.pbs.org/wgbh/aso/tryit/evolution/>

Of all the hominid fossils that scientists have found, the skulls are the richest in information. Skulls have changed dramatically in size and shape during our evolution, and give clues about how our ancestors ate and behaved. To describe and measure skulls, it is important to become familiar with a few anatomical features. The cranium encases the brain. The zygomatic processes

are arches that run from the cheeks to the cranium. The jaw is composed of the upper jaw (maxilla) and lower jaw (mandible). There are three categories of teeth. The four front teeth are called incisors, the pointed teeth behind these are canines, and the remaining teeth are molars (the fifth molar is commonly called a wisdom tooth). The foramen magnum is an opening for the spinal cord at the base of the skull.



Many aspects of a skull can be measured. Some of the most useful are seen from the side.

Place one end of the ruler on the ridge of bone above the eyes (brow ridge) and the other on the point where the mandible meets the cranium. You have divided the skull into two parts, the cranium and the face.

Divide the cranium area by the face area, and record as the cranium/face area ratio. This ratio is indicative of how large the braincase is relative to the face.

In some hominids, the face projects forward at an angle. To measure this, place the vertex of the protractor at the tip of the maxilla where the front incisors insert, as shown above. Place one ray on the base of the last molar, and the other ray on the bridge of the nose.

Other interesting measurements can be made on the bottom view of the skull. Identify the two large canine teeth and the back molars. Use the ruler to measure the distance between the two canine teeth and the two molars. What is the ratio of the two distances? This ratio can be used to compare the shape of the jaw.

The location of the foramen magnum can indicate how upright the hominid stood. When walking on all fours, it is an advantage to have the foramen magnum located at the back of the skull. With an upright posture, it is an advantage to have a foramen magnum tucked below the skull. Locate the center of the foramen magnum. Measure and record the distance between the center of the foramen magnum and the back of the skull, and from the center of the foramen magnum to the front incisors. Divide the first value by the second and record as the foramen magnum ratio.

Locate the two zygomatic processes. The muscles that move the lower jaw must pass through the gaps between the zygomatic processes and the skull. Although these muscles are not preserved in fossilization, their size can be inferred from the size of the gap. Measure the area between the zygomatic arch and the skull, and record as the zygomatic area.

Other possible measurements or observations that can be made.

sagittal crest, skull attachment position, cranial breadth, cranial length, cranial index, facial breadth, skull proportion index, facial projection index, facial projection length, skull length, brow ridges