Bioart: Exploring the Integration and Intersection of Biology and Art Creation

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Abstract Bioart is the product of the combination of biology and art. With the help of biological knowledge and technology, a series of artistic works full of vitality and beauty can be created. Under the background of the new era, strong scientific and technological development has promoted the evolution of art forms. This paper discusses the possibility of blending biology with bio-aesthetics in modern art creation, aiming at solving the problems of cultural inheritance difficulty, lack of ecological awareness and insufficient art education through this interdisciplinary field, so as to effectively spread Chinese excellent traditional culture, enrich people's spiritual life and promote social development.

Key words Bioart, Biotechnology, Artistic creation, Cultural heritage

1 Introduction

As an interdisciplinary field, the bioart lies mainly in artistic creation by using biological principles and technical means, which is an important branch of science and technology art[1]. In contemporary society, the mutual penetration of art and science has become a trend that cannot be ignored. This penetration is not only reflected in the mutual reference of technical means, but also in the deep combination of creative ideas. Bioart mainly draws on innovative methods in the field of art, and it is gradually gaining more attention in science education, knowledge dissemination and practical application[2]. However, due to the existence of knowledge barriers, the acceptance of bio-art in the art field is relatively low[3]. This study aims to deeply explore the integration point of bioart and modern art creation. By reviewing the development process of bioart, analyzing its influence on society and culture, and the strategies and practical guidance based on bioart, this paper discusses the great potential of this emerging art form in cultural inheritance, ecological consciousness shaping, scientific literacy improvement and art education.

This study aims to reveal how artistic creation, as an aesthetic experience, can become an important medium for cultural exchange, educational enlightenment and social progress.

2 The development of bioart

2.1 The origin of bioart In the 1950s, after the discovery of DNA, human beings entered the era of molecular biology. The combination of art and genetic engineering gradually produced the media model of bioart, which expressed people's thoughts on life, ecology and philosophy[4]. In 1933, Alexander Fleming initially revealed the possibility of combining microorganisms with artistic creation in the aesthetic sense through microbial drawing experiments, laying the foundation for the development of bioart. In 1997, Eduardo Kac, as an artist, first proposed the concept of bioart, also known as the pioneer of bioart[5]. Eduardo Kac pointed out the characteristics of bioart and the two major mediums of bioart (life medium and technical medium). He recorded the concept of bioart in *Signs of Life: BioArt and Beyond*. Eduardo Kac believes that the object of bioart must be a "living body", and that inactive substances do not fall into the category of bioart. In 2018, curator Wei Ying put forward the concept of "pan-biotechnology". Its media include biological concepts, biomaterials, biotechnology and biological data, *etc.* The media can be combined with each other to present works of art with different forms of expression[6]. The concept of "pan-biotechnology" makes the scope of choice of media for bioart wider and becomes an open proposition.

In the field of education, as a new teaching tool, bioart has been introduced into art education and science education, aiming at deepening students' understanding of life sciences and artistic creation through an interdisciplinary way. For example, higher education institutions in the United States, such as the Massachusetts Institute of Technology (MIT) and the California Institute of Arts (CalArts), offer courses related to bioarts. In China, the topic "Biodesign" is included in the postgraduate program of the Digital Media Studio of the Central Academy of Fine Arts, while the Information Art Design Department of the Academy of Arts & Design of Tsinghua University also established a bio-material design workshop. These activities together promote the progress of bioart in theoretical research and practical development.

2.2 Domestic research status of bioart Guo Lixuan *et al.*[7] explored the innovative application of the combination of biomaterial kombucha with clothing art from various dimensions such as application cases, aesthetic experience and service performance,

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and thus got the idea that the fashion evolution covered by kombucha bio-fashion goes hand in hand with biotechnology. Cui Yuxin *et al.*[8] analyzed the artistic beauty presented by the complementarity between marine life and artistic design through multiple design cases. Liu Zhiwen[9] explored the significance of biological media in sculpture creation and its practice and application in sculpture creation. Cheng Manxue[10] expounded the diversity and sustainability of biological media in bioart, and outlined the development of biological media. Wang Dan[11] discusses the expression of synthetic biology in traditional painting, new media, art design and post-digital era through several practical cases. Gong Wenli[12] explored the integration between biomorphology and visual art through the role of plant patterns in visual art, which provided rich innovative inspiration for visual art. Yu Tao *et al.*[10] combined traditional art with biological elements, painting materials and artistic creation methods, and deeply explored the mechanism of comprehensive material painting. Yang Guozhu[14] believed that after organic creatures in the sense of molecular aesthetics are promoted to inorganic creatures and computer and information data aesthetics, bioart gradually moves towards symbiotic "holistic" bioart.

