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BIOLOGICAL ARCHITECTURE. LIVING MEMBRANES

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Summary. In a world created by human beings, machines, instruments and buildings are hard structures, dead objects. They represent our mechanical view of the universe. The research presented here aims at creating conditions for development of a biological, living habitat. It examines dynamic systems that transfer information and energy through a liquid medium is needed. Using biological polymers as building material, the author has develop liquid, jelly-like, and rigid shapes and membranes on a human scale under different gravity conditions, 1 g on the Earth surface, relative weightlessness under water, and 0 g in space.

Key words: biological habitat, zero gravity, neutral buoyancy, biological polymers.

1 INTRODUCTION

In a world created by human beings, machines, instruments and buildings are hard structures, dead objects. They represent our mechanical view of the universe. Although in the language of civilization, we continue to talk about growth and development, these terms ìhave nothing to do with the natural processes of development. Nothing grows here; rather the dead materials are used to produce dead objects. Their common feature is that they are not alive." [1]

Figure 1: Zbigniew Oksiuta, Biological Habitat, Form Nr.090704, 2004. Diameter 2.5 m, Material: gelatin 2708 Bloom, Colour, taste, smell: neutral. Photo: Bernhard Jacobs,Twist, © Zbigniew Oksiuta – VG Bild-Kunst, Bonn

The fundamental things about the biological world are processes of self-organization. These processes can only take place in an unstable matter that enables free movement of molecules. Such matter is provided by water. All living organisms rise and develop in water medium as pneumatics i.e. as dynamic systems enclosed by membrane and filled with protoplasm. Genetically controlled, they change their shape and size; they grow and reproduce.

2 DISCUSSION

“Like the creation of cellular membranes in biological systems, in the history of human culture the making of clothing or the construction of a roof over one's head has been a universal and primeval activity, a necessary step towards survival, existence and development.” [2]

It is remarkable that the name of the basic unit of life - the cell, has architectural connotations. All living cells are surrounded by membranes, and, as James Lovelock writes, “hardly more substantial than a soap film, [a membrane] is as effective a barrier to leakage of the cell's constituents as the hull of a ship to water or the fuselage of an aircraft to the outside atmosphere. However, the watertightness of a living cell is achieved by quite different means from that of a ship's hull”. [3] But the living cell is not a chamber. It is clump of sticky liquid protoplasm in a nanoscale. It works not mechanically, but as a chemical factory.

