Transformation of the Traditional Creative Art Studio to an Experimental Bio-Art Studio as a Science Laboratory: A Historical Analysis

[1]Omar Mustafa Abbas & [2]Mohammad Glubb Al-Kinani
[1] Student, [2]Professor, College of Fine Arts,
University of Baghdad, Baghdad, Iraq
omar.mostafa1102a@cofarts.uobaghdad.edu.iq
mohammed.alkinani@cofarts.uobaghdad.edu.iq

Received	Accepted	Published
20.12.2023	20.06.2026	31.07.2026

https://doi.org/10.61275/ISVSej-2026-13-04-03

Abstract

An art studio is more than just a physical place occupied by the artists to produce works of art. Over the history of art, the studio has undergone experimental transformations within the boundaries of its environment and the art techniques. This has led to the disruption of its concept as an incubator for creativity, leading to a complete transformation from the studio environment with its materials and tools to a scientific laboratory environment. Some of it now employs living organisms artistically in places called 'bio-art studios.' This study examines the diverse experimental accumulations that the artists have undergone within the art studios, shifting the traditional art studio to a biological laboratory.

The research employs a historical descriptive methodology. It derives data from published documents, specialized exhibition guides, and in-person interviews posted on websites of art organizations and artists in Europe and America between 1990 and 2020. Data is synthesized to map a coherent trajectory of the historical transformation of the art studio.

Findings show that the shift from the studio to a laboratory was the outcome of experiments conducted inside the studios by using various materials and equipment. Changes have taken place on the artist's workspaces, which also include the rules to follow stringent safety and preventive protocols when dealing with live organisms in the laboratory. It is concluded that a growing number of organizations and museums show more interest in setting up participatory bio-art laboratories as a method of teaching and a tool for raising cultural and social awareness. In turn, this has resulted in the increased receptivity of science to art and *vice versa*.

Keywords: Studio, Laboratory, Experimental Transformation, Interactive participation, Bio-art.

Introduction

The art studio has witnessed a radical change in its physical space early in the nineties of the last century, and this has prompted the artists to look to the scientific laboratory and experiment with living things as a creative element of artistic work. Indeed, this has been assisted by scientists and technologists who have been specialized in these fields. It has led to the creation of what is now called bio-art, as opposed to traditional art. Along with adjusting to a whole new setting and its tools and gadgets, the artists also have had to re-evaluate the production techniques, presentation strategies, and supporting cast.

In this context, this paper examines the origins and the transformations of the traditional art studio. It aims to reveal the experimental shift from the studio to the laboratory and its reflection as a creative achievement of bio-art. Its objectives are:

1. To identify the shift resulting from the accumulations of experimentations within the art studio.
2. To produce a brief historical review showing the significant factors of the changes that has led to this shift.

Research Methodology

This research applies a descriptive method in revealing the shift from the studio to the laboratory. The descriptive method depends on studying the phenomenon, and is employed to describe and express it qualitatively. The descriptive method describes what is happening or has happened and obtain facts that are related to the issue, and clarify the possible shifts and changes and make predictions with future variables (Darwish, 2018). Two methods are employed.

First, data are collected from books, specialized exhibition guides, and personal interviews that have recorded the past and are published on authentic websites of institutions and artists.

Second, more recent publications that have examined the issue are reviewed. This review examines the artistic studies that have discussed bio art in the artistic works. In fact, several studies have discussed the concept of bio art in its different economic, political and ethical aspects. They refer to a range of ideas, and that gives the current research its significance when discussing the shift of experimentation and spatial environment that the artist occupies and his opening to a new culture: new work and display spaces.

Findings from Historical Records

The Evolution of In-studio Experimentation and Transformations

The Industrial developments have played a prominent role in disrupting the studio environment, in such a way that it has moved from its closed interior spaces to the outer spaces. It has been the artist's responsibility to do so while he was moving between the forests and the streets, thanks to the innovations of the ready-made color-tube with various shades. This transformation has generated new artistic experiences for what is known as modern art, the works that are produced by the well-known artists such as Monet, Manet and Van Gogh who, in their abundance and working techniques, have highlighted the ease of movement with the tools and colors that were provided by the mobile studio. For example, Monet had prepared a boat with the basic tools to serve as a floating studio, in which he painted landscapes and portraits of his friends (Wallace, 2014) (Fig. 1).

On the other hand, the industrial revolution has affected the methods of artistic production and has prompted the artists to think about the utilitarian function, in addition to the aesthetic one. Indeed, this has been reflected in the studio environment, which now includes a number of artists that are united by organized methodological unity, with differences in techniques and artistic manifestations, as in the Bauhaus school. In fact, it is considered the basis for the cross-fertilization of the arts and combination of the aesthetic and the functional, and the deviation of art from the

authority of museum arts and the shift to the logic of circulation (Mohammed, 2015). However, the attempts to shift towards the outer space has motivated some artists, such as Robert Smithson, to abandon even the tools and materials of art and employ elements of Nature as material and conceptual alternatives. He says that "Freedom from the constraints of the studio liberates the artist to some extent from the traps of the craft and the slavery of creativity" (Jones,1996:68).

The studio is now called the factory (Fig. 2). Founded by the artist Andy Warhol, it has been an attempt to change the stereotypical studio format by rearranging the elements of the place such as printing, photography, film, music and multimedia, so as to suit the nature of artistic genres,, while introducing the factory techniques into the production process that provide a model that contradicts the aesthetic concepts of the original. However, the reproduced, with a pragmatic consumerist dimension has not been possible in America in the 1950s. Right-wingers have attacked it as communism, the committed leftists have criticized it as bourgeois, while the liberals have defended it as the final choice of a free individual in a democratic state (Jones,1996).

