

# The Artistic Status of Bio-art

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## Abstract

This paper aims to define Bio-art by strengthening its artistic status through two distinct approaches. The first is based on the acceptance that the concept of Bio-art includes both the term “art” and the term “bio” that could stand for Biology, Biotechnology, and Bioethics. It is argued that despite its direct connection to scientific research, Bio-art is only partly linked to the methods of the pure science of Biology, while it stands closer to the technoscience of Biotechnology. However, while bio-artists often use scientific methods and techniques, they eventually focus on bioethical questions. To amplify the artistic status of bio-artworks, we claim that they are kinds of visual “enthymemes”, a term used by Aristotle to define incomplete rhetoric syllogisms linking all recipients to common questions. Our second approach is developed around Levinson’s intentional-historical theory, showing that Bio-art belongs to the evolutionary narrative of art and artistic intentions. We allege interconnections of distinct features of bio-artworks with artworks of different eras that in the context of a retrospective view are to be understood as having paved the way for the emergence of Bio-art.

**Key words:** Bio-art, Biotechnology, Bioethics, Metaphor-Enthymeme, Levinson’s intentional-historical theory

## Introduction

The term “bio-art” refers to a wider and largely heterogeneous group of artworks having as common denominator the use of biological material for their creation through research-experimental processes. The fact that their creators belong to the artistic field by having primarily artistic education turns them to artworks. In addition, the institutional framework recognizes them as such by including them in museums, exhibitions, collections, catalogs and arthistorical narratives. There are, however, creators who perceive themselves more as researchers rather than as artists, and their purpose is controversially artistic in the traditional sense of the term: on the one hand, there are bio-artists aiming at a direct criticism on the role of biotechnology to manipulate both life and environment, on the other hand, there are those who mostly focus on biotechnological research and experiment in order to create witty works that both pave the way for what may come in the future and challenge philosophical thinking. In any case, bio-artists communicate present as well as future samples of the potentials of biotechnology by asking us to think over their consequences either positive or negative.

Although the traditional definition of art as a rational activity with aesthetic purpose has ceased to exist since the early 20th century, these new developments of incorporating technoscientific methods and topics into artworks make it harder to formulate an ontological framework

for the artistic phenomenon. The claim that bio-art is art because both of its creators' intentions and its acceptance by the institutional artworld, is not to be considered as sufficient enough.<sup>1</sup>

This paper aims to create an ontological-theoretical framework for the definition of bio-art as art, which is to be accomplished through three distinct approaches. In the first part we distinguish bio-art from science, technoscience and their methods. Our purpose is to show that, although bio-artists often work in common spaces with researchers by using both their methods and their techniques, the result of their work is to be perceived in a completely different manner: while researchers mainly focus on increasing our potential to beneficially use biotechnology, artists aim furthermore to challenge bioethical questions. In the second part, we formulate a theory on the art status of bio-art by recognizing its fundamental features as ontologically artistic ones. Finally, in the third part, we adapt Levinson's intentional-historical theory on the definition of bio-art as art. We will show that bio-art belongs to the evolutionary narrative both of art and artistic intentions by alleging interconnections of distinct features of bio-artworks with artworks of different eras that in the framework of a retrospective view are to be understood as having paved the way for emergence of bio-art.

### **The relationship of Bio-art with Science, Technoscience and Bioethics**

Connections between bio-art and science derive first of all from bio-art's designation which includes the term "bio" referring to the empirical science of biology. Furthermore, there is an immediate relation between them due to the fact that bio-artists often work together with researchers by using common methods, materials and techniques. However, bio-art does not belong to the scientific era. This statement should not be understood as a retrograde view referring to the two cultures of Snow (1959, 2001) but as a conclusion resulting from both the ontological and the methodological distinction between science and art that is considered as necessary for a proper systematization of both the existing and forthcoming knowledge (Gemtou, 2018, pp.134-143).

Our first aim is to show that in fact, despite their seemingly common features, bio-art is totally different from the science of biology. While biology uses the scientific method, bio-artists just borrow significant parts of it in order to fulfill their own purposes. One fundamental feature of the scientific method is its specific character that is common to all empirical sciences, independently of distinct scientific purposes and methodological tools. Thus, it always begins with the formation of a theory as a rational attempt to explain a particular aspect of the physical or the social world. This theory is a kind of speculation that, if proven true, might improve pre-existing theories. The speculation is then subjected to experimental tests that intend to show its validity.<sup>2</sup> However, the emergence of the induction problem led to the formulation of the theory of falsifiability defining the scientific method as an attempt to discard theories rather than to prove their validity: any theory proved to be untrue is rejected or at best modified (Popper, 1959, 2002, 2005). In any case, however, the purpose of scientific research is to show that a formulated theory is either true or untrue.

