HOMINID CHRONOLOGY
QUESTIONS ADDRESSING POPULAR MYTHS
(Use one or more of these to include in the "Test Your Knowledge" set of questions)

Q. What was the relationship between dinosaurs and early humans? [E]
A) early people domesticated and trained some dinosaurs
B) dinosaurs were a constant threat to people
C) dinosaurs were around, but rarely seen, since they were dying out
D) humans appeared shortly after dinosaurs became extinct
E) the last of the dinosaurs died out more than 60 million years before people appeared

Q2 Dinosaurs lived during the time of early man.  [False]
Q3 Early human fossils are very rare, and appear to be randomly scattered over the past several thousand years. [False]
Q4 The fossils of early humans suggest a clear linear sequence, with each new species replacing the previous species.  [False]

TUTORIAL

A. THE BIG IDEA: Hominid fossils reveal clusters of traits, showing gradual change through time.

B. BACKGROUND:
If you have NOT done the comparison of hominoid skulls activity, then you should DO it first.
[Link to Tutorial for Comparison of Hominoid Skulls]
If you HAVE done the comparison of hominoid skulls activity, you might wonder WHEN each species of hominid lived. In addition, it would be useful to see if there is any pattern in their time spans of existence, and if so, to see how that pattern compares with the pattern of accumulated changes found in the sequence of skulls.
It turns out that most hominid fossils can be dated, usually from their context above or below layers of datable volcanic ash or lava flows, or from the ages of accompanying fossils of other animals which have been dated elsewhere in like fashion.
It also turns out that typically, the fossils for a particular hominid species begin to appear at a particular time, may be found in subsequent sediments covering perhaps several hundred thousand years, then no longer appear in the sediments; in other words, each species eventually becomes extinct.

C. THE ACTIVITY: “Chronology of Fossil Hominids” [Link to the Activity, Screen 1]

D. RESOURCES:
1. ENSIweb is an online resource which provides detailed classroom-tested lesson plans with reproducible handouts and expected outcomes. The interactive activity presented here is based on one of those lessons: “Chronology Lab”: <http://www.indiana.edu/~ensiweb/lessons/chronlab.html>

THE ACTIVITY

SCREEN 1A

CHRONOLOGY OF FOSSIL HOMINIDS

In the following screen, you will find a horizontal time scale, running left to right, from 5 million years ago (5 my) on the left, to the present on the right. A series of equally spaced vertical lines spans that space, with each vertical line representing 200,000 years (or 0.2 my). (Think of the screen as a football field, with the "yardlines" being 0.2 my years apart instead of 10 yards.)

You will also find, across the bottom of the screen, a collection of "hominid time bars", with each bar representing all the fossils and other evidence of one hominid species. The left end of each bar represents the earliest time fossils for that species were found, and the right end represents the time when that species apparently became extinct (no more fossils found after that time). Each bar is "labeled" with a small skull profile of the hominid it represents, and the name of that species.
Your mission is to click on each hominid time bar, drag it onto the time scale "football field", and move it to its proper position in time. When you think you've got it, drop it. If you've got it, it will stay there. If not, it will snap back to the "bar box", and you can try it again. If you want a clue, like "when did it first appear?" or "when did it go extinct?", then double click on the bar.

Repeat for all hominid time bars, until they are all aligned in their proper chronological order. When this is done, you may find that many of them overlap a bit, so click on them and drag them a short distance apart vertically (about 1 cm). While doing this, try to build a staggered progression for the adjacent species that seem to be most similar, so that each successive species in what seems to be a series is slightly higher than the previous. To do this most effectively, it helps to place the oldest bar (Ardipithecus ramidus) near the bottom of the chart, then build up and to the right with the others. For any species which seem to be very different, move them in the opposite direction (down), away from general trend.

When you are satisfied, click "DONE".

HOT LINKS FOR BUILDING FOSSIL HOMINIDS CHART

Information to provide for each species when its bar is double-clicked:

<table>
<thead>
<tr>
<th>Species</th>
<th>Date Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ardipithecus ramidus</td>
<td>4.6 my - 4.2 my</td>
</tr>
<tr>
<td>Australopithecus anamensis</td>
<td>4.5 my - 3.9 my</td>
</tr>
<tr>
<td>Australopithecus afarensis</td>
<td>3.9 my - 3.0 my</td>
</tr>
<tr>
<td>Australopithecus africanus</td>
<td>3.0 my - 2.3 my</td>
</tr>
<tr>
<td>Australopithecus robustus</td>
<td>2.0 my - 1.5 my</td>
</tr>
<tr>
<td>Australopithecus boisei</td>
<td>1.8 my - 1.4 my</td>
</tr>
<tr>
<td>Homo habilis</td>
<td>2.5 my - 1.8 my</td>
</tr>
<tr>
<td>Homo ergaster / Homo erectus</td>
<td>1.8 my - 0.3 my</td>
</tr>
<tr>
<td>Archaic Homo sapiens</td>
<td>0.7 my - 0.25 my</td>
</tr>
<tr>
<td>Neandertal</td>
<td>0.125 my - 0.03 my</td>
</tr>
<tr>
<td>Modern Homo sapiens</td>
<td>0.120 my - present</td>
</tr>
</tbody>
</table>

PROGRAMMING NOTES:
Use the following "Key" chart as a guide to proper placement in time for each bar. The vertical placement is not critical initially. Once all bars are placed in their proper time ranges, user should be able to shift each bar up or down (vertically) with respect to other bars, as long as it stays in its proper time range (left to right).

