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The Reproduction of Prebiotic Soup

Beatriz Klettner Soler

I WHAT IS PREBIOTIC SOUP?

Prebiotic soup is a primordial soup enabling the first life on Earth according to the theory of Alexander Oparin launched in 1924.

The theory says that four billion years ago, the prime Earth's surface was covered by a red-hot liquid composed by carbon and surrounded by gases. In the presence of water vapor, hydrocarbons were formed as the first organic molecules. The further combination with oxygen and ammonia produced carbohydrates and proteins that generated the primitive organic cells.⁽¹⁾

In 1952, two scientists called Stanley Miller and Harold Urey at the University of Chicago, conducted the Miller-Urey experiment, which consisted in recreating the circumstances on Earth at that time, in order to reproduce the prebiotic soup. They used the same gases, the water evaporating and electrodes to simulate lightning. By imitation, they achieved the reproduction of a brown soup filled with amino acids. They played God by creating life.⁽²⁾

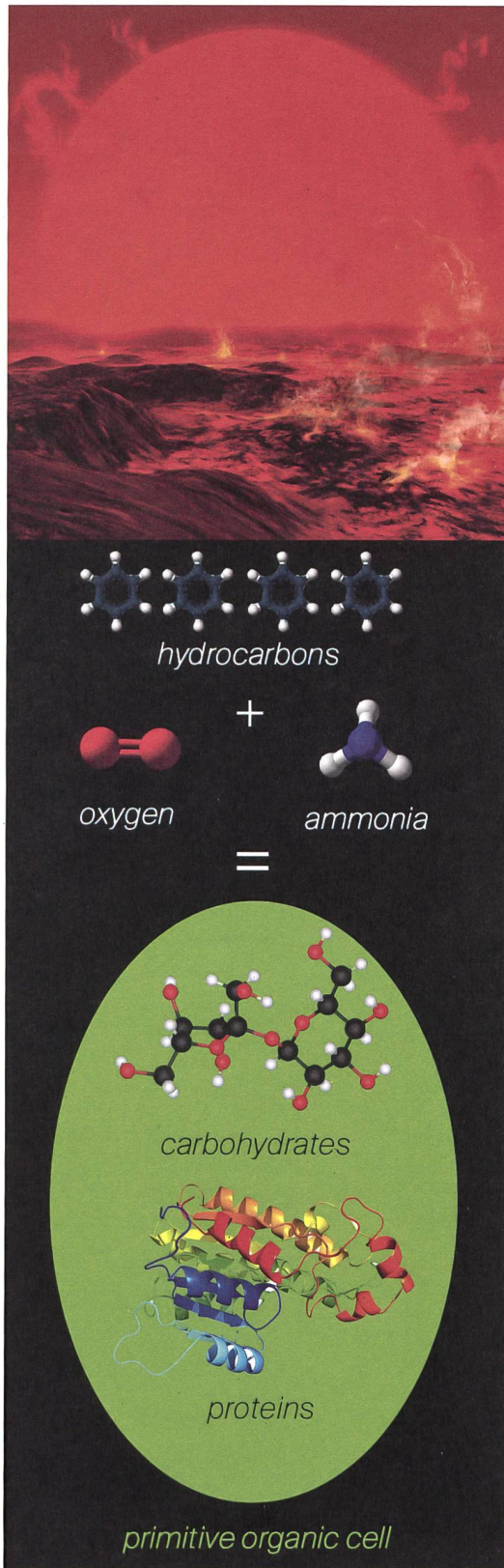
After this experiment, it was clear that our perception and ideas of creation would change. One only needs to do the following to recreate it:

- 1 Boil some water to mimic evaporation of the early ocean.
- 2 Add a few gases thought to be present in the early atmosphere.
- 3 Apply a jolt of electricity to simulate lightning.
- 4 Let run for a few days – and you're left with a brownish soup of amino acids, the building blocks for everything alive on Earth.

II A NEW DIRECTION: ENERGY CREATION

The Geochemist Michael J. Russell worked on alkaline deep sea vents, which produce chemical gradients very similar to those used by almost all living organisms today: a gradient of protons over a membrane. Early organisms likely exploited these gradients through a process called chemiosmosis, in which the proton gradient is used to drive the synthesis of the universal energy currency, ATP, or simpler equivalents.⁽³⁾