Bio-art is not a science, as bio-artists do not start their working procedure with a scientific theory. The starting point for their work is probably a speculation not necessarily related to science: usually it is more like a subjective intention with aesthetic, moral or philosophical character. Scientific theories are those that arise through systematic observations of reality and pose questions concerning the explanation of its function. A basic criterion for the scientific definition of a theory is the degree of its ability to be discarded through experimental and empirical-rational processes. The hypothesis, for example, that the genesis of certain cancers can be detected through research

on mice is a scientific one, because it can be either denied or verified through experimental procedures. On the other hand, the theory that patentability of living organisms<sup>3</sup> is unethical and leads to the distortion of the ontology of existence is not scientific in nature, since it cannot be discouraged or verified by scientific methods: there is no experiment to prove it to be true or false.

The distinction, however, between the pure science of biology and the technoscience of biotechnology is important to be clarified. Biotechnology is a branch of biology, but focuses on research that is formed through the mutual interaction of science and technology. The purpose of biotechnology is to produce beneficial to man and commercially viable technology through biological processes using mainly micro-organisms, especially parts and processed products of them such as enzymes, secondary metabolites and antibodies. The biotechnological research framework is extremely broad with multiple applications, such as wastewater treatment and gene therapy, and heterogeneous products such as pharmaceutical proteins, foods and detergents. Biotechnological research has been systematized through more distinct fields such as biopharmaceutical (red biotechnology), biotechnology applied to agricultural processes (green biotechnology), industrial biotechnology (white biotechnology) and educational biotechnology (orange biotechnology) (Kafarski, 2012, pp.811-816).

Biotechnology has opened up many new research fields with multiple potentials for the manipulation and exploitation of living organisms. At the same time, a strong philosophical/ethical framework has been set up, necessary to investigate both interventionist limits and general practices with their consequences for man and his environment. For the first time an ethical analysis of biotechnology with references to the future of mankind has been formatted by Gilbert Hottois in his "Ethique et techno-science"(1978). Hottois, by distinguishing between the theoretical nature of pure science and the interventionist-manipulative orientation of modern technoscience, sounds the bell by awakening the philosophers to explore the controversial role of technology in modern and future society. In the 1980s, Jean Francois Lyotard linked biotechnology to Capitalism by projecting it as the modern man's attempt to dominate the natural world (Lyotard, 1988). Furthermore, important was the contribution of Bruno Latour (1987), who analyzed the application of technology in relation to its social and political context, denouncing the myth of neutral science and its traditional distinction from technology, which often used to be associated either with positive or negative for humanity situations: technoscience is both created and practiced by people in a real socio-economic-political context, and its development is formed both through conflicts and alliances either between people, or even between people and non-humans (institutions, machines, animals).

Since then many philosophers have directly linked technoscience with society, heavily focusing on its negative and sometimes dangerous parameters such as technocracy, pollution, depletion of natural resources, climate change and the eradication of human values (Tsoumas, 2019, pp.79-88). At the same time, they have analyzed it in relation to politics, multinational capitalism, economic neo-liberalism and US imperialism. In this framework, research purposes, methods and expertise have not been analyzed as internal scientific principles and processes, but as instruments due to sovereignty and control of political systems. Thus, technoscience has been evaluated as directly dependent on both empowering principles and interrelated interests, which has created a negative atmosphere for its consequences on human civilization and its future.<sup>4</sup>