The studio thus became a cultural identity for the cities. It violated the expectations rejecting the traditional frameworks. In fact, according to Mohammed (2015), contemporary art themes were rejected and the studio was turned into a hollow work of art. The artist exploited the effect of the dynamic shift that was based on dialogue and participation, so that the intersection between disciplines would serve a bridge between science and art. This concept has been embodied in the spatial shift from the studio into an interactive laboratory, as in Olafur Eliasson Studio where the crew includes 90 people in specializations such as being artists, architects, designers, specialized craftsmen, art historians, scholars, and theorists. The laboratory takes an entire building that includes an archive, an art school, a seminar hall, an administration area, a rehearsal space, a production area, a workshop, and Eliasson's personal space (Coles, 2012).

Progressing further, in 2001, the artist Francis Bacon's studio has been moved from its original location to the museum as a piece of art with all the precise details of the place. Al -Bayati (2023) assures that "Contemporary beauty does not look at art as a physical form in appearance or as abstract as much as it contains a problem with the effect, artist, and its recipient". Despite the fact that Bacon employed the oil painting technique in most of his works, the spatial environment he left is considered an intellectual legacy of alienation, absurdity, and indifference.

Fig. 1: Claude Monet Painting in his Studio, Source: Claude Monet, 1874

Fig. 2: The Factory Andy Warhol's New York City Studio Source: New York City Studio

Interestingly, in 1998, the contents of Bacon's studio have been donated to the Dublin City Gallery, where a group of archaeologists have cataloged and photographed every component of the chaos and have archived all the contents, which include more than 7,500 diverse pieces of art (Harrison, 2006). In fact, Bacon's studio has been turned into an experimental laboratory for psychologists to study some pathological conditions. This has been indicated by Lacy Vitko-the

treatment coordinator at the Epilepsy and Fine Art Therapy Foundation who says that, "Art therapy is the process of creating works of art framed by their therapeutic relationships."

Treatments take place within the studio in several fields. Lowenberg (2014) points out that arts, such as drawing, music, and acting, is the most effective treatment method, as it reduces the risk of side effects of drugs. Moreover, the nature of the place is considered a living documentary material. The studio, in its physical space, has been turned into an artistic material after he became its producer. In an interview, Bacon has said,

> "I can only draw here in my studio... I cannot work in very tidy places. It is easier for me to draw in a place like this is chaotic. I don't know why but it helps me"
>
> Buchanan, 2011:87 (Fig. 3).

Understandably, the technical change in the use of materials and tools within the studio has led to acceptance of the process of transformation towards new work environments.

Fig. 3: Francis Bacon's 7 Reece Mews studio, London
Source: Ogden, 1998

The Shift from the Studio to the Laboratory

Interestingly, the contemporary technical shift has produced new interactive relationships that have terminated the barriers of classification between the artistic genres and the neighboring sciences. Indeed, it has urged the artists to shift to work in some environments that are more suitable for artistic production processes that are not available in the traditional studios, in terms of tools, media, and working methods. The studio has thus undergone shifts towards the forms that are more open in their absorption of multiple disciplines, often making them indistinguishable from the laboratory environment (Coles, 2012). (Fig. 4).

The institutional awareness has contributed to the process of a shift towards a laboratory environment. That has been done by employing certain educational tools towards accepting art in science, and science in art, on the one hand. On the other hand, it has provided the specialized materials and equipment that are financially expensive, as it has been summarized by Michael Century, a program director at the Canadian Center for Information Technology Innovation when he declared that the first of such materials is the art centers that were established to support artistic experimentation with emerging technologies. For instance, the first among them are the Experiments in Art and Technology, Institute for Research and Coordination in Acoustics and Music, Center for Advanced Visual Studies at Massachusetts Institute of Technology. Secondly, media centers that were interested in research and engaging the public with festivals and exhibitions have come to surface. According to Banff (Century, 2013), the 'Third' is the studio laboratories that are based on strong partnerships with industry or higher education, such as Media Lab at

Massachusetts Institute of Technology, Xerox Park Bayer Artist-in-Residence Program, and the Center for Advanced Visual Studies at MIT.

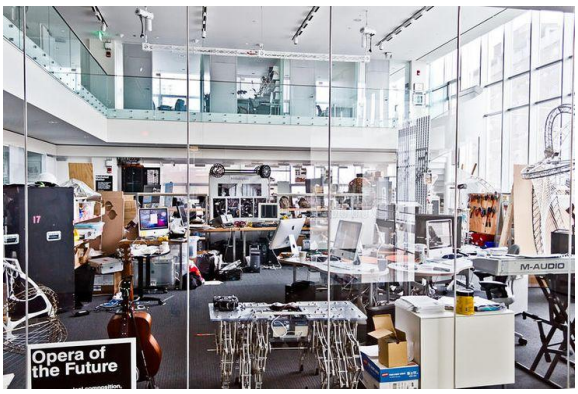

Fig. 4: Massachusetts Institute of Technology Media Laboratory
Source: MIT Media Lab, Cambridge, USA

The intersection of experimentation between the artistic creative sense and scientific discipline has produced a hybrid partnership and a multi-use environment of public benefit. It has placed scientific and artistic research centers in a state of generative thinking and planning for the interactive participation in the creation of new artistic-scientific works, as it has been hosted by the educational laboratory of Exploratorium Museum. It has stated:

> "We get the artists in every aspect involved in our work in multiple ways so as to inspire their curiosity, and enable them to foster an interdisciplinary approach to seeing and understanding the world. The artists contribute in countless ways to our ongoing research and development, both inside and outside the museum."
>
> Exploratorium Arts, 2014:178

Thus, experimentation has become part of the show in a laboratory space dedicated to visitor interactions, in which pure science is transformed into the joy of discovery. According to Edwards (2010), Obrist and Vanderlinden, Laboratorium has invited the artists and scientists to open their laboratories, philosophers and historians to explore the meaning of the laboratory, and the public to consider how the laboratory is defined.