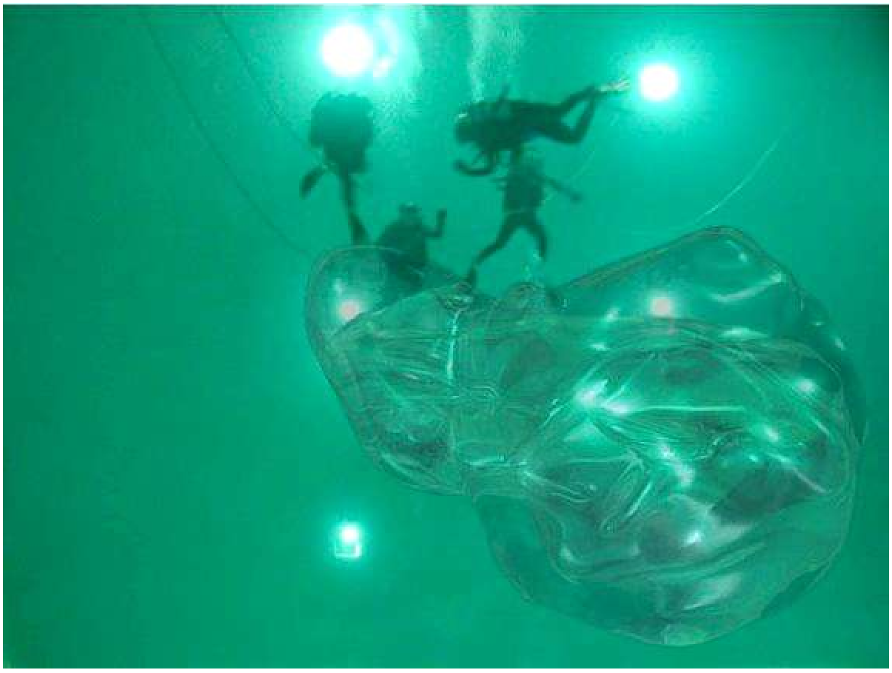

Figure 2: Zbigniew Oksiuta, Isopycnic Systems (liquid systems of equal density). Liquid membranes: inflation of hollows in a polymer lump floating under water. Videostill: ìMesogloeaî, 2003. The film was partly shot in a Neutral Buoyancy Facility, ESA European Space Agency, Cologne. Photo: Uwe Lierman, animation: Industriesauger-TV, Cologne © Zbigniew Oksiuta ñ VG Bild-Kunst, Bonn

Can life processes, which normally take place in water in the nano-scale, happen in a macroscale? We understand that the shaping of liquid membranes in a architectural scale, or a stretching of a living cell to the size of a house is not possible. It is necessary to develop new ways, until now not existing in nature, which would make it possible for the biological processes to occur in an architectural scale.

The general subject of my research is to create conditions for development of a biological, living habitat. For this reason examination of dynamic systems that transfer information an energy through liquid medium is needed. I use biological polymers as the building material. I develop liquid, jelly-like, and rigid shapes and membranes on a human scale under different gravitation conditions: 1 g on the surface of the Earth, relative weightlessness under water, and 0 g in space.

These membranes and shapes can be compared to a state of a rigorous building. They are still lifeless, but with a large biological potential: they can be use as a soil and scaffolding for growing of the living organisms.

“In order to achieve this, the whole transparent research container is constructed as a biological 'Petri dish' in an architectural scale. Breeding Spaces is an attempt to generate a system in which the borderline separating the interior from the outer environment is not a foreign body..., but an immanent element of the whole structure. It plays an active role in the processes inside the system, thus drawing on properties that are specific to biological membranes in living organisms. The breeding process involves injecting plant and animal cells into the interior of a form, in this way creating a kind of biological fabricators or introverted biosphere.” [4]

Figure 3: Zbigniew Oksiuta, The Cosmic Garden, 2003-2007. A liquid polymer pneu (a bubble cast) made in space as a container for breeding live organisms. Videostill: ìMade in Spaceî, Animation; AndrÈ Hindenburg, Industriesauger-TV, Cologne © Zbigniew Oksiuta – VG Bild-Kunst, Bonn

“The Future of life may exist only inside ecological enclosures, a kind of biological miniaturized world.” [5]

Since the biological membrane is an universal principle and forms the basis of each living system in the cosmos, it is conceivable in a great variety of consistencies and sizes, as a soft, gel-like or fluid object, the size of a cell, a pill, a fruit, a house or even biosphere. As a bioreactor, incubator or artificial placenta, it would become the new cradle of life and could in the future allow us to cultivate food, tools and shelters. It could even support us in settling the cosmos – it is a life form, thus, with a biological future. [6]

3 REFERENCES

[1] Herbert Gruhl, Das irdische Gleichgewicht, ÷kologie unseres Daseins, Deutscher Taschenbuch Verlag, p 22 (1985)

[2] Zbigniew Oksiuta, Forms, Processes, Consequences, Exhibitions catalogue, Arsenal Gallery, Bialystok and Centre for Contemporary Art Ujazdowski Castel, Warsaw, (2007)

[3] James Lovelock, Gaia: A New Look at Life on Earth, Oxford University Press, 84. (1979)

[4] Zbigniew Oksiuta, Biological Habitat: Developing Living Spaces, Sk-interfaces, Exhibition catalogue edited by Jens Hauser, Liverpool University Press and FACT (Foundation for Art & Creative Technology), Liverpool (2008)

[5] Dorion Sagan, Biospheres: Reproducing Planet Earth, Bantam Books, New York, p.8 (1990)

[6] Zbigniew Oksiuta, op cit.