

CHRONOLOGY LAB

by Larry Flammer

SYNOPSIS

Students plot the times of existence for the several species of hominins (formerly "hominids") on a two-dimensional time line chart. Can be expanded to include new discoveries, and relative divergence of ape lines.

CONCEPTS

1. Different hominin species came and went over different periods of time over the past 4-5 million years, often with 2-3 species living at the same period of time and in the same general part of the world.
2. A provisional evolutionary tree of hominins may be constructed easily from the array, but still with areas of considerable uncertainty.
3. When used with the matching array of skulls, the gradual changes toward modern humans is inescapable.
4. In concert with other, independent lines of evidence of human evolution, this shows how science can build confidence in a particular explanation (namely: humans have clearly evolved).

MATERIALS

1. Directions sheet, with list of species and their ages
2. Time scale sheet
3. Keys for overhead projection (completed Time Scale sheet)

STUDENT HANDOUTS

1. Directions sheet, with list of species and their ages
2. Time scale sheet

TEACHING STRATEGY

1. This is best done as an adjunct to the "Skulls" lab (Hominoid Cranium Comparison), probably as a homework assignment during or after the skulls have been studied and discussed.
2. It helps greatly if you can briefly show how to start marking the time ranges on the time line (using overhead) as per directions, and even give them a quick glance at the finished product, just to give them the idea.
3. When the students have finished (next day?), have them check their work by looking at the projected image of a completed chart. Then, show them how the "existence" range lines can be connected with gently curving dashed lines (see key, part 2), using an overhead marking pen, producing a provisional evolutionary tree.

THE CHANGING CHRONOLOGY: The data provided on the Directions sheet were essentially accurate prior to 2001, taking the chronology back nearly 5 million years. However, "science marches on." Don't miss this opportunity to show how more recent data have changed the picture, that even fossil studies are very dynamic! After showing and discussing the results, show what the results would look like with more recent data, taking us back to around 6 million years ago, plus new fossils and new interpretations of those data. Use the **"2002 results chart, #1"** and then some of the provisional connections shown on the **"2002 results chart #2"**. If you want your students to actually DO the "2002" version, provide them with the more recent discoveries (along with the original table) and the **"2002 - 6mya blank chart"**. Furthermore, you may want to have them check to see what has been discovered more recently, and to add those discoveries to the chart.

VISUAL ENHANCEMENT: A suggestion by 6th grade science teacher Karen Maor was to paste or tape little pictures of the skulls next to the names of each hominin. Such pictures are available from various sources online, including the collection of scale photos on our site of a sampling of six hominin skulls, each shown in 4 different views. The side (profile) view would probably be best to use. If you do use these, you should reduce them considerably to about 2x3 or smaller size. Or, if you make a classroom-size Chronology, you could use the larger photos.

4. As an example of the uncertainty in science, be sure to show a few alternative "pathways" to connect some of the fossil ranges, using additional dashed/dotted lines, and some question marks. You can also ask what differences we might expect to find in the hominin fossils which could be found between the selected ones we have (intermediate or transitional features), and where we might look for such fossils to test those hypotheses (in sediments or ash deposits of that particular age, in that part of the world). Doing this provides an excellent example of how we can make testable predictions about events of the past, which could be reasonably confirmed by subsequent discoveries.

UPDATE: For a very nice chronology which reflects several more recent finds, take a look at the article in *The American Biology Teacher* 65(5) May 2003, pages 333-339: "Teaching Human Evolution" by DL Alles and JC Stevenson. The article actually has virtually NO teaching ideas, but it does have a nice summary of the current state and interpretation of the subject, along with an excellent chronology diagram, suitable for use on an overhead, or for a class handout.

5. Point out (ask) "how many different species lived..." at selected periods of time. For example, at 1.8 mya, there were 4 different species of hominins living (all in Africa).

6. It is interesting to point out that ALL of the fossils older than about 20,000 years were found ONLY in the old world (Africa, Europe, and Asia), never in the Americas.

7. Take a look at the very nice online interactive chronology, "The Origins of Humankind", with built in details of specific fossils, and a plausible "tree" can be found on the PBS/WGBH-

Evolution web site. This was developed in mid 2001, so it has a number of the new fossils and species found since the present lesson was posted (1998).

8. Early Human Phylogeny: Click on the branches of this family tree to learn more about different species of hominins and the scientists who discovered their fossils. If you click on the red question marks, you can find out why some branches of the family tree are still debated.

9. Becoming Human: This interactive documentary about human origins is worth an hour of your time, but if you're in class and you're looking for specific information, jump to "Becoming Human: The Documentary." Then select "Lineages" from the menu at the top. Move your cursor to the bottom of the screen, and a menu will pop up. Click on "The Human Family Tree" (or go directly to "The Human Family Tree") and then on the three theories to see alternative versions of the human family tree. You also may want to read the hominin profiles.

10. Since this lesson was developed and placed on this site, hundreds of new hominin fossils of these and several new species have been found. Take a look at the summary commentary of these Major Recent Developments (based on an article in the 6 March 2002 Science), along with a revised chronology diagram reflecting this new material.

11. See a very nice new provisional phylogeny which includes the recent discoveries along with profile drawings of the skulls of each species. It also shows the time spans for the main artifact traditions. This is a one-page PDF file, posted here 10 March 2003, with the kind permission of its source, Dr. Richard Klein, Prof. of Anthropology at Stanford University.

12. A very useful extension and/or alternative to the Chronology Lab or the Skulls Lab is the approach developed by Jeremy DeSilva at the Boston Museum of Natural History: HUMAN EVOLUTION: INTERPRETING THE EVIDENCE. This was featured in the American Biology Teacher journal, April 2004. It is structured around the comparison of three different interpretations by 3 different anthropologists in how known hominin fossils are related to each other. Students become involved in reviewing their criteria and assumptions, and defending their own interpretations. An excellent experience in the process of science, including uncertainty, bias, assumptions, and controversy amongst scientists. Website includes full text of article and diagrams (3 full page provisional phylogenies, easily compared as transparencies, or handouts for students.)

13. Return to the "Skulls" lab (Hominoid Cranium Comparison) for further discussion and integration of the chronology info with the array of skulls.