The Louvre Museum provides an interactive experimental space within its unique spatial environment with Dai Nippon Printing Company-DNP Museum Lab, with modern display technologies, which aims to make art and culture easily accessible to everyone, by developing methods and creating environments that enhance the functions of the museums. The traditional ones, covering every era in a virtual way by combining them with technological developments of multimedia displays (DNP, n.d.), as interactive laboratories that make the fun element in education as an essential factor in making science move out of its strict contexts of transferring information into a space of purposeful artistic interaction. The thinker John Locke believes that:

> "Man can achieve knowledge of the things that exist in the material world by deducing, that there is a basic rule upon which these connected conclusions are formed, and this rule is due to experience and sensory experience"
>
> Abbas, 1996:62

Museums also have had the laboratories that were specialized in processing and preserving the works of art in scientific ways, due to the chemical and biological reactions caused by the variable time and environmental factors on the materials of works of art. For example, Hermitage Museum has 16 specialists, including physicists, chemists, biologists, and art historians, who work in a joint laboratory environment to restore and document works of art, while detecting forgery (Kosolapov, 2020). However, diversity of laboratory collaborations between the artists and the scientific disciplines depend on the nature of the need. Nevertheless, the significance of artistic collaboration is influential and effective on a level parallel to scientific interventions.

Biological Laboratory

As a result of the evolution of art into a higher form of scientific - artistic expression and its use of biological laboratories, its materials and tools have undergone tremendous change. They include the conventional tools to the ones that allowed the artists to work with living things to create art. This is known as bio-art, a contemporary art form in which the artist employs living things such as bacteria, plants, and animals to express themselves artistically. He explores the nexus between art, science, and technology through the use of biotechnology, genetic engineering, and pure science in his artistic creations. Interestingly, in order to challenge the popular perceptions of beauty, he employs evolutionary techniques (Kac, 2007).

According to Gilles Deleuze, the transition from the studio to the laboratory is comparable to the expansion of the "rhizome network" since both involve non-parallel developments between heterogeneous objects and the developments that jump from one line to another rather than working through formation (Mustafa, 2018). This is the approach that research and educational institutions have taken in using the two poles-art and science-and turning them into a cultural product that uses artistic displays to further humanitarian objectives.

Moving on from this, Oron Catts and Ionat Zurr, two artists and scholars, have launched the Tissue, Culture & Art (TC&A) project in 1996. This creative partnership between science and art investigates how tissue engineering may be used to represent one's artistic vision. The Tissue, Culture & Art (TC&A) project has produced cutting-edge artworks, exhibitions, written articles, and performances that center on the social effects of tissue engineering (Catts & Zurr, Tissue, Culture & Art project, 1996). Their projects have addressed the changing nature of human-animal relationships, laboratory-grown food, tissue-grown clothing, and life-like sculptures. The laboratory has served as both a practical and theatrical setting, and their performances have hinged on bringing the laboratory into the galleries with what the organism imposes. As Ionat & Catts (2023) point out, it has been necessary to remodel the laboratory in order to alter the biomedical setting to present new emotional scenarios and contemplations.

Adding to these, Oron Catts and Ionat Zurr have presented engineered tissue sculptures such as Victimless Leather, Disembodied Cuisine and Semi-living worry dolls (Fig. 5), which have been displayed in an artistic context within (Ars Electronica) exhibition. The biological sculptures have aroused the recipients' astonishment, who have shared their fears according to the mythological structure of these dolls by recording these questions on a computer equipped with an application guest book (Kenway, J. et al., 2006). Johung (2019) shows that, through these, people can express their concerns to the semi-living anxiety dolls. Rituals of feeding and killing are routinely performed. Public is invited to witness the feeding process, which takes place in a laboratory located within the gallery, as an integral part of the artistic experience. At the end of each installation, the artists had to literally kill their creations. Catts & Zurr (2017) say that killing is done by bringing out the semi-sculptures.

Fig. 5: Disembodied Cuisine,
Source: Oron Catts & Ionat Zurr, 2003

In 2000, artists Oron Catts and Ionat Zurr have collaborated with the University of Western Australia to establish the Symbiotic-A. This has been a laboratory in an environment that combines artistic and scientific spaces. It is in fact the first biotechnology laboratory designed for spatial sharing in various disciplines between artists and scientists. Many workshops have been held in various parts of the world to introduce artists and scientists to the genetic engineering of plant and animal tissues (Kelley, 2016). This laboratory contributes a lot in the preparation of research knowledge and building of communication bridges with scientific disciplines at the university.

Notably, since this laboratory was opened, more than 120 residents, visual and performance artists, science fiction writers, art historians, political theorists, geographers, scientists and musicians, among well-known artists have benefited. Indeed, they have worked with biological materials, as same as Paul Vanoss, Stelark, Steve Kurtz, Paul Thomas, Orlan and Adam Zaretsky have done (Rogers, 2022).

The significance of the shift towards the laboratory occupied by bio-art, as an awareness tool and as part of critical intellectual influences directed towards controversial ethical, cultural, and social issues have since grown tremendously. In fact, as Thackerc (2007) says, bio-art can raise more controversial issues, and contribute to raising the awareness of ethical and political issues in the field of biotechnology by making science more accessible to non-specialized audiences with presentation methods that allow direct audience participation.

In this view, art is not primarily about giving answers. It provokes and makes us feel uncomfortable about things so that we can re-evaluate and think about them (UWA Research Impact, 2018). In this context, it is noteworthy that while being in the Symbiotic-A laboratory, artist Paul Vanouse and microbiologist Susan Barker have developed the Latent Figure Protocol project, which uses DNA sequences in a gel. A DNA gel image is a culturally constructed artifact identified by the laboratory, looking as if it was present before the laboratory intervention (Da Costa & Philip, 2008).