2.3 Foreign research status of bioart John R Mallard revealed scientists' concerns in the construction of visual practices and the significance through an in-depth analysis of data visualization problems in the field of biomedical imaging[15]. Swain Kelley[16] discussed the core position of molecular biology and biomaterials in artistic creation, and made an in-depth analysis of the ethical challenges faced by bioart. Mattanovich D *et al.*[17] explored how artists can use the biological process of fermentation to show the interaction between microorganisms and the environment, and create novel works of art through this process, thus promoting the dissemination of scientific knowledge. Renee L Ripley *et al.*[18] studied how bionic art and architecture draw inspiration from structures in nature, promote the sustainable development of architectural design, and bring innovative changes to the field of art and architecture. Sarah J Adkins – Jablonsky *et al.*[19] explored the positive impact of incorporating agar art into microbiology laboratory teaching on student education, noting that it helps students explore complex concepts in innovative ways.

3 The influence of bioart on society and culture

3.1 Change of social concepts promoted by bioart The rise of bioart has broken through the boundary of traditional art, and has had a profound impact on the public's cognitive structure and social concept. This art form creates challenging works of art with the help of biological principles, biotechnology and biological materials, such as cells, genes and microorganisms. These works often arouse the audience's deep thinking about the nature of life and the application of biotechnology. Bioart not only stimulates the public's reflection on the application of biotechnology in daily life, but also prompts people to conduct in-depth discussions on many aspects from genetic engineering to cloning technology. These technologies are not only the focus of scientific research, but also a hot topic in society. Related works of art often lead people to re-examine the relationship between human beings and nature. By exploring these topics, bioart promotes the innovation of social concepts, especially in environmental protection and ecological sustainability, and raises public awareness. For example, the art work *Family Park* embodies the close connection between human beings and nature and the creative concept of cycles.

3.2 Ethical controversy and thinking caused by bioart The creative ideas of the bioartist reflect its position on biotechnology. For example, the artwork *Half – Alive Worry Doll* shows the artist's positive optimism about biotechnology; the *Young Family*, reveals the artist's negative worries about genetically modified technology with strong visual impact. In the field of bioart, ethical issues are the key components of social impact. Since bioart works may touch controversial biotechnology and biomaterials, their ethical attributes often become the focus of public discussion. With its experimental and pioneering nature, bioart provides a key platform for the public and policy makers to discuss biotechnology ethics and ecological responsibility, thus promoting the society to hold a cautious and rational attitude towards its application while celebrating scientific achievements[20].

3.3 The role of bioart in the inheritance of traditional culture Bioart has played an innovative and cross-era role in the inheritance of traditional culture. By integrating modern biotechnology with traditional cultural elements, the artist explores a new expression of traditional culture. For example, many artists have incorporated the symbols and signs of traditional culture into their creations, realizing the combination of the essence of national culture and modern scientific and technological means, thus creating works of art that reflect a sense of the times and retain the core of traditional culture. This kind of artistic expression not only continues the cultural memory, but also promotes the wide spread and innovative development of traditional culture under the background of globalization, and stimulates the public's awareness of cultural heritage protection. Through this interdisciplinary integration, bioart provides a new path for the inheritance and reconstruction of traditional culture, so that it can continue to develop under the background of modern science and technology and adapt to the cultural needs of the new era.

3.4 Application of bioart in education The essence of bioart lies in the integration of science and art, which promotes interdisciplinary cooperation in the field of education. This interdisciplinary education method can enhance students' comprehensive ability, so that they can use interdisciplinary knowledge to think innovatively when facing complex problems. Using biomaterials or biotechnology for artistic creation, students can experience firsthand how technology empowers art and explore the infinite possibilities of technology in the field of art. In addition, bioart is not only a process of artistic creation, but also a platform to stimulate students to think deeply about issues such as bioethics and scientific and technological responsibility.

4 Solutions and practice guidelines based on bioart

4.1 Technology application and creation process The creation of bioart often relies on cutting-edge biotechnology, and therefore, ensuring the proper application of technology is central to the practice of bioart. Artists should work closely with scientists in the creative process to ensure the accurate application of biotechnology. This kind of cooperation can not only enhance the scientific nature of the works, but also provide necessary technical support for artists, thus avoiding technical misuse or unnecessary risks. Laboratories must be equipped with necessary equipment and facilities and comply with national or international biosafety regulations to prevent negative impacts on the environment.

