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RHIZOMATIC BODY: THE SHIFT IN COMPREHENSION OF LIFE AND BODY WITH THE TURN OF THE BIOTECHNOLOGICAL PARADIGMS

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In the beginning of the 1950s molecular biology and then genetic engineering were those branches of life sciences that were reckoned as to bring the revolution. The development of the discipline was tremendous: the double helix structure of DNA was identified in 1953, in the 60s the new biology and especially the development in the molecular biology promised that mankind is soon to become the "master of evolution" in the 80s it was believed that the new field is truly bringing a revolution comparable to those in microelectronics and computers, in 1997 Dolly, the first cloned sheep was born, and in June 2000 (5 years earlier than it was predicted) a rough sketch of human genome was sequenced. Jeremy Rifkin, the first name of the movement against uncritical acceptance of genetic technology, noticed already in the 70s (but most noted in 1998 with the book *The Biotech Century*)[1] that industrial age has finished and that we are entering a new era, radically marked with biotechnology, and one in which the perception of ourselves and the society will completely change. "The 20th century was shaped by spectacular breakthroughs in physics and chemistry, but the stars of the 21st century will be the biological sciences, and those deciphering the genetic code of life. After thousands of years of fusing, melting, soldering and forging, we are not splicing, recombining, inserting, and stitching living material."[2] According to Herbert Gottweis's synoptic review of the chronology of life sciences for the Ars Electronica 1999 symposium on this topic, (1.) the 70s present the phase of hopes and fears, (2.) the 80s the phase of exaggerations and (3.) the 90s the fantasies being overtaken by contradictory realities.[3]

In the 90s the computer paradigm made an impact on life science: biology started to uncover the complexity of (bio)coding and gained the character of information science -bioinformatics with gene code as it focal point came to the foreground. In the times of computer culture the mechanisms of life were considered as the options of programmability and "artificial life ought not to be understood as a simulation but rather as a preliminary stage of hardware versions."[4] Computers, with a remarkable expansion in the 80s, introduced thinking about the logical structure of an organism and changed the cultural perception of life.

In the 80s computer scientist Christopher Lengton, one of the founders of artificial life field, developed cellular automation loops capable of reproduction taking place similarly as in living structures, DNA molecules. It has become possible to create "living systems" which were able to grow, multiply, develop and accommodate to the environment (digital ants, birds and other virtual creatures or organisms), with computers. Types of artificial life were developed that were visually mimicking human and animal appearance: robots and highly developed automats appeared. Peter Weibel, the curator of the 1993 Ars Electronica festival, which was devoted to the question of artificial life and to genetic art, offered a comprehension of life, strongly determinate with computer-logic: "Life, death, immortality, reproduction, heredity, development, evolution, growth, adaption -all these concepts have been given a new dimension by the computer culture. Computer culture enforced the shift of paradigm from defining life as a substance, material hardware or mechanism to conceiving life as a

code, language, immaterial software, dynamical system. Handling computers has taught us that the 'logical structure' of an organism can be separated from its material basis and that life is a property of the former, not the latter."[5] On the basis of computer paradigm at the end of the 20th century "the world was translated into a problem of coding" as acknowledged by Donna Haraway, this held for communication sciences as well as for modern biologies where it can be illustrated by molecular genetics, ecology, sociobiological evolutionary theory and immunobiology. "The organism has been translated into problems of genetic coding and read-out. /.../ In a sense, organisms have ceased to exist as objects of knowledge, giving way to biotic components, i.e. special kinds of information-processing devices." [6]

