

Beginning of life

The evolution of life

The evolution of the first organisms

The first living organisms we have proof of thanks to fossils, are three and a half billion years old. They are the so called "stromatolytes"; structures made of several layers piled one on top of the other like a stack of pancakes. Today one can find organisms similar to the fossilized stromatolytes in Australia's hot seas. These present day stromatolytes are made up by the growth of bacteria communities and blue algae on which grains of sand deposit. Both bacteria and blue algae are prokaryote organisms, meaning that they do not have a differentiated nucleus, and therefore they are more primitive. But blue algae are able to perform photosynthesis and so we can believe that the first forms of life on Earth date even further back than 3 and a half billion years ago.

We don't have eukaryote cell fossils over a billion years old, so we can assume that life's evolution in the first two or three billion years was very slow and affected only unicellular organisms. Instead researchers believe that the step from unicellular to multicellular organisms happened very quickly, because the first fossils of complex organisms were already plentiful six hundred million years ago.

Precisely six hundred million years ago the Precambrian Era finished and the Palaeozoic era began, of which we have sure fossil proof, when life existed only in the sea. Subsequently algae made their first attempts to colonize the land. After the appearance of the first plants on dry lands came the first herbivores, of which some subsequently evolved into carnivores.

Darwin's theory

Pasteur's simple and remarkable experiment put a definite end to all controversy among abiogenesis and biogenesis believers, but new questions about life's origin arose. If to create a living being there had to be another living being, who created the first one? Furthermore if an organism creates only identical beings, how can it be that on Earth one can find such a large variety of living beings? Fortunately the fossils that were found and Darwin's theory on evolution are able to give some answers to these new questions. In fact, according to the English naturalist, in fact, fossils prove that ancient living organisms were different from present day ones and according to the evolution theory individuals within a same species that have minor differences from one another (such as in the case of man, where there are people with light blue eyes, others with brown ones etc..). When the surrounding environment changes, individuals that have better characteristics to adjust to new conditions, are those that will survive and generate new living beings with similar features to theirs, while others less adapted will be extinguished before being able to reproduce. Consequently, the better adapted individuals, through the natural selection of the best characteristics, will create individuals with even better ones.

Darwin believed that all species alive nowadays descended from a single common ancestor and thanks to the natural selection they were able to create new organisms that adapted to the requirements of an ever changing environment.

The development of evolution theories

Towards the end the 19th century Weismann (1834 – 1914) debunked Lamarck's belief according to which features acquired during the course of a generation were transferable to descendants and identified in the mix of different heritages, as happens with sexual reproduction, which is the main cause of biological variability. Thus a relationship between evolution and genetics was established. The first genetic contributions to evolutionism came from two researchers, Hardy and Weinberg who in 1908, each one of them on his own, did a statistic study on gene distribution among a population and on the necessary conditions to avoid variations between one generation and the next one. The opposite conditions, in fact, can constitute a number of evolution factors such as :

Gene mutations

Advantage of individuals with a specific genetic makeup compared to others

Numeric limitation of the population

Gene migration between neighbouring populations

Around 1920 some geneticists among whom Fisher, Wright and Haldane, did a statistic study of the evolution issue, including Hardy's and Weinberg's theories in a broader spectrum of causes that can modify genetic balances in a certain population and influence its evolution.

Thus natural selection became an evolution factor and certain basic elements of Darwin's theory were upheld.

Mathematical models calculated by population genetics have been proved both in laboratory experiments as well as in different natural habitats thus providing final evidence.

A revolutionary bestseller

Charles Darwin introduced his famous theory in 1859 in a book whose title was "The origin of the species". In this book Darwin expanded and modified Lamarck's evolution theory by introducing the natural selection concept. This new theory fueled strong debates and harsh criticism, but the book was a real bestseller which was sold out within one day!

The first fossils

The oldest sedimentary rocks that we know of date back to 3 and a half billion years ago and they probably contain traces of life. These rocks were found in Canada, in South Africa and in Australia and have been given a precise age thanks to the radioisotope method. The chemical analysis of these rocks has revealed the presence of certain compounds that could be considered as "chemical fossils" because apparently they come exclusively from the metabolism of living beings. As a matter of fact we cannot be 100% certain about them being so ancient because the rocks may have been contaminated subsequently by organic material which was produced much more recently.

Fossils in history

Man's fascination with fossils dates way back to the old ages. For instance, some shellfish fossils apparently were used as prehistoric jewels. Plinius believed that they had been created by lightning while Empedocles described some hippopotamus fossils that were found in Sicily as giant bones. Descriptions of these findings were gathered in the so called "gigantologies".