Similarly, in 2007, the Symbiotic-A laboratory has hosted the Harlequin Coat project developed by artist ORLAN who created a hybrid coat by collecting several layers of skin in addition to laboratory-made cells. It serves as a powerful symbol of cultural hybridity. The project combines digital photography and exploration of beauty from different cultures and the media. Parker-Starbuck wrote:

> "Skin transplants are a routine procedure, practiced in our time, but what is unconventional is the transplants on my skin along with cells extracted from a black woman's fetus - sold on the Internet"
>
> Parker-Starbuck, 2013:234

Artist Stelarc's performances are among those that constitute a response to the shift towards the interactive bio laboratory, through the use of spaces of medical clinics and laboratories and their tools, along with artistic works that explore the human body by applying different medical and engineering methods, as in his works 'Third Hand,' 'Stomach Sculpture' and 'Extra Ear'. These are works that are full of strangeness, excitement, and even provocation. In fact, he wrote,

> "Despite the initial interest shown by some doctors since 1997, they eventually changed their minds. The reason behind this hesitation is that the Extra Ear project goes beyond Mere plastic surgery and involves not only modifying existing anatomical features, which are now socially acceptable, but also delves into the realm of constructing an additional trait that might be perceived as monstrous, or resembling a birth defect, extreme body modification, or even radical genetic change"
>
> Reichle, 2009:84

Inside the surgical theater (Fig. 6), the laboratory products of ear engineering, surgical instruments, and the artist's body come together. Shockingly, art has brought the laboratory environment out of its isolation into performances that the recipients watch through a group of images during the surgical operation.

In 1997, Artist Edward Kack has cooperated with a group of doctors and engineers to implant a data chip under the skin of his leg. The process of implanting the "time capsule" became an event and a direct artistic performance in front of the audience who were present in the exhibition, and it opened new dimensions in employing the technology inside a human body. A small chip was implanted in his body and was broadcast live on television and the Internet (Reichle, 2009). Likewise, in his artistic work (A-positive), he transports laboratory devices to the showroom to be part of the event, and uses them directly in front of the audience. In this event, the artist and the robot are in direct physical contact through an intravenous needle and transparent tubes, feeding each other in a mutually beneficial way. Eduardo Kac wrote

> "We can no longer consider the body to be isolated from a strong connection to the artistic scene; We cannot fail to resist biometric bio surveillance. Disembodied DNA became a computational tool, while artificial blood circulates in human blood vessels"
>
> Kac, 2005:157.

In 2000, artist Kac collaborated with a group of genetic engineering scientists, in the laboratory of National Institute for Agricultural Research in France (INRA), to produce the first genetically modified rabbit, that was known as 'Alba-Alba or GFP Bunny', which is a hybrid that glows green (phosphorescent) when it is exposed to ultraviolet light. Kac explained that

> "At the beginning, it was difficult, even for specialized audiences, to understand that bio art was precisely a new form of contemporary art; it was difficult for audiences to recognize what they had not previously recognized as the unique aesthetic principles of bio art" (Fig. 7).
>
> Kac, 2020:98

In Berkmen Laboratory, one of the research laboratories at New England Biolabs, artist Maria Penil Cobo creates her artistic works in cooperation with the microbiologist Dr. Mehmet Berkmen and employs several types of bacteria. This method was a challenge and difficulty in the

mechanisms of working and controlling a single environment that includes different growth processes over time. She wrote:

> "our primary mission is to change the relationship between humans and microbes. "Using the universal language of art, bacterial art brings the invisible to the public's eye, increasing awareness, and raising curiosity"
>
> Frankel, Temple, Dikener, & Berkmen, 2023:7

In 2015, their work (Neurons) won the scientific and artistic competition prize for the art of agar, which was launched by the American Society for Microbiology (ASM), through which it attracted those artists who were interested in dealing with living organisms (bacteria, fungi, germs). In 2023, in a statement on its website, the association announced the names of the winners of the ninth annual Agar Art Contest, and that was s participation that was beyond expectations. In the same year, the association received a record number of 390 entries from 37 countries (Urban, 2023). What distinguishes the competition is the division of participants into several categories. It gave the scientists, artists, hobbyists, and children, a platform to display their creative creations by using live microbes to draw pictures on agar (Urban, 2023). The art of agar depends directly on laboratory tools and media, and the risk rates vary according to the difference in the raw material and the methods of preserving it.

Artist Anna Dumitriu led the "Trust Me, I'm an Artist" project (2011-2017) with Professor Bobbie Farsides, of Clinical Ethics at Brighton and Sussex Medical School, and Lucas Evers, head of Manufacturing and Leadership Program at Wetlab. which aims to explore ethical considerations for artists who work in laboratories, biotechnology and biomedicine, and encourage innovations in the artistic production and audience development (Dumitriu, 2018), The project resulted in an art exhibition that brought many artists with diverse approaches together to work with materials. Nine artists participated in their artistic works, including gene editing, human tissue transplantation, the nuclear material commons, interspecies communications, smuggling of biological materials across continents, and the relationship between human rituals (EXHIBITION: Trust me, I'm an artist, 2017)

Interestingly, the shift to the laboratory has produced a new intellectual approach to the artistic work. It is done by adding explanatory labels that help non-biology specialists understand the changes that occur in the organism and its environment, as is done by artist Anna Dumitriu. She employed dangerous and infectious organisms such as cholera, tuberculosis, plague, and various types of organisms and moved them from their own sterilized laboratory environment into the showroom, without any barriers or protective measures. She explained that

> "When I work with dangerous organisms, I cooperate with the appropriate laboratories to ensure that all necessary safety and bio containment requirements are met"
>
> Clay, 2021:44

Taking the virus from the laboratory to the exhibition puts the recipient in a state of anxiety and direct confrontation with the effects of a deadly enemy. About her experiences, as in Plague Dress - 2018, Yesinia pestisbacteri, Cholera Dress, and Bacterial Baptism, the artist wrote

> "When I was collaborating with Dr. James Price, we discovered that the textiles that infused with bacteria retained their colors when sterilized, which means that I could create works of art with them"
>
> Clay, 2021: 44

In 2020, the artist won the best artwork prize in Microbial Arts Competition that was joined by the Federation of European Microbiological Societies - FEMS to celebrate the World Microorganism Day. An International Micro-organism Day that aims to raise awareness about the significance of micro-organisms and microbiology research among the general public (The Winners of MicrobeArt2020,2020).