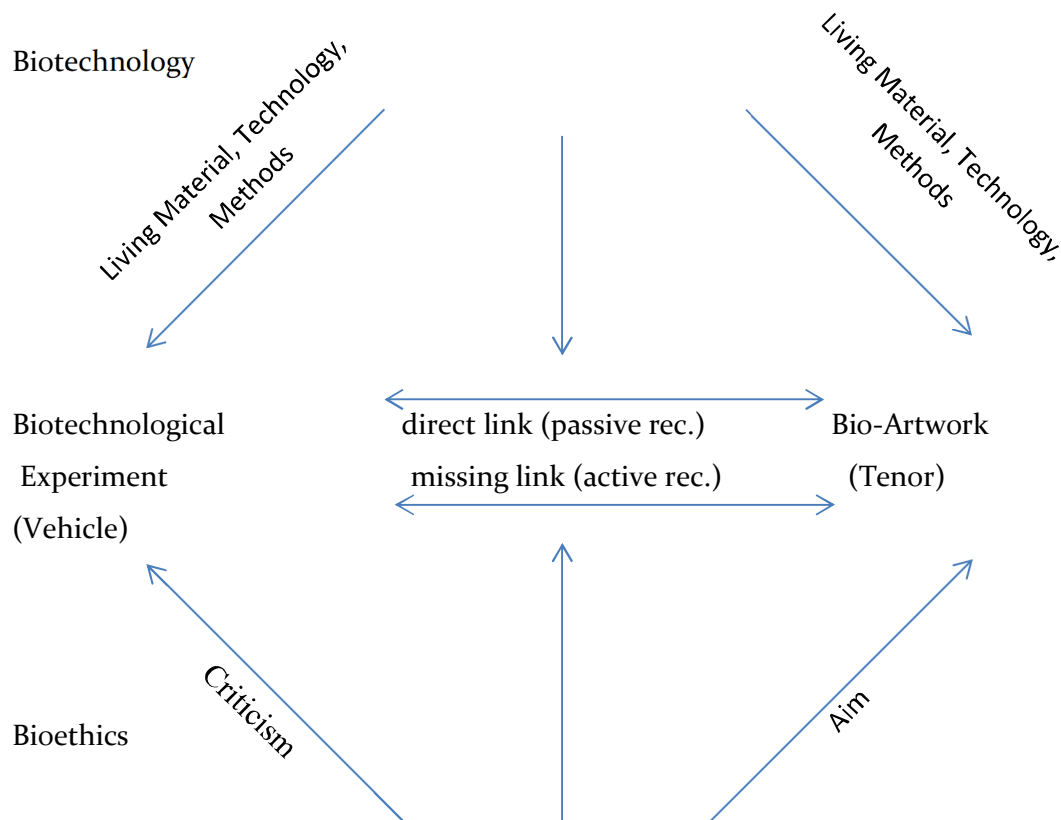
Bio-art expresses similar concerns with bioethics. Biotechnological research and its products get transformed into artistic projects aiming at the awakening of their recipients by provoking their philosophical thinking. The intentions of bio-artists, embodied in their artworks,

are morally oriented: a bio-artwork is a carrier of ethical values referring at the role of biotechnology to the life and the future of both the humanity and our planet.

### Bio-art as Enthymeme

Up to here we have shown that bio-art, although it is the result of research work that often takes place in laboratories and sometimes in collaboration with scientists, is not a scientific activity. It draws though from the scientific method its experimental part, which however is not to be understood as an attempt to prove a scientific theory. Bio-art is more related to technoscience in the sense that it focuses extensively on technology: it does not refer to the pure science of biology but mainly to the technoscience of biotechnology. The closest bio-art stands to bioethics, as bio-artworks are to be perceived as visual transcriptions of moral concerns. They are a kind of metaphors, in which the scientific experiment, the used technology and the final product appear as art: the artwork that is displayed as a biotechnological experiment is the tenor of the metaphor<sup>5</sup>.

Table 1



In his argumentation in favor of the artistic character of A. Warhol's *Brillo Boxes*, exhibited in 1962 at New York's Stable Gallery as artworks while being optically equivalent to the commercial cans on the supermarket shelves, A. Danto (1983, pp. 165-207) perceives the artwork as an Aristotelian enthymeme. The enthymeme is a kind of incomplete rhetoric syllogism, with a missing premise or a missing conclusion, which are to be filled in by its recipient in order for him/her to create an understandable and valid syllogism. The structure and quality of the enthymeme is, however, of such a kind that all recipients eventually end up to the same completions. Danto refers

to H. W. Fowler's statement on the role of the rhetorical question which also works on the patterns of an enthymeme, as follows: "A question is often put not to elicit information, but as a more striking substitute for a statement. The assumption is that only one answer is possible, and that if the hearer is compelled to make it mentally himself it will impress him more than the speaker's statement." (Danto, 1983, p.170)

Art, from its beginnings as a representational form of reality, has been a kind of visual metaphor (Wollheim, 1993): depicted forms are to be associated with real ones due to relations of visual similarity. The use of symbols already from the ancient times has however added to the definition of art as a metaphor a more conceptual character. In fact, it turned the ontology of art from a passive visual metaphor to an interactive rational enthymeme. Religious symbols, for example, associate asymmetric visual and real forms, by links deriving from the established religious traditions: in order to find out the connections, the recipient has to be familiar with the certain religious context that provides an inter-subjective understanding of its symbolic forms.

