Human Evolution

Contents

Objectives

- To collect data from biological organisms.
- To be able to assess the data collected for comparative purposes
- To construct a phylogenetic tree using the data collected.

Introduction

One of the methods of analysis biologists use to suggest evolutionary relationships is a comparison of the similarity of physical traits. This method, called cladistics, considers organisms which share similar traits to be more closely related than organisms which share few similar traits.

In this lab simulation you will be examining the skulls of modern organisms believed to be related to humans as well as fossilized skulls of organisms believed to be ancestral to modern humans. By determining similarities and differences in these skulls, you are to propose a possible phylogeny or evolutionary family tree for humans.

There are 9 skulls to be considered in this analysis: Homo sapiens (modern humans), modern chimpanzee, modern gorilla, fossil H. sapiens neanderthal, fossil H. erectus, fossil H. habilis, fossil Australopithecus africanus, fossil A. afarensis, and fossil A. boisei. The skulls in this simulation are all pictured to the same scale.

Activity 17.1
Data Collection

Open the Human Evolution simulation located in the Genetics and Evolution section of the BiologyOne DVD. After the title screen, the first screen of this simulation shows the 9 skulls to be studied. Clicking on a skull will take you to a second screen with the skull ready for measurements. The gray buttons at the lower right will rotate the skull left or right. The small picture of the skull at the lower right will toggle the skull between a frontal view and a view from below the skull.

In the upper left of the screen are buttons that will open either a vertical or horizontal ruler on the screen. The rulers can be moved around the screen by clicking on them and dragging the ruler. To remove the ruler from the screen, click on the ruler button again. The 'C' button opens a calculator on the screen if needed.

In the lower left of the screen is the species name of the skull you are presently viewing and a button to return you to the first menu screen of the simulation.

For each skull complete the following observations and measurements. Place your observations and data into the table in the Results Section. If you are unable to collect data for a particular characteristic for a skull, mark that skull 'N/A' in the table.

Characteristics

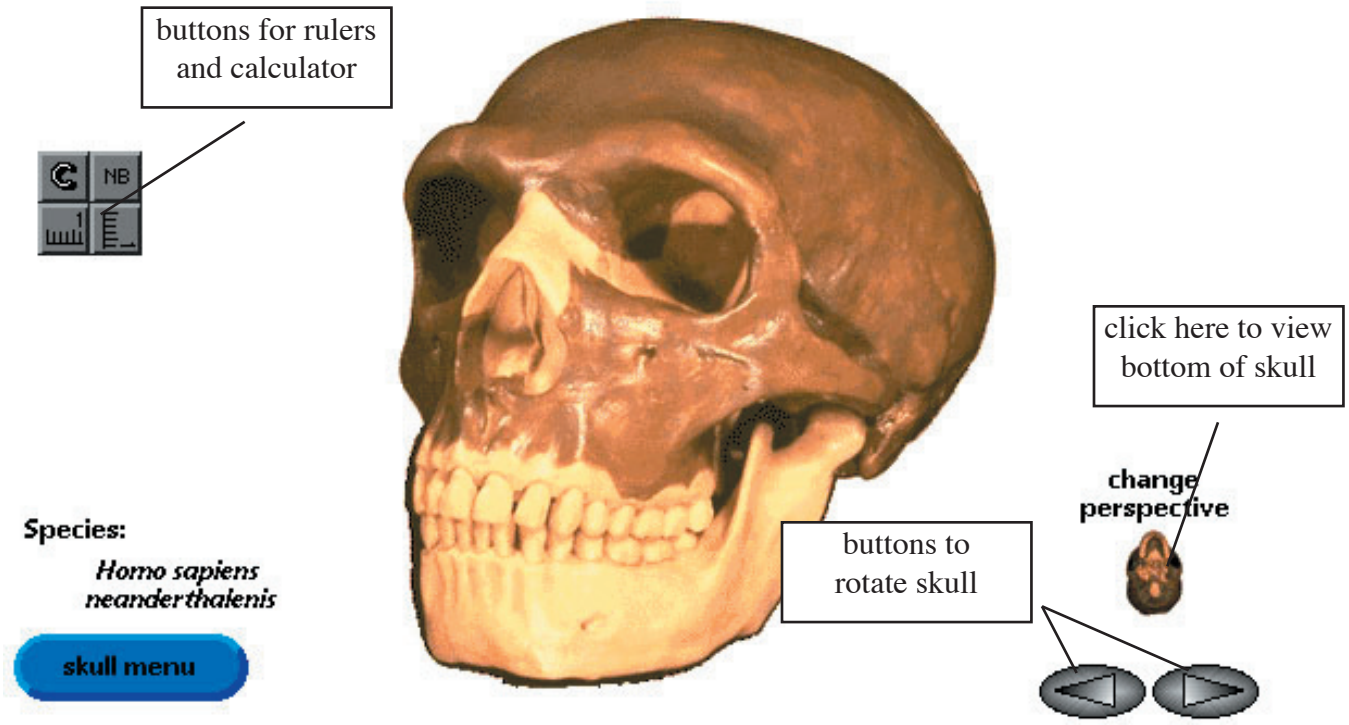
Forehead: Does the skull extend vertically above the eyes or does it immediately slope back. If a forehead is present, measure and record the forehead height.