Early initiatives, for art to manipulate the living substance and create new kinds of living creatures, appeared already in the 80s. Vilém Flusser, in his essays on discovery and science for Artforum magazine, considered the issues of life, genetic information, creation of new forms, evolution, and the like and suggested: "Why is it that dogs aren't yet blue with red spots, and that horses don't yet radiate phosphorescent colors over the nocturnal meadows of the land? Why hasn't the breeding of animals, still principally an economic concern, moved into the field of aesthetics? It's as if nothing in the relationship between humanity and the biological environment had changed since the life-style revolutions of the Neolithic age. Yet at the same time that the farms of North America and Western Europe are today producing more food than we can consume, we also, not coincidentally, have learned techniques that ultimately make conceivable the creation of plant and animal species according to our own program. Not only do we have mountains of butter and ham, rivers of milk and wine, but we can now make artificial living beings, living artworks. If we chose, these developments could be brought together, and farming could be transferred from peasants, a class almost defunct anyway, to artists, who breed like rabbits, and don't get enough to eat."[7] In the next decade some artists started to manipulate living organisms. This presented a big shift in comparison with the traditional modes, since then art was not anymore producing representations of organism's transformations, as for example Salvador Dalí thematized the genetic age with painting it, and the artist was not even programming the platform for a computer generation of digitally "living" organisms. The artists started to use genetic engineering as a tool to produce works of art. In 2000 Eduardo Kac instantly succeeded to broadly communicate the issues of genetically modified organisms as the domestic animals with transgenetic art, especially his project *GFP Bunny* (Green Fluorescent Protein Bunny), an albino rabbit that glowed green when illuminated with certain blue light with maximum excitation at 488 nm, made with EGFP, an enhanced version of the original wild-type green fluorescent gene found in the jelly-fish *Aequorea Victoria*. Even earlier, Joe Davis added a synthetic DNA molecule with an encoded visual icon into the existing genetic material of a butterfly to make it eternal within a living organism that reproduces itself and the artistic supplement (*Microvenus*, 1986), thus creating a literal example of an artwork in the age of genetic reproduction.

Within the century of biotechnology an important turn took place concerning comprehension of life in science and culture at the turn of the millennium. There were great expectations from work related to the research in human genome which should, as believed, assure the discovery of the "code of man" and thus finally the comprehension of a human being. Never the less, the questions concerning life and human being have not been answered with the results of the *Human Genome Project* (2000)[8] but have only just started to be raised. Before publishing the results, it was known that all human beings have 99,9% of their genetic information in common, and that 99% of it is identical to that of a chimpanzee-thus the 0,1% of variation presents a great significance. The researchers delivered surprising news: man has only 30.000 to 40.000 genes (and not 120.000 to 140.000 as it was predicted), that is hardly a little more than a microscopically small worm (with only 1.000 cells and no brains which has 19.000 genes) and just three-times more than a wine-midge. The results have not only shocked the laics but the genetic experts as well. The journals worldwide commented: little more than a worm, humiliated crown of the creation, insult etc. The high listed shares of the biotechnological companies at the stock exchange have steeply fallen. The results surprised with the information about the quantity of the genes, but collaterally and more importantly they demonstrated that science is far from "knowing a human being" from understanding the genes and the complexity of the organism and thus from mastering the

"software" substance of the human "hardware." The "riddle of life" has not truly been solved.

It has been proven that the project of the mastery over the immaterial essence of an organism, over the genotype to control the phenotype, the power to program one's life according to a wish through manipulation of the genes steps away to the undefined future. The modern project of disenchantment of the world has not succeeded with the written sequence of human genome; the absolute knowledge about a human being has not been attained. This project has rather proven to be questionable and could be recognized as one of the modern great narrations with totalistic expectations and discontenting outcomes. As Mladen Dolar interprets Hegel's concept of the ascension of knowledge: "The teleological aim, where this great narration [of Hegel's] should come to an end, is proven to be an empty point,"[9] the situation illustrates exactly this kind of a slip of the telos, the instant collapse of the purpose or the beginning impulse and the final end or the aim, as well as the totality of the trajectory, at the final stage.