The shift into a laboratory has been accompanied by the opening of study branches in universities and holding of workshops, seminars, exhibitions, and research grants, as provided by incubating institutions that aim to enhance dialogue and criticism through the issues that are raised by bio-art, as in SOLU-Space laboratory under the management of the Bio-Art Society. This laboratory is equipped with the state-of-the-art facilities for bio-art research. It provides access to the specialized equipment and resources, enabling the artists and scientists to get engaged in experimental and practical work with living organisms and biological materials (Berger et al., 2023). The Society also plays a role in the scientific art initiative known as "Ars Bioarctica." According to Aarniosuo (2020), the project began in the fall 2008 in long-term cooperation with Kilpisjarvi Biological Station of Faculty of Biological and Environmental Sciences at University of Helsinki, to develop new types of scientific and artistic thinking.

In 2011, SVA Bio-Art Lab was founded by artist Susan Anker as part of a new facility for the Fine Arts Department of School of Visual Arts in New York City (Sabry, 2021) (Fig. 8). In this lab, the scientific tools and techniques become tools and techniques in artistic practice. SVA Bio-Art Lab contains modern scientific microscopes and a 3D bio printer. This machine can create living cellular tissues or non-living scaffolds. It seems to be an exceptional option for the researchers who are in need of support (Programs, 2018). Indeed, the shift into a laboratory has enhanced the educational objectives and has created a new display media, which artists and scientists contribute to creating the art that enables the editing of complex scientific experiments and presenting them to the public by the use of the latest digital technologies and simulations in a simplified and exciting manner, as in Microbia Museum experience.

It introduces the visitors to the significance of microscopic organisms, and displays invisible organisms by using various real and virtual means of display that are employed by laboratory devices and equipment. Jasper Buikx-Head of ARTIS-Micropia (Microbia, the first specialized museum for microorganisms) said that "The unique thing about it is that we grow 300 types of living microbes in our laboratory" (Calling, 2015). As Haider (2022) says, thanks to experimental laboratories, museums are shifting from traditional content to creativity, and becoming living institutions. The status of the museum is constantly changing. Weil (2003) points out that there is currently a shift in the attitude towards museums, as the museum is no longer appreciated only for its internal possessions, but by looking externally at the benefits it provides to the individuals and the communities it seeks to serve (Weil, 2003).

Fig. 6: School of Visual Arts, SVA, New York
Source: Microbia

Findings from the Review of Published Materials

IN published literature, Malea & Leonidas Karampinis (2014) discuss the ethics and practices that govern the procedures for collecting and displaying Bio-Art through a questionnaire to collect data from neighborhood artists, museums, and gallery visitors. The results show that the majority of artists had advanced degrees and applied different forms of life. Some (77%) of the Bio artists were engaged in Bio-Art through their research in fine arts, while a smaller percentage of (23%) them were inspired by their interest in the biosciences. 85% of the artists however face negative reactions from the visitors, and half of them face negative reactions from the directors of cultural institutions and other social groups. As a result, some Bio-artists intend to reconsider their use of bio materials in the future. Some bio-artists also face certain restrictions imposed on the use of bio materials due to legislation, ethical positions, or institutional rules. They also discuss the lack of a generally accepted ethical framework for the prod.

Cortabitarte (2015) puts forward the idea that in Bio-art, humor is used as a rhetorical tool that holds the potential to present ambiguous and non-normative perspectives on ethical issues that arise due to the developments in life sciences based on the dissonance theories of Henri Bergson and Arthur Schopenhauer, and the game theory of John Morell. It analyzes the performativity power of humor in the artistic practice of Adam Zaretsky, the self-proclaimed mad scientist and moralist who misbehaves. Through a case study, he argues that the detached mode of engagement elicited by aesthetic humor is crucial in allowing art to move beyond the normative and rational morality of academic discourse and embody multiple or even contradictory points of view simultaneously. Cortabitarte (2015) writes “This is why we welcome humor at its most beguiling,”

Yetisen, et al. (2015) emphasize the evolving relationship between art and science, while highlighting the interdisciplinary nature of life sciences and the cultural and aesthetic contributions that life artists can make to scientific research. Some scientific laboratories show their willingness to collaborate with the Bio-artists. This study expects that galleries and museums will provide corresponding formal contexts for the public display of vital arts. The study also indicates support for institutions and companies by providing the laboratories that are available to live artists and to everyone, and they are equipped with low-cost versions of common laboratory equipment or with recycled tools and machinery from institutional and corporate sources. Yetisen, et al. (2015,732) argue that Bio-art, not only plays a role in critiquing and applying science, but also has the potential to help science understand itself in a better way.

In this connection, Vaage (2016) highlights the ethical dilemmas that artists and their audiences face when engaging with Bio-art, as it involves “tampering” with Nature. The discussion emphasizes the potential impact of Bio-art on people and its role in shaping ethical frameworks and decisions regarding the use of biotechnology. Works of art can represent ethical issues visually and engage viewers emotionally and intellectually in ways that scientific research cannot. Vaage says:

> “Many bio-artists have emphasized that participants in interactive bio-art workshops gradually become aware of the ethical issues in what they actually do,”
>
> Vaage, 2016,102).