Artworks, such as representational paintings, with obvious correspondences between their inner forms with extrinsic ones, are perceived as inter-subjective metaphors of common visual principles of the two discrete worlds involved, the depicted and the real one. Such artworks are automatically perceived and understood in a more passive manner. The non-representational artwork as well as that of the modern and postmodern eras drawing on or even converging with science, technology, philosophy and reality, should however be considered more as an enthymeme: in order for the recipients to feel its power (Danto, 1983, p.174), they should have both the appropriate information of the framework that provides the links between its two words (its inner "world" and the "world" of science etc.) and the will to understand it. Otherwise, these kinds of artworks are at risk of being rejected ontologically as well as evaluatively.

The metaphorical character of artworks constitutes a fundamental ontological feature. Among the existing ontological theories aiming to find common and timeless principles for the artworks overall, a theory that defines them as results of analogical thinking, either passive or more active, in the form both of a metaphor or an enthymeme, seems to be the most appropriate one, as it satisfies the definition of all kinds of artistic expressions. In order to evaluate the degrees both of appreciation and aesthetic experience, it is more possible that those will be stronger in cases that the recipient actively participates in its understanding: we deeply feel the strength of an artwork when we manage both to find out and to complete its carrying messages. To do so however, we have to be familiar with its apparently missing cognitive framework responsible for its character as a visual enthymeme.

Bio-art constitutes art as it has the character of an enthymeme: drawing mostly from the technoscience of biotechnology and its philosophical-bioethical framework, a bio-artwork is a visual enthymeme that requires our rational activation in order to complete its inner elliptical syllogism. Its two parts refer to the same by human manipulated living reality, while as the vehicle stands the technoscientific experiment and as the tenor the bio-artwork. Its recipient is invited to find out the two links between the two parts. The first link is the apparent one deriving from the biotechnological field: direct correspondences between the scientific and the artistic experiment are immediately to be recognized. The second link is though a missing one, whose disclosure is absolutely dependent on the recipient. It is connected to the ethical thinking that is formatted around biotechnology (see table 1). Only the informed and cultivated recipient who manages to create a moral syllogism linking both parts of the enthymeme-artwork may gain a strong aesthetic experience. Recipients who are not capable to cognitively participate in this hermeneutical procedure may reject bio-art both at an ontological and an evaluative level. This is a decisive

parameter for the limited reception of such works by the general public, but it does not affect either their ontology as artworks or their potential to create intense aesthetic experiences to other (more willing) audiences. The more cultivated the recipient of a bio-artwork is by being aware of the general philosophical discussion that exists around Biotechnology, the more intense his/her aesthetic experience.

### **Bio-art historically defined**

Up to here, we have focused on the ontological definition of bio-art as art, both by distinguishing it from the fields with which it is related (science, technoscience, bioethics, living reality) and by defining its fundamental features as artistic ones in the framework of an ontological theory. Next we will develop our argumentation on the artistic value of bio-art through a historical approach. Based on the intentional-historical theory<sup>6</sup>, we will show that beyond the facts that it is created by artists and is institutionally received by the artworld, bio-art is art because both the intentions of its creators and the fundamental features of the artworks are to be traced back at several moments of the history of art.

A basic purpose of the creators of bio-art is to combine art with technoscience and bioethics. Their aim to converge distinct rational fields of human activity is not an unprecedented one. In the Renaissance, homo universalis was the model of the cultivated man, as he garnered more mental qualities: Leonardo da Vinci was as much an artist as a scientist and a researcher. His anatomical drawings, although being products of empirical observation and research, have been mostly recognized as important artworks. The merge of scientific and artistic work was then considered to be beneficial for the evolution of knowledge, as it culminated in a tradition that had its origin in Greek antiquity: ancient Greeks did not distinguish between art and science. The term of art referred to the visual arts, the applied arts and also to some sciences, such as arithmetic and logic. At the same time, there was a distinction between the liberal and the mechanical arts that continued to exist until the Middle Ages (Tatarkiewicz, 1970, pp.26-27; Tatarkiewicz, 1980, p.50; Summers, 1987, pp. 244-245) : the visual arts belonged to the mechanical arts. The situation changed in the Renaissance when the visual arts were elevated and transferred to the category of the liberal arts, as they were considered to stand closer to science than to craft (Gilbert and Kuhn, 1972, pp.157-158; Tatarkiewicz, 1974, pp.302-303).