Biotechnology needed an instant reorientation. Genetic paradigm, accordant to computer paradigm in culture, turned to the paradigm of regenerative medicine with the branches of tissue engineering and immunology in the foreground. There is an important difference between the two paradigms: rather than a computer-based regime these branches base on a tactile regime. Thus this new orientation of biotechnology simultaneously presents a turn to the material manipulation of life; life is thus no more to be understood merely as a code, but rather as a cell with ability to compose a tissue. The body has ceased to be whole not only in a digital sense: now it can be fragmented directly by a dissection of the flesh. The questions concerning life have become bounded to its material basis, to the body and the corporal.

Manipulating life has become a tactile practice, a sculptural work rather than programming. The interest to introduce the tactile strategies for manipulating life and living organisms into art has grown. Transformational process of the living material has become possible alive within artistic environments. Marta de Menezes was one of the first that manipulated a living being directly, in real time and space in her art installation, with a purpose to raise a question about what is natural (*Nature?*, 2000). Specifically, she changed butterfly's wing patterns with preceding manipulation of the cocoons cultivated in the installation tent with sustained conditions. Not only have such rough manipulations of living organisms, on a rather greater scale appeared, but the artists have started to use tissue engineering as an art practice, now being able to perform fine manipulations of the living material on a micro level live within the particular laboratory conditions established at the art shows. Such projects assuring processual laboratorial installations supply the outcomes which could be called "wetworks." These are tissue-engineered products in liquid media, placed on specific scaffolds sustained in particular environments alive, which have not been possible to enter the world of art before the raise of tissue-engineering. The techniques, as well as the discourse of biotechnological art, have changed according to the contemporary development of biotechnology.

Options of tissue engineering, especially the possible manipulation of skin or cartilage cells, became the center of biotechnology around 2000, with one of the breaking points in the achievement of scientists (from Massachusetts) to grow an ear with human cells in the body of a laboratorial mouse (the results were published in 1995) -the prototype human ear from polyester fibers and human cartilage cells were transplanted into the back of the mouse. The mouse tissue itself cultivated the ear during the growth of the cartilage which finally completely replaced the artificial fibers. There were hopes that this technology will once in the near future enable a routine re-growth of ears, noses, skin and bones, utmost even internal organs. In 1998 the product "Apligraf" from artificially grown skin was confirmed as an engineered part of a body, which has been since then regularly produced in tissue engineering centers to heal skin corrosions or burns. Even if biotechnologists are still not able to produce complex tissues (for example muscles) with tissue engineering the technology however promises a possibility to produce whole organs or even limbs once in the near future. The idea to transplant in vitro cultivated ear on a human being has been developed in the field of art with Stelarc's project *Ear on arm*. However, even if Symbiotic A, in collaboration with Blood Transfusion Centre of Slovenia, has engineered a small version of an ear (a quarter of a natural size, *Extra Ear for Stelarc*, Ljubljana, Kapelica Gallery, 2007), in the end an ear from artificial material has been used for Stelarc's third ear on his body.

Tissue engineering and new comprehensions of stem cells present new hope of life sciences in the last decade. Primarily, tissue engineering emerged as a response to transplantation problems, mainly in association with the response of the immune system, which meant the rejection of allogenic tissue. Engineering and cell cultivation in the laboratory for the purpose of transplantation were responsible for the establishment of a new expression called regenerative medicine. Tissue engineering is in vitro tissue manipulation technology, which nowadays mainly uses stem cells in artificially created support systems that are set up for the execution of specific biological functions, particularly for the repair or replacement of parts of the tissue (like skin, cartilage and bone). Stem cell is a non-differentiated cell, which has the ability of self-regeneration, during which two *daughter cells are created -the first one is identical to the original but the other one is partially* differentiated and more specialised. Somatic stem cells are located throughout the whole adult human being even though they are very rare and are momentarily hard to seize because they are lodged in tissue niches, while embryonic stem cells are found only in the embryo.