Slesingerova (2018) provides a critical social analysis of the debate on the social and cultural phenomenon of Bio-art in relation to bio power, through the works of specific artists who were interested in working with living or semi-living tissues and bio-technologies. Produced by artists Louis Beck, Heather Dewey Hagborg, and Piononymus, the text examines the artistic implications of bio work for current forms of power over life. It says:

> “Our bodies, molecules, and genes come under the control of a broader stream of science- and technology-based practices that determine and invent new forms of life, new biological, or rather bio-digital”.
>
> Beck et al., 2018:78

Chistyakova (2020) discusses Bio-art within the framework of critical post-humanism. She does so within the concept of Bios and Zoe between biological life and spiritual life, in which human centrality is dominant over other beings. She also highlights the aspects of violence and immoral issues that hide behind the works. In fact, Bio-artist Chistyakova (2020) points out that critical trans humanism is changing art in the ways we engage with non-human life forms.

Grba & Todorović (2020) compare between Bio-art and generative art. Highlighting the conceptual and technical similarities, Bio-art is considered a continuum of complex and interesting software and hardware, and playfully exploits the fluid meaning of the adjective "natural," which traditionally reflects the contextual interests of the parties. Generative and lively artists are at their best when they nourish their critical self-awareness with knowledge, skill, and humor, and how these creative fields are inescapably human and thus always political.

Gemtou (2021) discusses the distinctive features of the biographical artworks from different eras, within a retrospective context as having paved the way for the emergence of biographical art. This is divided into two parts. The first one goes back to Aristotle, as he uses it to identify incomplete rhetorical syllogisms that connect all recipients with common questions. The second one is based on Levinson's historical theory, which shows that Bio-art belongs to the evolutionary narrative of art and artistic intentions.

Anker (2021) covers different aspects of Bio-art, such as iconography, artificial life, wet tooling, and the intersection of art and biological science. It addresses the impact of climate change on agriculture. Explaining how Bio-art is not limited to a particular type of media or geographic location, and is an international movement with practitioners in different regions around the world, In fact, Anker (2021 says that there are several sub-genres of bio-art: artists who integrate images and concepts from science Modern, in their work using traditional artistic media such as painting, sculpture, printmaking and performance art. They are the Artists who use computer software, systems theory and simulation to explore several aspects of biological science, through digital sculpture, new media installations, film and video. They are the artists who work directly with biological materials and wetware practices as a medium for their art.

Güneş Mutlu Avinç (2022) also discusses Bio-art from a different point of view. This time, it is through the influence of Nature on art, themes, concepts, techniques and materials which are selected from "Nature" in art and architecture with awareness of environmental protection. Added to these is Lopatkina (2022) Bioart who discuss the post-industrial methods and how to employ them in favor of developing and finding ways to permanently control the human body. As can be seen, Bio-art research not only changes the human race itself, but also changes the image of the artistic world as a whole. The human body gradually undergoes a change in its values prevailing in favor of mechanical improvements to its basic design.

In contrast, Jacobs, Devleminck & Hannes (2023) reveal how new ways of knowing about environmental issues are generated through Bio-art. They focus on five artworks Microbiocene by Baum & Leahy, CMD: Experiments in Bio-Algorithmic-Politics by Michael Sedbon, Funkee: Fungal Supercoating by Emma Van der Leest, Fur_Tilize by Dasha Tsapenko and Becoming a Sentinel Species by Sissel Marie Tonn. Jacobs et al. say:

> "Biological art breaks through established ways of knowing and provides other ways of understanding the world we live in, and organism and artist engage in a co-creative process of living and making with each other"
>
> Jacobs, Devleminck & Hannes,2023: 61

Bringing new dimension, Ahmedien (2023) discusses the use of metaphors in Bio artworks and how they shape understandings of biology. He explains that metaphors in Bio-art can be classified based on the relationship between biological concepts (source domain) and the way they are presented in the artwork (target domain). He explores different types of metaphors used in

biographical art, including figurative metaphors, operational metaphors, and post-metaphorical metaphors. According to him, figurative metaphors use conventional or non-biological means to represent biological concepts, while operational metaphors use biological materials in contexts separate from the actual concept being represented. In post-metaphorism, influenced by synthetic biology, source and target domains are mutually integrated. It highlights potential problems, such as over-simplification of biological systems and commercialization of genetic material. It also emphasizes the significance of considering the epigenetic factors and broader human identity beyond any genetic information in bio media-based artworks.

Conclusions

This research reveals that throughout history, the studio environment has witnessed several developments in technologies, tools, performances, and styles, which have affected the artist's workplace, but have not removed him from it in the literal sense, while the shift to the laboratory was like a genetic mutation in shifts. After the shift to the laboratory, traditional art tools have been replaced by technically complex tools and devices that are suitable for Bio-art. The shift has forced the artists to cooperate with specialists in biology, medicine, and technology, to produce works of art from living organisms. In fact, the effect of the shift to the laboratory is reflected in the use of laboratory devices and equipment as part of the elements of the artistic work inside the galleries.

As revealed, while performing surgical operations became part of the artistic performances in front of a live audience, the event has been photographed and broadcast to a distant audience outside the exhibition. Certain scientific institutions have also contributed to establishing collaborative laboratories between the artists and scientists by providing financial support and residency programs, and have attracted non-specialized groups of amateurs and university and school students by holding exhibitions, competitions, and awarding prizes. Institutions and museums have invested in the creative artistic experiences within the laboratory, and have used it as a contemporary cultural and social awareness tool, by creating interactive and educational laboratories and galleries.

Indeed, shifting into a laboratory has required the artists to adhere to the conditions and protocols of prevention and safety, in order to work within some laboratories, which is a new environment in the production of artistic works. Undeniably, the shift from the art studio to the laboratory has resulted in the production of hybrid and strange works which are loaded with astonishment and shock, in a manner consistent with the contemporary artistic goals.

