

## **Big History or the 13800 million years from the Big Bang to the Human Brain**

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Big History is the integrated history of the Cosmos, Earth, Life, and Humanity. It is an attempt to understand our existence as a continuous unfolding of processes leading to ever more complex structures.

Three major steps in the development of the Universe can be distinguished, the first being the creation of matter/energy and forces in the context of an expanding universe, while the second and third steps were reached when completely new qualities of matter came into existence.

### 1. Matter comes out of nothing

Quantum fluctuations and the inflation event are thought to be responsible for the creation of stable matter particles in what is called the Big Bang. Along with simple particles the universe is formed. Later larger particles like atoms and the most simple chemical elements hydrogen and helium evolved. Gravitational contraction of hydrogen and helium formed the first stars und later on the first galaxies. Massive stars ended their lives in violent explosions releasing heavier elements like carbon, oxygen, nitrogen, sulfur and iron into the universe. Subsequent star formation led to star systems with bodies containing these heavier elements.

### 2. Matter starts to live

About 9200 million years after the Big Bang a rather inconspicuous star of middle size formed in one of a billion galaxies. The leftovers of the star formation clumped into bodies rotating around the central star. In some of them elements like silicon, oxygen, iron and many other became the dominant matter. On the third of these bodies from the central star much of the surface was covered with an already very common chemical compound in the universe, water. Fluid water and plenty of various elements, especially carbon, were the ingredients of very complex chemical compounds that made up even more complex structures. These were able to replicate themselves. Life had appeared, the only occasion that we human beings know of. Life evolved subsequently leading eventually to the formation of multicellular structures like plants, animals and fungi.

### 3. Matter starts to think

A comet or an asteroid crashed into Earth about 66 million years ago, ending the dominance of dinosaurs. Small animals giving birth to living offspring were now able to evolve into a multitude of species, among them the primates. A group of primates migrated from Africa to other continents less than 100000 years ago. Their brain developed a special quality, self-conscience. This ability to reflect about oneself boosted their survival considerably. Man (*Homo sapiens*) had entered the scene, becoming one of the dominant species of this planet. Due to his immense ability today to handle matter and energy he has become something of a caretaker of planet Earth. Man is responsible for sustainable development for the good of his society and of the whole biosphere.

If there is a fourth step in the history of the universe, discoveries in astrobiology may provide us with some clues in the next decades.