Scientists assume that less differentiated cells are also present in the tissue. Stem cells enable several new ways of treatment. Today, the expression "advanced therapy" is well-established in the EU medical legislation (the EU Act (ES) number 1394/2007 of the European parliament and board) which divides advanced therapies into gene therapy, somatic cell therapy and tissue engineering. Advanced therapy uses principles of self-regeneration in tissue injury as well as in the cancer treatment.

In life sciences and in Western medical thought and practice a turn is taking place, yet very slowly, from mechanical paradigm or the paradigm of artificial body to the paradigm of the auto-regenerative body. The modern comprehension of an organism assured a concept of its composition from mechanical parts and thus medical treatment was conducted on the basis of elimination or exchange of the damaged parts. This corresponded well with the Cartesian causal comprehension of the body, detecting local defects and offering direct pointed treatment. In aesthetic surgery the body was as well transformed mechanically, with direct plastic interventions in the body and with insertions from artificial materials. Recent acknowledgements demonstrate that such methods are obsolete because collaterally damage is done to the healthy parts of an organism, thus the advanced therapy suggests the use of body's own matter, which should be implanted to improve the quality of body's immanent auto-regeneration. Advanced therapy therefore no longer suggest mechanical or chemical repair of the body as a machine, and even not a digital repair of the body as a digital medium, but develops options of stimulating the auto-regenerative body. Current paradigm of biotechnology is oriented to manipulation with body's own cells for composition or regeneration of tissues or other bodily parts, with special, increasingly stronger interest for stem cells.

The turn of the paradigms towards auto-regeneration denotes an important shift in understanding life and body and Eugene Thacker points to the new comprehension of a body *introduced with regenerative medicine: "Tissue engineering is able to produce a vision of the* regenerative body, a body always potentially in excess of itself."[10] Regenerative medicine operates with a fragmented body and manipulates it at the cell level, however new techniques implicate possibilities to indirectly gain the control over the organism as a whole (not only over the parts or structures of it), and that is because of the techniques that improve auto-regeneration. According to Thacker because of the idea of regeneration the economy of the body parts (transplantations, xeno-transplantations) has been replaced with the economy of auto-regeneration (regeneration of tissues from one's own cells) which is cyclic and proliferative (produces a great number of parts = tissues with division of cells).[11] Options that are thus open promise salvation of several health problems (degenerative illnesses, cancer etc.), transformation of a body, and improvement of life quality and "rejuvenation" - what actually means prolongation of life and active age of social subject. Although they have both been prolonging since forever, the possibility of auto-regeneration, intensified by biotechnology, is the one that displaces the boundary of life beyond the traditionally attained ones, and that is with working "from within" or better - with the body itself – instead of manipulating the body and life "from outside" (with the help of mechanical or chemical intervention).

In the second half of the 20th century several technologically supported media were in full swing and were likewise used by arts - the so-

called digital revolution in culture happened simultaneously with the so-called end of art. With the introduction of life sciences in everyday culture and also in regard to the fact that biotechnology is significantly changing the paradigms of life and body, artist found their mission in answering to these contemporary aspects of reality. Biotechnological art uses biotechnological procedures, techniques, technologies, know-how and knowledge and is not only, if one could here use the semiotic terminology, significant on the level of meanings and on the level of appearance (forms, expressions and methods), but as well in its codification constructions and deconstructions with which it is capable to develop a critical stance or reflection of the dominant ideologies. One of the leading curators of the contemporary investigative art, a strong supporter for the biotechnological art (who curated the exhibition *Ecology of the Techno Mind* at the Ars Electronica Festival in 2008) Jurij Krpan, wrote in his credo: "We dedicate special attention to projects that topicalize the reverse engineering of nature with their direct application of technologies and biotechnologies on the human body -as explicit merge of biological organism and inorganic mechanics as possible. These projects include, in the most expressive way, works by artists who stake their bodies in the true sense of the word by way of their utter unacceptability for the technologically accelerated and amplified society. We call them body related works, in which the artist's body is displayed with all its `wet ware` and sublimeness, the ultimate experiential boundary. Blood-letting performances, invasive surgery, body modifications, genetics, sexual identities, biopolitics in general and many other originally composed artistically explored topics provide a reflective device which makes it possible to interpret cutting-edge biology, biotechnology, bionics, genetics, prosthetics, robotics, telecommunications, etc. - where tension and creative conflict generate an extraordinary fertile production of meanings."[12]