This research thus uncovers the historical transformation of the traditional art-studio in becoming a scientific laboratory. This is indeed similar to how traditional settlements and buildings are being transformed now into Technology-Savy modern environments. This research thus makes a significant contribution in understanding how the traditional spaces are undergoing change in the face of technological advancements.

Acknowledgements

The authors declare that this research did not receive any external funding. However, the unreserved support received from the university of Baghdad, Baghdad, Iraq is greatly appreciated.

Statement of Conflict of Interest: The authors decare that there is no conflict of interest in carrying out this research.

Ethical Practice: This research followed accepted ethical practices. It did not involve any personal data, nor did it coerce any participants to take part in this research. No person has been involved because it is based primarily on published research. Authors from whom information and ideas have been burrowed have been cited.

Availability of Data: Data presented in this research is selected from a larger data set and they are available for scrutiny by any legitimate organization.

References

A. Edwards, D. (2010) The Lab, Creativity and Culture. United State: Harvard University Press.
Aarniosuo, A. (2020) Bioart Society: Annual Report 2020. Finland: Bioart Society.
Abbas, R. A. (1996) John Locke, Imam of Experimental Philosophy. Beirut: Dar Al-Nahda Al-Arabi.
Ahmedien, D. A. (2023) Analysing bio-art's epistemic landscape: from metaphoric to post-metaphoric structure. BioSocieties, 18, 308-334. doi:https://doi.org/10.1057/s41292-022-00270-y
Al-Bayati, S. J. (2023) The new aesthetic in contemporary world painting. Al-Academy, 287–302. https://doi.org/10.35560/jcofarts1226
Anker, S. (2021) Epistemic practices in Bio Art. AI & SOCIETY, 36, 1389–1394. doi:https://doi.org/10.1007/s00146-021-01152-w
Berger, E., Mari K. K., Marietta R. & Line T. (2023) State Of The Art - Elements for Critical Thinking and Doing, Helsinki: Bioart Society.
Buchanan, I. (2011) The Clutter Assemblage. DRAIN Journal of Contemporary Art and Culture,-Power, 8(1), 1-7. http://drainmag.com/the-clutter-assemblage/
Calling, A. (2015) Micropia: See the Invisible Amsterdam [Video]. youtube. https://www.youtube.com/watch?v=g6zvy3wLYpU&t=27s
Catts, O. & Zurr, I. (1996) Tissue, Culture & Art project. Retrieved from Tissue Culture & Art project: https://tcaproject.net/about/
Catts, O. & Zurr, I. (2017) Vital Tissue Constructs, Charissa N. Terranova, Meredith Tromble, The Routledge Companion to Biology in Art and Architecture, UK: Routledge.
Century, M. (2013) Pathways to Innovation in Digital Culture. Canada: Centre for Research on Canada.
Chistyakova, M. (2020) Bio-Art Between Bios and Zoe. Fourth International Scientific Conference Communication Trends in the Post-literacy Era: Multilingualism, Multimodality, Multiculturalism (pp. 390-398). Yekaterinburg, Russian Federation: KnE Social Sciences. doi: DOI 10.18502/kss.v4i2.6356
Clay, A. & Timothy J. (2021) On Media, On Technology, On Life - Interviews with Innovators, Denmark: River Publishers. https://doi.org/10.13052/rp-9788770225946
Coles, A. (2012) The Transdisciplinary Studio. London: Sternberg Press.
Cortabitarte, I. D. (2015) "It's not a joke!" Bio-art and the aesthetics of humour. European Journal of Humour Research, 3(2), 50-61. http://dx.doi.org/10.7592/EJHR2015.3.2.3.desenacortabitarte
Da Costa, B. & Philip, K. (2008) Tactical Biopolitics- Art, Activism, and Technoscience. USA: MIT Press.
Darwish, M. A. (2018) Research methods in the human sciences. Egypt: Arab Nation Publishing and Distribution Foundation.
DNP. (n.d.) What is Museumlab? Retrieved from Louver- DNP Museum Lab: https://www.museumlab.eu/greeting/theme/index.html
Dumitriu, A. (2018) Trust Me, I'm an Artist: Building Opportunities for Art and Science Collaboration through an Understanding of Ethics. Leonardo, 51(1), 83-84. doi:https://doi.org/10.1162/LEON_a_01481
Eve Frankel, Jasmine Temple, Eliz Dikener & Mehmet Berkmen (2023) Bridging the gap with bacterial art, FEMS Microbiology Letters, 370, 1-7, https://doi.org/10.1093/femsle/fnad025
EXHIBITION: Trust me, I'm an artist. (2017) Retrieved from zone2source: https://zone2source.net/en/tentoonstelling/waag-society-trust-me-im-an-artist-3/

Exploratorium Arts (2014) San Francisco: Exploratorium. Retrieved from https://www.exploratorium.edu/arts

Gemtou, E. (2021) The Artistic Status of Bio-art. National and Kapodistrian University of Athens, 13(1), 1- 13. doi:DOI: 10.21659/rupkatha.v13n1.02

Gombrich, E. (2016) The Story of Art. (A. Hudayfa, Trans.) Manama: Bahrain Authority for Culture and Antiquities.

Grba, D. & Todorović, V. (2020) Rendering life: Transgressive affinities between bio art and generative art. Technoetic Arts, 223-238. doi:https://doi.org/10.1386/tear_00040_1

Haider, M. (2022) Museum Practices in the Twenty-first Century (Museums and Change). In A. Chaaya et N. Elias (éd.), Arts & Archaeology manual. Beirut: Faculty of Letters & Human Sciences publications, Lebanese University: 327-337 (in arabic).

