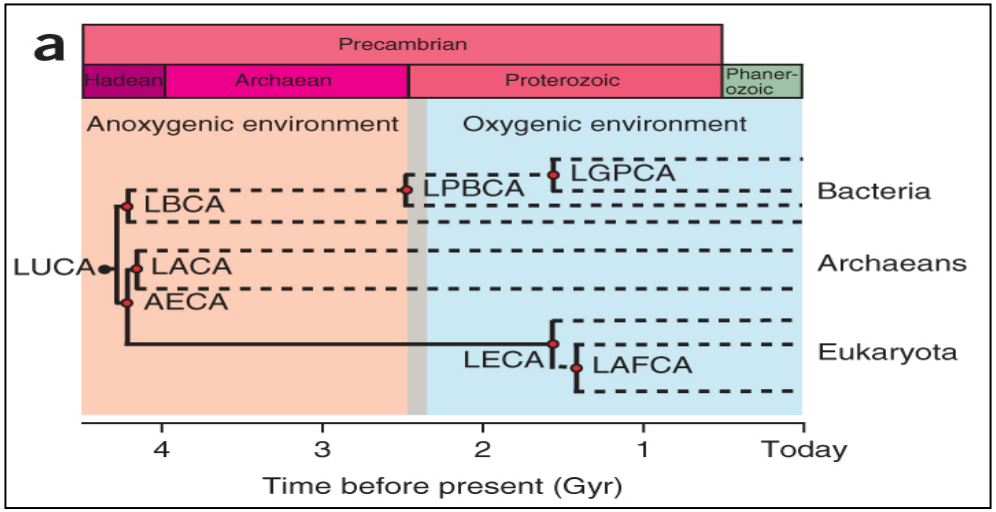
Primordial Weather Report: Hot and Acidic

- Akin to a modern crime lab reconstructing the timeline of a crime by using forensic evidence, scientists have recently used **paleogenetics** and **paleobiochemistry** to recreate in a modern laboratory the past history of a family of enzymes called **thioredoxins** that are present in all forms of life and present in billion-year old (**Gyr**) organisms.
- Questions about primitive enzymes from earth's earliest organisms cannot be answered by examining fossil records. However, using sophisticated molecular evolution techniques, Georgia Institute of Technology Professor Eric A. Gaucher and his graduate student Zi-Ming Zhao have now successfully "resurrected" enzymes from extinct organisms that lived in the Precambrian.
- All 3 Domains (*Bacteria*, *Archaeans*, and *Eukaryota*) of modern life shares a single common ancestor, referred to as **LUCA**: last universal common ancestor (see Fig. a, below). The scientists were able to reconstruct thioredoxins present in some of the earliest (4.2 – 3.5 Gyr) organisms (LBCA, LACA, and AECA) that descended from LUCA.



Depiction of Early Earth (Credit: http://cosmographica.com/)

- In essence, the revived thioredoxins were employed as **molecular barometers**. Indeed, the stability and activity of these revived enzymes revealed that they were ideally adapted to perform their biochemical task in an environment that was considerably hotter and more acidic than our present environment.
- The paper ("*Single-molecule paleoenzymology probes the chemistry of resurrected enzymes*") was published online April 3, 2011 in the advanced edition of the journal *Nature Structural and Molecular Biology.* This research is supported by the **NASA Exobiology and Evolutionary Biology** program.

04/22/11