However, after the scientific revolution it seemed necessary to distinguish rational activities, by the formation of taxonomic models not just for the distinction of autonomic fields such science and art, but even for the inner parts of each field separately, such as the distinction between empirical and humanistic sciences. Concerning art, in the 17<sup>th</sup> century the fine arts were separated from the crafts and also the painters and sculptors from the mere craftsmen due to the efforts of the French Academy of Painting and Sculpture. Philosophers such as D'Alembert, Diderot and Batteux formulated an ontological framework of the distinction between Art and Science, fine arts and crafts by proposing taxonomic models. In the 19<sup>th</sup> century the distinction between the empirical and humanistic sciences was promoted by the fundamental criterion of their distinct methodological tools of explanation and interpretation respectively. Art, which has been the subject of the humanities, was since considered as an independent field without any correlation with science.

In the late 19<sup>th</sup> century, however, artists turned to the scientific knowledge (Gamwell, 2002), which they approached in a dual way, both as a field of inspiration for artistic work and as the source of the experimental method: artworks started since to function as visual experiments

with reference to modern scientific knowledge. Art has always evolved through experiments that were thought of a practical nature. As discussed by E. Gombrich (2002, pp. 24, 76-77, 221-232, 276-277, 279-280, 307), art evolves through the trial-error model. However, from the end of the 19th century, experimentation in art has had a more theoretical background: it hasn't been related just to the evolution of styles or materials, but also to the answering of questions that have been either directly related to the scientific field or indirectly linked to it through critical-philosophical approaches. The first trend includes the intentions of many modern artists, such as the impressionists and the post- impressionists who drew from the theories of Helmholtz, Chevreul and Maxwell on visual perception (Gamwell, 2002, pp.111-121) the cubists who relied on theories from the fields of physiology and non-Euclidean geometry (Gamwell, 2002, 134-140) and the surrealists who have experimented with the techniques of psychoanalysis and automatism (Gamwell, 2002, pp.243-257).

There are art historians and bio-artists (Myers, 2015, p.234-interview with the Australian artist, Boo Chapple) who see correlations between bio-art and surrealism, by recognizing the bio-art movement as the starting point of a new surrealist era (Myers, 2015, p.21). A common parameter between surrealism and neo-surrealism is the intention to give a visual form to possible versions of reality, discrete from the conventional ones that are the product of conscious infiltration procedures. The aim of the surrealists was to limit down the influence of consciousness on the perception of reality by unraveling the unconscious through the use of a variety of techniques, such as automatism and the cause of shock. After the First World War with the thousands of losses in human lives, rational thinking that had since the Enlightenment been recognized as the fundamental axis for human progress, was now challenged and moreover targeted as responsible for the global disaster. Surrealists explored new possible aspects of human perception that would lead both to the real understanding of human nature and to new possibilities of perceiving the world. Bio-artists are a kind of new surrealists as they aim to reveal new correlations and distinct aspects of the real<sup>7</sup>, living at an era where everything is changeable due to biotechnology and the technosciences in general. Bio-artworks often have an uncanny<sup>8</sup> impact to their perceivers as also was the case with the surrealistic creations (Zwart, 2012).

Bio-art has formed a trend in art having as fundamental axis the critical - philosophical approach to the achievements of science: it has been established in the postmodern period and mostly refers to the technosciences and the philosophy developed concerning the effects of technological evolution both on man and the planet. Philosophy has always influenced art<sup>9</sup>, while in the 20th century modern art turned itself into a philosophical inquiry by formulating ontological questions about its essence and its role both through the emergence of its morphologic elements as autonomous aesthetic values (abstraction) and through the exaltation of the common - commercial object to an artwork aiming at the revelation of its cognitive value by the challenge of philosophical thinking (Duchamp & ready-mades, conceptual art). Through such approaches, additionally, boundaries between art and real life have been gradually abolished. As the starting point of this procedure are to be mentioned both the cubist collages and the Duchamp's *ready-mades*. It continued however in the second half of the 20th century through several movements such as pop-art (Warholl's *Brillo Boxes*), conceptual art, neo-dadaism, environmental art and neo-realism.