Harrison, M. (2006) In Camera: Francis Bacon: Photography, Film and the Practice of Painting. UK: Thames & Hudson.

Ionat, Z. & Catts, O. (2023) Tissues, Cultures, Art. Switzerland: Springer International Publishing.

Jacobs, A., Devleminck, S. & Hannes, K. (2023) Co-Creatively Producing Knowledge with Other-Than-Human Organisms in a (Bio)Technology-Controlled Artistic Environment. Social Inclusion, 11(3), 51- 64. doi:doi:https://doi.org/10.17645/si.v11i3.6609

Johung, J. (2019) Vital Forms: Biological Art, Architecture, and the Dependencies of Life, New York: University of Minnesota Press.

Jones, C. A. (1996) Machine in the Studio: Constructing the Postwar American Artist. Chicago: University of Chicago Press.

Kac, E. (2005) Telepresence & Bio Art: Networking Humans, Rabbits, & Robots. United States of America: University of Michigan Press.

Kac, E. (2007) Introduction, Art that Looks You in the Eye: Hybrids, Clones, Mutants, Synthetics, and Transgenics. Cambridge: MIT Press.

Kac, E. (2020) GFP Bunny at 20. Journal of Posthuman Studies, 4(2), 119- 128. doi:https://doi.org/10.5325/jpoststud.4.2.0119

Kelley, L. (2016) Bioart Kitchen, Art, Feminism and Technoscience. London: Bloomsbury Publishing.

Kenway, J., Elizabeth B., Johannah F. & Simon R. (2006) Haunting the Knowledge Economy, Ukraine: Taylor & Francis.

Kosolapov, A. I. (2020) The Art and Science of NDT at the Hermitage Museum. (J. Ross, Ed.) The NDT Technician (TNT), 19(3), 1-5.

Koursari, E. (2020) And the winners of #MicrobeArt2020 are... FEMS. accessed on 2nd January 2024 https://fems-microbiology.org/and-the-winners-of-microbeart2020-are /

Lopatkina, M. A. (2022) The Concept of Bio-Art in the Culture of Post-Industrial Society. Culture and technologies studies, 7(1), 33- 44. Retrieved from http://cat.itmo.ru/en/2022/v7-i1/309

Lowenberg, K. (2014) New Study: Art Therapy May Build Self-Esteem in People Living with Epilepsy. Retrieved from Epilepsy Foundation: https://www.epilepsy.com/stories/new-study-art-therapy-may-build-self-esteem-people-living-epilepsy. accessed on 3 December 2023.

Malea, E. & Leonidas Karampinis, E. K.O. (2014) Field research on the ethics and practice regarding the operation of Institutions hosting BioArt Collections. In ICOM-CC 17th Triennial Conference Preprints (pp. 1-8). Melbourne, Australia: Paris: International Council of Museums. Retrieved from -https://www.researchgate.net/publication/311395519

Muhammad, B. (2015) Art and architecture. Baghdad: Al-Fath.

Mustafa, B. (2018) Paths of postmodernism: motives and starting points. United Kingdom: Hindawi Foundation.

Mutlu Avinç, G. & Selçuk, S. A. (2022) On the Evolution of Art and Nature Relationship: Bio-Informed Art. AM Journal of Art and Media Studies, 27, 57-74. doi:DOI:10.25038/am.v0i28.493

Parker-Starbuck, J. (2013) Reflective Viewing ORLAN's Hybridised Harlequin, Banksy, Bacon, and the Animal-Human Divide. In F. W. Causey, Performance, Identity, and the Neo-Political Subject. New York: Taylor & Francis.

Reichle, I. (2009) Art In The Age Of Technoscience- Genetic, Engineering, Robotics, And Artificial Life In Contemporary Art. New York: Springer.

S. Vaage, N. (2016) What Ethics for Bioart? NanoEthics, 10, 87-104. doi:DOI 10.1007/s11569-016-0253-6

Sabry, F. (2021) Kweekvlees: Hoe kunnen we een borst of een vleugel laten groeien in plaats van een hele kip, Dutch: Een Miljard Goed Geïnformeerd.

Slesingerova, E. (2018) Biopower imagined: Biotechnological art and life engineering. Social Science Information, 57(1), 59- 76. doi:DOI:10.1177/0539018417745164

Star Rogers, H. (2022) Art, Science, and the Politics of Knowledge. United State: MIT Press.

SVA Artist Residency Programs (2018, February 6) Bio Art: From the Laboratory to the Studio. [video] Retrieved from vimeo: https://vimeo.com/254583765

Thackerc, E. (2007) Open Source DNA and Bioinformatic Bodies. In E. Kac, Signs of Life Bio Art and Beyond (pp. 31-41), The MIT Press.

Urban, J. (2023, December 13) ASM Announces 2023 Agar Art Contest Winners. Retrieved from American Society for Microbiology: https://asm.org/Events/ASM-Agar-Art-Contest/Winners

UWA Research Impact. (2018, October 18) SymbioticA: provoking dialogue about artful science. Retrieved from The University of Western Australia: https://researchimpact.uwa.edu.au/research-impact-stories/symbiotica/

Wallace, I. (2014, June 11) The Evolution of the Artist's Studio, From Renaissance Bottega to Assembly Line. Retrieved from Artspace: https://www.artspace.com/magazine/art_101/art_market/the-evolution-of-the-artists-studio-52374

Weil, S. E. (2003) Beyond Big and Awesome: Outcome-based evaluation. In R. R. Richard Sandell, Museum Management and Marketing. London: Routledge. doi:https://doi.org/10.4324/9780203964194

Yetisen, A., Davis, J., Coşkun, A., Church, G. M. & Yun, S. H. (2015) Bio-art. Trends Biotechnol, 33(12), 724-734. doi:DOI:10.1016/j.tibtech.2015.09.011