Tissue-engineered art has an interest to perform and transpose the live with sculpturing it alive. A medium used in a situation where manipulation of living material in vitro takes place in real time, is not a medium that would assure an image, a representation. Even comparing this situations to the tradition of body art performances one can notice important differences, as observed by Maja Murnik: "In the foreground there is still the body; but it performs itself as crumbled, independent and transformed, without the author's full presence. The fragments of the artist's body are expropriated from it and set into new environment, where they, with the use of biotechnological tools and know-how of manipulation with living material, live further on, yet changed and sometimes together with the fragments of the bodies of the observers."[13] Here the semiological frame of discussion actually becomes questionable because what is constituted by the tissue-engineered performing installations is not a medium in a modern sense. The mediated is deconstructed, established is rather a plane of consistency, "a body without organs" which is no longer subordinated to the concepts of substance and form, the procedures of unification and totalization. In such a plane of consistency several connections open since it is itself as "a row of doors."[14] A map is established is and not a tracing, which contributes to the connections of the constituents, maximal opening of bodies without organs onto a plane of consistency, which is itself part of the rhizome.[15] As acknowledged by Mojca Puncer a situation with the installation that is full of living human components in sustained environment asks us "what we can say about the materiality of the body if exactly because of this materiality we can never fixate the body in a simple object of thinking?"[16] Such "medium" exceeds the construction of the Euclidian world, it is by no means a display, but is an environment that exists all around the observer who is its part and thus demonstrates Merleau-Ponty's immersion of the subject in the world.[17] Life is here not represented and is not virtual, it is performing, the live lives. The "medium" of such four-dimensional manifestation is itself a kind of art-ificial body. It is not a supplementation of the presence (as Derrida criticizes the traditional understanding of representation which is not exhibited as a break in presence)[18] in the sense of continuing, homogeneous modification of the presence in representation or the progressive weakening of the presence; it does not represent, recall, express or render present, and it is even not a differentiated mark in Derridean sense, denoted with the break in presence. The processual installation evolved in time is a living body. The bodily environment is established with its wetness, temperature and other fragility, which conditionally, if the experiment is successful, enables living of cell(s) or tissue(s) for some period of time. Life being constantly endangered

by death is here *present*, and that is in its extreme sensitivity, thus it can as well stop in any moment. Its ending however would not be a boundary, line, break, but has already been constantly present in the existence of this living, as suspended for an indefinite period in the future and also in the past; and likewise, in the death life is present as a possibility, especially now, when being enabled by biotechnology.

The artistic situations that repeat the gesture of mastery and control over life do not repeat the social tendency to systematic attainment of absoluteness, but on the contrary: with exceeding the notion of the body and with establishing a rhizomatic body they immersively (here and now, inside and outside) position the subject into a non-orientational environment-body, in which the observer itself becomes a cell in a tissue, one of many living beings in a colony. In an affective confrontation as enabled with the *Unique* installation (Tratnik, 2006) a human being becomes aware of himself as being a multitude of living, which doesn't constitute clear and closed wholeness, doesn't have clear boundaries, but traverses into the environment and the environment as well traverses onto and into him, so that he literally becomes part of a living tissue, a living rhizome. Such processual installations deconstruct the logic of total control and domination and open the social body in its core exactly with making the biopower present, and with simultaneously subverting it in establishing environments or situations that cannot be completely controlled.