Since the 19<sup>th</sup> century, artists have often criticized social and political situations through their work: Courbet rebelled against the establishment through his art. Since then, art has become a powerful tool of social and political criticism in the hands of bold artists who have used the potential of the image to awaken their fellow citizens. As in the years of the Industrial Revolution

that artists (along with other intellectuals) took on the role of highlighting key social and political problems that had serious consequences on people, in the age of biotechnological revolution artists have also felt the responsibility to alert humanity about the consequences of biotechnological practices.

The intercourse of art and technology is neither something new: since the beginnings of the 20th century, many artists seemed to be baffled by the limits of technological interventions. There were those who positively perceived the role of technology in society by painting scenes of the new technological age (futurists) and others who approached the new situation in a more skeptical or even satirical way (Gamwell, 2002, pp.179-184, 282-283). Apart from the role of technology as a field of artistic inspiration, some artists began even to incorporate it into their works<sup>10</sup>, a practice that finally became a dominant trend in the postmodern art scene. The establishment of the EAT, a company for conducting experiments in art and technology, by Kluever, Rauschenberg, Waldhauer and Whitman, was of decisive importance to that direction. Johann Wilhelm Kluever, a Swedish-Norwegian engineer, was the first who promoted collaborations of artists and engineers in laboratories, by changing the relationship between art and technology from the stage of technological applications in artworks to the stage of the equal coexistence of art and technology – artists and researchers in laboratories (Miller, 2014, pp.34-49). Kluever also founded a group for art and science at Bell Labs (Miller, 2014, p.35), enhancing the new collaborative attitude between artists and researchers, which finally led to the formation of the “artist in residence” institution with many artists having been hosted in research laboratory since then (Ede, 2000, pp. 55-67).

It should however be stressed that, while it seems unprecedented that technological products are renamed into works of art, it is a phenomenon that has its roots at the very beginnings of humanity. In prehistoric times artifacts served both practical and aesthetic purposes. For example, the bullroarer, evolved through the hunting technology of the lasso (Lawergren, 1988, pp.31-45) was used in the Paleolithic era both as a means of long-distance communication and as a musical instrument with which native Americans and Australian Aborigines accompanied their rituals (Morley, 2013, pp.105-109). Other representative examples are technological products, such as swords, exhibited in museums and admired not only for their historical but also for their aesthetic value. However, in the framework of Bio-art, biotechnological products are not converted into artworks with aesthetic intention but more with a cognitive- artistic one<sup>11</sup>. This is a process that has its origins in Duchamp's ready- mades, has been perpetuated by conceptual art, and has reached its peak both with Bio-art and the art associated with computers and artificial intelligence.<sup>12</sup>

Real life constitutes the subject of bio-art's work at the level both of microcosm and whole organisms, which are explored experimentally through biotechnological methods in order either to expand knowledge to imaginative (and usually not accessible by scientists) regions showing future possibilities, or to provoke philosophical thinking on the relationships of human, science and technology, biological and technological entities, power systems and their control. Living organisms have always been a subject of visual arts since their beginnings in the prehistoric rock formations, however in a pictorial manner. The first attempts to visualize living organisms in order to systematically observe their structure took place in the Renaissance. Artists of the Cinquecento dealt with the anatomy of the human body: Leonardo da Vinci illegally dissected about thirty bodies, but had to cease with this practice as demanded by Pope Leo I. A large number of drawings and notes testify though his systematic research on the brain, the muscles, the heart, and also the fetus. Later on, Andreas Vesalius co-operated with an artist, probably from Tizian's workshop, to illustrate his “*De Corporis Humani Fabrica*”<sup>13</sup>, a systematic research on the anatomy of the human body. From that era exist many volumes including naturalistic depictions of plants and animals,



which sometimes are products of pure empirical observation and sometimes are combined with fantastic elements deriving from folk traditions, such as Conrad Gensler's monumental work on the fields of zoology, phytology and entomology.