4.2 Ethical norms and social responsibility Bioart not only blends art and science, but also deals with ethical and social issues. Therefore, in the creative process, artists and researchers should fully consider the ethical influence of their works, and formulate creation and display guidelines that meet ethical requirements. All works of art involving biological experiments should be reviewed and approved by the ethics committee to ensure that the creation does not involve illegal or unethical behaviors, such as unapproved human experiments and animal experiments. Artists should take the initiative to explain the ethical background of their works to the audience and the public, so as to enhance transparency and public trust. For creations involving living bodies, strict ethical norms and technical processes should be followed to ensure respect for life.

4.3 Education and promotion The education and promotion of bioart play a vital role in popularizing scientific knowledge, enhancing the public's art appreciation ability, and cultivating the next generation of interdisciplinary innovative talents. It is necessary to promote bioart in art and science education, formulate comprehensive curriculum, and cultivate students' ability to use biotechnology in artistic creation. Museums, science centers and cultural institutions can hold exhibitions and popular science activities related to bioart to show the diversity and possibilities of bioart to the public. It is necessary to develop online educational resources that provide learning and creative opportunities for students, researchers and artists worldwide. By opening online courses, workshops and resource libraries, more people can participate in the creation of bioart, breaking through geographical and technical restrictions.

4.4 Sustainability of creation and display Bioart is closely related to ecological and environmental issues. In view of the characteristics of its use of biological materials, ecological sustainability must be considered in its creation and display. In the creation, renewable and degradable biomaterials should be preferred to avoid pollution to the environment. The life cycle design of works should also follow ecological principles, including how to deal with waste materials, how to recycle or properly dispose of biological materials after the exhibition. Artists can directly discuss ecological and environmental issues through bioart works. Through this kind of creation, it not only enhances the social responsibility of the works, but also stimulates the public's attention to environmental issues.

5 Conclusion

This paper discusses the interdisciplinary characteristics of bioart and its potential impact on cultural heritage, educational application and social responsibility. Bioart demonstrates the profound integration of technology and humanities by combining cutting-edge biotechnology with artistic creation. As a new art form, bioart not only innovates traditional art creation methods, but also provides a new carrier for cultural inheritance, breaking the boundary between culture and science and technology, and enabling traditional culture to be reborn in the context of modern science and technology. In terms of technology application, ethical norms and sustainable creation, bioart provides new solutions for future artistic creation, and calls on artists and researchers to adhere to the balance between science and technology and ethics in the creative process.

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ucation in the curriculum. It can encourage teachers to actively participate in ideological and political education work in universities, and create a good atmosphere where everyone in universities values and actively participates in ideological and political education work by establishing a sound system for curriculum ideological and political education.

4.3 Inspiring students' enthusiasm for participation, and enhancing the interactive experience of curriculum ideological and political education The participation of students in classroom teaching determines the effectiveness of classroom teaching. Therefore, to establish the student-centered position in the teaching of curriculum ideological and political education, it is necessary to understand the students' wishes firstly. There may be differences in the acceptance and feedback of curriculum ideological and political education among different students. Some students may be more concerned about the learning of professional knowledge and hold a reserved attitude towards the integration of ideological and political content. The other students may show a strong interest in ideological and political content. This requires teachers to pay attention to individual differences among students in the teaching process, and adopt flexible and diverse teaching strategies, to meet the learning needs of different students.

5 Conclusions

In the context of the new era, a core task of talent cultivation in higher education is the reform of curriculum ideological and political education. The reform aims to achieve a deep integration of professional courses and ideological and political education, which is a long-term and constantly innovative exploration process. It is a challenge to effectively combine curriculum ideological and political education with professional teaching, which requires teachers to have a high degree of patience and dedication. Through in-depth analysis and research on the course Culinary Raw Materials, this study aims to explore its potential ideological and political education elements. At the same time, by deeply integrating ideological and political education with the course Culinary Raw Materials, it is committed to integrating socialist core values into professional curriculum teaching, enabling students to deeply understand the importance of core values such as integrity in the culinary industry, thereby enhancing students' moral cultivation, promoting their comprehensive growth, and achieving the dual goals of education and value guidance.

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