

HOW LONG AGO IS LONG AGO? - THE EVOLUTIONARY TIMELINE

By LaVonne Batalden

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| Name of Course | LaVonne Batalden BIO 212 Evolution and Diversity Module - How Long Ago is Long Ago? - The Evolutionary Timeline |
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| Course Level | Sophomore |
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| Possible subject Areas | Biology, Earth Science, Math |
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| Identify quantitative concepts/skills that students will develop | Proportions Large numbers Scientific notation |
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| Overview | <p>Introduction:</p> <p>The earth is estimated to be about 4.6 billion years old. <i>Homo sapiens</i> may date to 160,000 years ago. The United States has been an independent country for 230 years. You may have been around for around 20 years. Sometimes it is difficult to grasp that large range of time at a glance. To appreciate the timescale for the evolution process, change over time, and the appearance of the diversity of life forms, this activity will help you develop a tangible example of this time scale. It will be the beginning of the exploration of the appearance of life on this planet and its change over time.</p> <p>Time periods: Geological time is divided into several time periods. Eons are the longest period. Eons are divided into eras. Eras are divided into periods. Periods are divided into epochs. Epochs are divided into stages, but we will not consider them in this activity.</p> |
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| Describe/List the measurable |
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**outcomes or
learning goals of
your activity**

1. To increase the appreciation for the time scale for evolutionary processes.
2. To be able to use a proportional scale to translate the large numbers into a familiar size range.
3. To fit the geologic time periods into that time scale.
4. To begin to place evolutionary events into the time scale.

MAIN ACTIVITY

Materials:

Geologic time scale

<http://geology.com/time.htm>

<http://www.ucmp.berkeley.edu/help/timeform.html>

Adding machine tape

Masking tape

Markers

Measuring tape/ meter stick and rulers

Excel or calculators

Procedure:

Part A: Making a Paper Timeline

1. Find a partner with whom to work. Select the materials you will need and find an area in the hall to work.
2. You will be constructing a scale model of the earth's history from its birth, 4.6 billion years ago until the present. Use a scale of 1 cm = 2,000,000 years.
 - a. How long will your piece of paper need to be? _____
How will you set up the problem?

Cut off the length of paper, tape it down and mark one end as the "Present." Use this as your starting point for your measurements.

Using the scale given, measure and mark the "birth" of the earth.

3. Using the same scale and the geologic timelines, <http://geology.com/time.htm>
<http://www.ucmp.berkeley.edu/help/timeform.html>, calculate the length in centimeters of each eon, era, period and epoch. You may use Excel for these calculations. Measure those lengths and label them on your timeline paper. Develop a color coding system that will help you differentiate the divisions on your time line. Make a legend that will identify your coding system.
4. Add the following events to your timeline. (Dates are approximate and may vary in different

sources.) Indicate the Era and Epoch. Give the date in scientific notation

| Event | Date (mya) | Date in scientific notation | Era | Epoch |
|------------------------------|------------|-----------------------------|-----|-------|
| Dinosaurs appear | 200 | | | |
| Insects appear | 350 | | | |
| Bony Fish appear | 425 | | | |
| Prokaryotes appear | 3500 | | | |
| Dinosaurs extinct | 65 | | | |
| Eukaryotic cells appear | 2200 | | | |
| Pangaea breaks apart | 200 | | | |
| Oxygen increases | 2700 | | | |
| Plants invade land | 450 | | | |
| Seed plants develop | 325 | | | |
| Amphibians appear | 360 | | | |
| Mammals appear | 200 | | | |
| Primates appear | 30 | | | |
| Birds appear | 145 | | | |
| You were born | | | | |
| Humans in Western Hemisphere | .015 | | | |
| Invertebrates appear | 600 | | | |
| Flowering plants appear | 140 | | | |
| Reptiles appear | 300 | | | |
| "Lucy " appears | 3.25 | | | |
| Multicellular organisms | 1200 | | | |
| <i>Homo sapiens</i> appears | 0.160 | | | |
| US Independence | | | | |
| First hominid tools | 2.8 | | | |
| Agriculture develops | .006 | | | |

Answer the following questions:

1. How long were dinosaurs around? _____. How does that time compare with the time primates have been around? How does that time compare with the time *Homo sapiens* has been around?
2. How does the length of time for the appearance of the first life forms, prokaryotes, to occur compare with the time for eukaryotes to develop from prokaryotes and for eukaryotes to become multicellular?
3. How long was life in the sea before it moved to the land?
4. How long were primates present before *Homo sapiens* evolved?

Part B : Translation of the Evolutionary Timeline into an Earth Year

Carl Sagan is a well known cosmologist who helped us understand this huge time frame by putting the age of the universe into a 365 day year.

<http://www.boreme.com/boreme/funny-2007/carl-sagan-cosmic-calendar-p1.php>

<http://web.singnet.com.sg/~teohanch/t1CosmicCalendar.html#bmT1>

<http://www.astrosociety.org/education/astro/act2/mathprint.html>

Your task will be to do a similar project by putting the earth's lifespan and the evolutionary events you put on your timeline into a 365 day year. An Excel spread sheet will assist you in the calculations. If you need a review of Excel, check out [Excel 2007](#)

Calculation Hints for Earth Calendar

24 hours X 60 minutes = 1,440 minutes/day

1,400 X 365 days in a year = 525,600 minutes/year

$$\frac{\text{\# of million years for the event of interest}}{4,600 \text{ million years (age of earth)}} = \frac{x (\text{\# of minutes of the year})}{525,600 (\text{minutes in year})}$$

$$\frac{x (\text{answer above})}{1,400} = \text{days ago} + \text{remaining minutes}$$

Count back the number of days from December 31

Use remaining minutes from your calculation to determine the time counting back from midnight of the day before.