User should be able to toggle back and forth between the chart done interactively and this one, then eventually go on to the Check Questions when desired.

Also provide button for user to toggle back between this screen and the Check Questions, OR, Even better, place each Check Question in turn just below this Chart, so Chart can be seen while reading and responding to the Question (and reading the response).
1. Notice that as fossils have been found, they seem to fall into discrete groups, each somewhat different from those adjacent, sufficiently so that they are given different species names. Sometimes this is not easy, since fossils may show a mix of characteristics of one or two other groups.
   A) This creates a problem for human evolution, suggesting that we may be looking at something else.
   B) This is exactly what we would expect if early humans gradually changed over time, eventually forming new species.

2. Notice that in most cases, the beginning of one species overlaps the extinction time of another, sometimes with considerable overlap. At about what point in time were there apparently 4 different hominid species living at the same time (in Africa)? ____ million years ago.

3. When you compare the chronological sequence of hominids with the sequence of hominid skulls used in the "Skulls Lab" (roughly by size), what pattern presents itself most clearly?
   A) the earliest hominids had the smallest skulls, which increased in size over time
   B) large brain size (skull size) was reached very early, and remained large over time
   C) brain size stayed small throughout the series, until the appearance of Homo sapiens
   D) there was no particular pattern seen

4. Given the chronology we've developed for the several hominid species, and the general mechanism of evolution, what sort of connections could we infer between those species?
   A) Each species appeared suddenly, in no way connected to the previous species
   B) Each species developed gradually at some point from the previous species
   C) Each species arose as the previous species died out, therefore replacing the previous species
   D) All the species appeared suddenly at the same time

5. When we make those connections, the history of human evolution appears to be most like...
   A) a ladder of successive species
   B) a branching tree of new species
   C) a sudden appearance of modern humans, without any apparent predecessors
   D) a jumble of species, all appearing at about the same time.

6. Where is the most significant gap in the record, the time frame where we should search for hominid fossils to fill the gap?
   A) 3.9 mya;  B) 3.0 mya;  C) 1.8 mya;  D) 0.2 mya

7. If hominid fossils were found for that time slot, in which genus would they most likely be placed (based on their characteristics)?
   A) Ardipithecus
   B) Australopithecus
   C) Homo
   D) some new genus
   E) no way to predict

8. Why are all the fossils of a particular species placed in that species, even when they may be found at different times?
   A) They posess the same or very similar characteristics
   B) They are of about the same age
   C) They are found in the same area
   D) All the above
ANSWERS TO QUESTIONS, WITH APPROPRIATE REPLIES

1. If reply is A, respond: "Not at all"
   If reply is B, respond: "Very perceptive...you've got the idea"

2. If reply is 1.8, respond: "Perfect"
   If reply is other than "1.8", respond: "Take a closer look; where do 4 time bars all touch the same time line?"

3. If reply is A, respond: "Good eye...that's it"
   If reply is other than A, respond: "Take a closer look; remember, the skulls were sequenced from smallest to largest, approximately in the same order as you've found in your chronology. Try again."

4. If reply is B, respond: "This IS the most logical conclusion. Congratulations!"
   If reply is A, respond: "When we find that each new species is very similar to the immediately previous species, this suggests a biological connection. Try again."
   If reply is C, respond: "Notice that there are several cases where the previous species continues to exist well into the time range of the next species to appear. Try again."
   If reply is D, respond: "Not at all...take another look at the chart! Try again."

5. If reply is B, respond: "Excellent"
   If reply is other than B, respond: "Take a closer look, and try again"

6. If reply is D, respond: "You've found the gap. Nice going"
   If reply is other than D, respond: "A gap would be where no time bar touches a vertical line, or any other point in time. Try again"

7. If reply is C, respond: "You are a true Homo sapiens, a 'person with wisdom'. Very good."
   If reply is other than C, respond: "Notice what the genus name is for the species which are both older and younger than that time slot. Try again."

8. If reply is A, respond: "That's it...that's the whole point. When fossils with the same characteristics (and therefore given the same name) are placed into a chronology, they are found to cluster within a fairly short time range, usually not concurrent with other species, and certainly not spread out over the entire time range of hominid evolution."
   If reply is B, respond: "Species are established based on physical characteristics, not age. Try again"
   If reply is C, respond: "Species are established based on physical characteristics, not location. Try again"
   If reply is D, respond: "Only one of the choices reflects the basis for designating species. Try again"