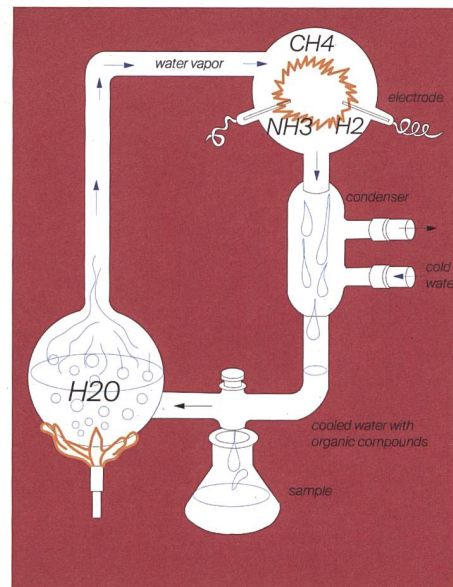
A



A Creation of primitive organic cells, 2020.
Image: author

B Miller-Urey experiment from 1952, 2020.
Image: author

B



C

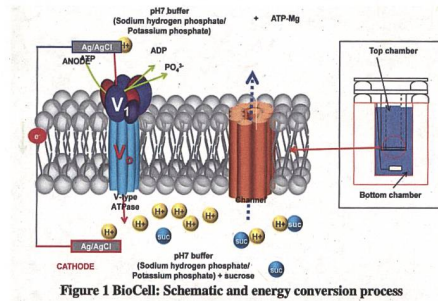
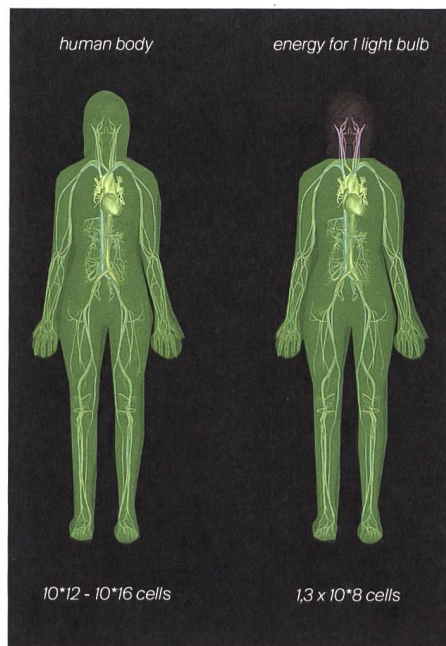


Figure 1 BioCell: Schematic and energy conversion process

D



C Stack of BioCells Converting ATP to Electrical Power and Possible Applications, 2007. Image: V.B.Sundaresan, S.A. Sarles, D.J. Leo, Materials Research Society, Volume 950

D Cells of human body vs. Cells needed for electrical light, 2020. Image: author



E Imagined interior with prebiotic soup, 2020. Image: author

The theory by Michael J. Russell explores how through chemiosmosis, a chemistry reaction that produces adenosine triphosphate, known as ATP, an energy-carrying molecule was found in the cells of all living things. ATP captures chemical energy obtained from the breakdown of food molecules and releases it to fuel other cellular processes, the first organisms were able to create energy to continue reproducing. ATP can also be converted into electrical energy through the energy converting device BioCell that uses a proton-sucrose co-transporter (SUT4) to convert the chemical energy in ATP into electrical energy.^(A)

The theory of Michael J. Russell, together with the discovery of Miller and Urey, provides great potential for the future of energy creation. We can talk about a perpetuum mobile or a self-sufficient energy system. We are able to recreate prebiotic soup out of basic compounds, which is a life source that is continuously reproducing, creating more and more chemical energy on the way. We also know it is possible to transform ATP into electrical energy, therefore it could be possible to use prebiotic soup as an energy source.

III THE ARCHITECTURE OF REPRODUCTION

We need 1.3×10^8 cells to reach 100 W aka. 1 light bulb. The human body has between 10^{12} and 10^{16} cells, so we need fewer cells than a human body to create sufficient energy to have electrical light. Cells take only a couple of hours to reproduce (between 3 and 4), since prebiotic soup is continuously reproducing, it would mean an exponential growth of cells, and thereafter of energy. There exists the possibility for the architecture of the future, of managing energy entirely based on organisms.

A prebiotic soup energy system in a building could not only provide more and more energy through time, but also have an atmospheric change in how we perceive space. We would cohabitate with organisms that at the same time provide for us. Such a space, if made visible, could create an ambience only seen four billion years ago. We could see life evolving from our living room in a light that is completely self-sufficient. And maybe even create, through different ambient conditions, other species, that could survive and balance the extinction of life.

Donna Haraway explains in her Cyborg Manifesto how humans and machines are intertwined. We are hybrids of machine and organism.⁽⁴⁾ A creature of social reality as well as a creature of fiction. Going further in this theory, we can compare the cyborg in ourselves with the cyborg of the architecture of reproduction. The building can become a new symbiosis between the animate and inanimate. As walls and ceilings define space, the primordial soup can fill it, as a piece of furniture or as part of a wall. The

soup can become the missing element that can bring architecture to life. It can form a mechanism of coexistence between human and non-human, helping to provide for the well-being of the inhabitants of the building, as well as having the freedom to develop into new forms of life.

Prebiotic soup is a liquid, it can take any form you assign to it. If the soup is used to produce energy, it will need the system mentioned above.

The soup cannot be reduced to merely an object, as it is a living form. Nonetheless, we have the tendency to envision it through human perception. The prebiotic soup can easily be viewed and imagined as a form of decor, similar to a lava-lamp, an aquarium, or even be a part of a chair or a table. The reinterpretation of this energy system into an object could facilitate its integration in our homes.

Alexander Oparin, Stanley Miller and Harold Urey, Michael J. Russell, and Donna Haraway envisioned a future based on the past. The reproduction of prebiotic soup can be the way to a self-sufficient future. The cyborg between organic and inorganic entities leads to a stronger union between architecture and energy production.