The invention of the microscope in the 16<sup>th</sup> century, but mostly its advanced form due to the incorporation of achromatic lenses in the second half of the 19<sup>th</sup> century, opened the way for detailed observations of the microcosm not only to the researchers but also to the artists who seemed to be enchanted by its forms and colors (Gamwell, 2002, pp.77-80): artists of the German Jugendstil (Gamwell, 2002, p.48) and the French Art Nouveau (Gamwell, 2002, pp.77-80) were absolutely influenced by those new discoveries. The next step in the development of the relationship between art and life have taken place in the late 20<sup>th</sup> century with the Bio-art movement: the living world both at the cellular level and in the form of whole living organisms has become part of the artwork not however as a depicted form but in its real substance.

As it has already been shown, the loosening of the boundaries between art and science, art and technology, art and philosophy, and even art and real life has been the result of a gradually evolving process: initially all those rational activities as well as real life only functioned as inspirational fields for the artists, who used to work with their own means. In the contemporary era though artists have directly integrated basic attributes of them into their work: Science as a theoretical construction offered them the experimental method, philosophy was identified with abstraction and conceptual art, technology was united with artistic creation, and life has been incorporated into it in its real dimensions.

A last feature of bio-art to be mentioned is that in many cases bio-artist have the initial idea, while the project is to be completed by a researcher who has the expertise. This has been a common practice since the late 19<sup>th</sup> century, when August Rodin first assigned the visualization of his ideas to craftsmen. Moreover, it was a symbolic move in order to show that the role of the artist is primarily a cognitive one, as art should cease to be perceived as a craft. From then on, modern artists having as their fundamental intention to remove art from its traditional definitions as first the imitator of reality, secondly the expression of the beautiful and thirdly the product of a perfect know-how, have introduced new methods and purposes, such as the highlighting of the artistic idea as more important than the craft. In this framework there has been a tradition of collaborations, such as in the field of bio-art, where the scientist/researcher is the one who has the expertise in order to realize the artistic idea.<sup>14</sup>

### **Concluding Remarks**

In spite of its distinctive character and its seemingly new methods, bio-art is not only to be understood as art on a nominalist basis according both to the profession of its creators and the institutional reception of the works by the artworld, but also in terms of ontological and arthistorical definitions. As shown above, bio-art constitutes a contemporary trend in the framework of the arthistorical development that is linked to multiple and distinct levels with pre-existing historically certified artworks. At an ontological level, the bio-artwork is to be perceived as a visual enthymeme linking the biotechnological experiment with the bio-artistic one. Thus, it becomes an artwork through the challenge of philosophical thinking dealing with bioethical questions about the consequences of biotechnology on the present and the future humanity. Both the appearance and the development of bio-art reflect to a certain extent the evolution of the human perception that has reached the point of understanding the philosophical value of art, which has the potential even to identify with other mental activities, such as Biotechnology.

The purpose of bio-art, however, is an artistic one, mainly expressed through references to bioethical issues. In contrary though to bioethics, which is a philosophical field using its own rational argumentative means, art as an ontologically free activity has the potentiality to use both the means and the methods even of the rational field which it aims to criticize. Bio-art is a relatively new artistic expression that borrows both from biotechnology and bioethics in order to fulfill its purpose which is to awaken its perceivers by creating philosophical thinking. However, it is also to be understood as a means for the communication of general matters in the technosciences, as its either ignorant or more informed perceivers may get both interested in and puzzled by biotechnological and bioethical issues.

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## Notes

<sup>1</sup> The institutional theory recognizes as the main ontological features of artworks both that they are artifacts and that they have been perceived as art by institutionalized members of the artworld (Dickie, 1974). This theory demonstrates the direct link of art and society, in the context that art depends to a large extent on social institutions. It fails, though, in terms of creating ontological definitions. Among others, criticism was expressed about both its cyclical character and the absence of persuasive arguments about the reasons that an institution recognizes an artifact as an artwork (Wollheim, 1987). Also, supporters of the intentional fallacy theory, such as W.K. Wimsatt, Jr., and Monroe C. Beardsley, claim that interpretations of artworks based on extraneous elements, especially on the intentions of their creators, might be both incomplete and wrong (Wimsatt Jr. and Beardsley, 1954). Similarly, Roland Barthes argued that after the completion of his/her project, the creator metaphorically dies, and its interpretation belongs to its recipient (Barthes, 1977).

<sup>2</sup> B. Russell challenged the absolute credibility of the inductive scientific method, arguing that it could lead to false conclusions. More credible are the conclusions derived from productive arguments based on rationally true propositions (Russell, 1912, 2015).