Sagittal crest: A sagittal crest is a bony ridge along the top of the skull. Is there a sagittal crest on the skull? If so, rank how pronounced it is relative to the other skulls.

Prognathism: Protnathism is the presence of a muzzle or snout, a protrusion of the face below the eyes. What is the relative prognathism of each skull relative to the others?

Facial slope: You can determine the slope of the face by dropping a vertical line from the eyes (you can place the

Simulation Screen for Skull Measurements



vertical ruler here) and then measure the distance from that line to the front teeth (using the horizontal ruler). You could just use this measurement as an indicator of facial slope or if you want you could calculate the angle of slope.

Supraorbital browridge: This is the bony ridge protruding above the eyes. If a browridge is present, measure its thickness at the thickness point.

Chin: On some of the skulls you can observe the chin, in others the chin is absent. If a chin is present, is it vertical or does it slope away from the skull or back toward the skull?

Number of teeth: How many teeth are present in the upper jaw.

Dental arcade: This refers to the shape of the jaw. When viewed from below the jaw may be box shaped with the sides parallel, an intermediate 'V' shape, or 'U' shaped.

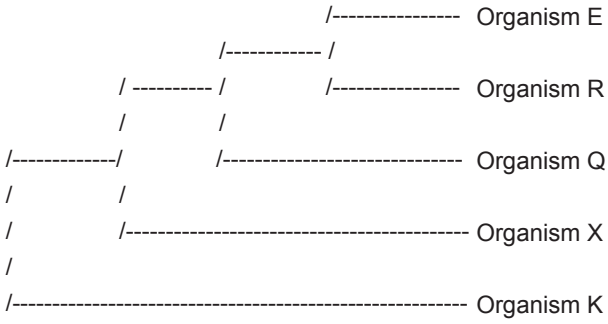
Canines: These are the third teeth from the center of the upper and lower jaw. Describe the canines. How long are they? Are they sharp or rounded?

Diastema: This is a gap in the teeth between the incisors and the canine teeth in the upper jaw. Is a diastema present? What is its size?

Cranial module: This provides a rough estimate of the skull's size. It is calculated from the skull's length, breadth and height. The skull's length is measured from the most forward point of the forehead to the most posterior point at the back of the skull. The skull's breadth is the skull's widest point at the level of the temples. The skull's height is measured from the base of the skull (not the face) to the top of the skull. If a sagittal crest is present, measure to the base of the sagittal crest. Cranial module is calculated from: (length + breadth + height)/3.

From the data and observations in this table, construct a branching tree to illustrate the relationships between these organisms. An example of a phylogenetic tree for several hypothetical organisms is shown below. Be prepared to justify your tree using the data you've collected.

Example of Phylogenetic Tree



Name _____

Results Section

Activity 17.1
Data Collection

Data Table

	forehead	sagittal crest	prognathism	facial slope	browridge	chin	# of teeth	dental archade	canines	diastema	cranial module
Homo sapiens											
chimpanzee											
gorilla											
H. sapiens neanderthal											
H. erectus											
H. habilis											
A. africanus											
A. afrensis											
A. boisei											

Activity 17.2
Phylogenetic Tree

In the space below diagram the phylogenetic tree you propose based on the skull data you collected.