Notes

1 Jeremy, Rifkin, *The Biotech Century: How Genetic Commerce will Change the World*, London: Phoenix, 1998.

2 Jeremy Rifkin, "The Biotech Century. Genetic Commerce and the Dawn of New Era" in: *Ars Electronica 99. Life Sciences*, p. 47.

3 Herbert Gottweis, "Genetic Enineering, Scientific-Industrial Revolution and Democratic Imagination," in: Gerfried Stocker, Christine Shöpf (eds.), *Ars Electronica 99. Life Sciences*, Linz: Ars Electornica, Festival for Art, Technology and Society, 1999, pp. 122–134.

4 Jens Hauser, "Bio Art – Taxonomy of an Etymological Monster," in: Christine Schöpf, Gerfried Stocker (eds.), *Catalog Ars Electronica 2005: Hybrid – Living in Paradox*, Ostfildern-Ruit: Hatje Cantz Verlag, 2005, p. 184.

5 Weibel, Peter, "Life – The Unfinished Project in: Gerbel, Karl, Weibel, Peter (ed.), *Ars Electronica 93: Genetische Kunst – Künstliches Leben/Genetic Art – Artificial Life*, Wien: PVS Verleger, 1993, p. 10.

6 Donna Haraway, "The Cyborg Manifesto. Science, Technology and Socialist-Feminism in the Late Twentieth Century in: David Bell, Barbara M. Kennedy, *The Cybercultures Reader*, London, New York: Routledge, 2000, p. 303.

7 Flusser, Vilém, "On Science" Artforum, New York, October 1988, p. 9.

8 The results were published in the beginning of 2001 in two reputable magazines – *Nature* and *Science*: *Nature* published the results of the public financed research of the group of scientists, gathered in an International Human Genome Sequencing Consortium or the *Human Genome Project*; and *Science* published the results of the private biotechnological project *Celera*.

9 Mladen Dolar, *Heglova fenomenologija duha 1.*, Ljubljana: Društvo za teoretsko psihoanalizo, 1990, p. 9. (trans. P. T.)

10 Eugene Thacker, "The Thickness of Tissue Engineering: Biopolitics, Biotech, and the Regenerative Body" in: Gerfried Stocker, Christine Shöpf (eds.), *Ars Electronica 99. Life Sciences*, p. 183.

11 Ibid., p. 182.

12 Jurij Krpan, "Concept Introduction" in: Jurij Krpan, Sandra Sajovic (eds.), *Ecology of the Techno Mind. Ars Electronica 2008 Featured Art Scene: Kapelica Gallery*, Ljubljana: Kapelica Gallery, Zavod K6/4, 2008, 9.

13 Maja Murnik, "Body art prakse: nekaj misl" in: Polona Tratnik (ed.), *Art: Resistance, Subversion, Madness*, Monitor ZSA, 31/31, vol. XI, nr. 1–2, Koper: Annales, 2009, p. 181. (trans. P. T.) Murnik is referring to the installations of P. Tratnik.

14 Gilles Deleuze, Félix Guattari, *A Thousand Plateaus. Capitalism and Schizophrenia*, London, New York: Continuum, p. 559.

15 Ibid., p. 13.

16 Mojca Puncer, "A Story About Hair" in: Polona Tratnik: Lasje/Hair, Ljubljana: Kapelica Gallery, Museum of Modern Art Ljubljana, Gallery Miklova hiša, 2005, p. 13. Puncer is referring to the project 37°C (P. Tratnik, 2001) for which an observer is

entering a dark and warm installation living room, which is concentrated with the presence of the cultivated human living tissues.

17 Maurice Merleau-Ponty, "Eye and Mind" in: Galen A. Johnson (ed.), *The Merleau-Ponty Aesthetics Reader. Philosophy and Painting*, Evanston, Illinois: Northwestern University Press, 1993, p. 138.

18 Jacques Derrida, "Signature Event Context" in: *Limited Inc.*, Evanston: Northwestern University Press, 1977, p. 5.