<sup>3</sup> Since the 1980s, experiments have been carried out on transgenic mice (Onco mice) to investigate the causes of certain cancers. Onco mice are perceived as a distinct class that has physical and artificial, theoretical and practical, abstract and specific ontology. Their existence is patented as an invention, which raises many philosophical questions and has also become political as transgenic mice are used as a reference to the conflict between the European Union and the United States on the patentability of living organisms. These are issues that concern bio-artists as well. An example is the “Embracing Animal” (2005-6) of Kathy High, in which the artist explores the relationship between humans and transgenic living organisms, particularly those involving human genes (Wilson, 2012, p.28).

<sup>4</sup> At the same time, there are philosophical studies both on technoscience’s ontological and epistemological status (Echeverría, 2003). However, in the context of approaches focusing on the negative impact of Biotechnology on culture and society, the reference is mainly on Big Science as it has been defined at the Manhattan Project, which directly related science, technology and political power (Hottois, 2019)

<sup>5</sup> The first who analyzed the metaphor in its two parts, the tenor and the vehicle, was I. A. Richards in his book *The Philosophy of Rhetoric* (1937). Richards describes the tenor as the subject to which attributes are ascribed and the vehicle as the object whose attributes are borrowed.

<sup>6</sup> The theory of the intention-historical definition was founded by J. Levinson (1979, pp. 232-250). Despite objections and criticism, it still is the only ontological theory of art that links philosophy and history, explaining the artistic phenomenon in terms of its historical evolution. For the problems arising in applying this theory to revolutionary forms of art, see Wilson, 2015, pp. 407-416.

<sup>7</sup> For example, Myers (2015, p.10) refers to the bio-artist Vincent Fournier who, in an interview, talks about his intention to reveal new versions of the real by the mixing of living forms with synthetic biology, cybernetics or nanotechnologies.

<sup>8</sup> “Uncanny” is a term used in psychoanalysis referring to a feeling created when familiar entities suddenly appear detached from their normal context (Zwart 2012, p.51)

<sup>9</sup> For example, the influence of both the neo-platonic philosophy on Florentine renaissance art and the “Naturphilosophie” on the German romantic artists.

<sup>10</sup> The history of the relationship between art and technology has its beginnings in the “Deutscher Werkbund”, the Bauhaus, the Kinetic Art of Moholy Nagy, Naum Gabo and Jean Tinguely and continues up to today with the works of artists, like Erik Guzman and Edward Ihnatowicz (Miller 2014, pp. 80-81, 277-279).

<sup>11</sup> The cognitive character of art differs from that of science. Science is defined as the mental activity that aims to increase our information potential through systematic rational and experimental controls. On the other hand, in art, which is free and independent of rules and limitations of expression, knowledge refers to subjective understandings of reality having a more philosophical character. The purpose of art is to broaden the mental horizon of its recipients by both awakening their consciousness and building new paths of thinking (Gemtou, 2011a, pp.49-53).

<sup>12</sup> Already in antiquity, it was believed that art evolves through artists who have both the ability and the courage to make landmark discoveries (Gemtou, 2015, pp. 35-48). Each invention creates a new direction in the context of the evolutionary course of Art, in which artworks have the revolutionary initial creation as their starting point. This has been a stable pattern in the evolution of art that reflects the evolution of human perception. Big Bang’s cognitive theory explains the breakthroughs in the histories of art, science and technology in connection to the evolution of human brain function: the primary appearance of art was the result of the genetic mutation that occurred at 50,000 BC influencing the collective modes of brain function (Appenzeller, 1998), p. 1451 ; McBrearty, Sally, and Brooks, 2000), pp.453-563). Similarly, changes in science, technology and art of the 20th century are directly linked to the sophisticated perceptual capabilities of the modern man who both perceives and explains the world based on adaptive approaches of its data aiming at his own benefit.

<sup>13</sup> Contrary to Leonardo's drawings, the drawings of *Fabrica* are not naturalistic depictions of the human body and its structure but link artistic beauty to empirical observation deriving influence from the aesthetic principles of both the classical antiquity and Renaissance iconography of vanitas.

<sup>14</sup> See, for a typical happening conducted by a scientist under the guidance of an artist, Orlan's "Reincarnation of Saint Orlan" (Gemtou, 2011b, pp. 639-650)

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