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Expressive Biology-Based Bio-Beauty Art: Conceptualization and Creative Potential

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Abstract

This study aims to conceptualize expressive biology-based bio-beauty art and to explore its aesthetic characteristics and creative potential. This study adopted a qualitative and conceptual research approach, conducting a literature review and analyzing representative case studies. The findings identified three defining characteristics of expressive biology-based bio-beauty art: process-oriented aesthetics, ethical and ecological relationality, and the reconceptualization of the body. These characteristics provide a conceptual foundation for the expansion of aesthetic values, the promotion of sustainable creative practices, and the development of expanded modes of bodily expression. Bio-beauty art is defined as an expressive biology-based artistic practice that explores the relationships among life, environment, and beauty through the body. The proposed conceptual framework has the potential to broaden the scope of contemporary beauty art and to provide a foundation for future practice-based research and the development of expressive biology-based bio-beauty artworks.

Keywords: Bio Art, Bio –Beauty, Art, Beauty Art, Bioaesthetics, Expressive Biology.

I. Introduction

The practice of manipulating the biological world for aesthetic purposes has a long and rich history. The artistic and literary representations of animating inanimate materials or transforming one living form into another emerged alongside cultures that cultivated species from wild progenitors. The classical Greeks were keen observers of the similarities that could be perceived between the geometries of human physiology and those of natural forms. The artistic, architectural and mathematical principles of Greece's so-called "Golden Age" were derived from these biological tenets, thereby establishing the foundational framework for the arts and sciences that subsequently flourished during the European Renaissance (Yetisen et al., 2015). Expressive biology is

predicated on the notion that living organisms should be regarded not merely as instruments of production, but as expressive media. This perspective has the potential to expand the conventional boundaries that delineate biology, art, and design. This standpoint challenges the prevailing notion of biological phenomena being solely driven by functional utility, instead recognizing life as a wellspring of aesthetic experience and creative endeavor. Whilst extant bio-beauty research has chiefly concentrated on the functional efficacy, environmental sustainability, and technological applications of biological materials, the aesthetic potential of biological phenomena as a medium for creative expression has received only limited attention. It is therefore essential to extend

the integration of biology and beauty beyond the domains of technological advancement and ecological responsibility, encompassing artistic expression and aesthetic experience.

In this context, the study proposes the concept of bio-beauty art from the perspective of expressive biology. The concept of bio-beauty art has not yet been thoroughly explored within the existing scholarship. This study aims to contribute to the existing body of knowledge by extending expressive biology-based aesthetics, incorporating biological principles and life phenomena as creative resources, into the domain of beauty art. Bio-beauty art is defined as an expressive biology-based artistic practice that explores the relationships among life, environment, and beauty through the body. Bio-beauty art has the potential to contribute to the development of a new category of beauty art integrated with biology. The objective of this study is to establish the concept of expressive biology-based bio-beauty art and to explore its aesthetic characteristics and creative potential. This study provides a theoretical foundation for further discussion in this emerging field. The present study adopts a qualitative and conceptual research approach to explore the concept and creative potential of expressive biology-based bio-beauty art. First, a comprehensive review of the extant literature on expressive biology, bio art, posthuman aesthetics, and sustainable aesthetics is conducted to establish the theoretical foundations of the study. Second, it conceptualizes bio-beauty art by extending expressive biology-based aesthetics into the domain of beauty art. Third, the study examines the creative potential of bio-beauty art through three interconnected dimensions: the expansion of aesthetic values, sustainable creative practices and expanded modes of bodily expression.

II. Theoretical Background

1. Expressive Biology

Expressive biology, a concept developed by the beauty company Arcaea, signifies a novel approach to the beauty industry that utilizes biology as a creative instrument for self-expression, diverging from conventional industrial chemistry. This concept redefines beauty by establishing biological systems as the foundational infrastructure of aesthetic creation, thereby enabling the utilization of inherent biological mechanisms as a medium for self-expression (Arcaea, n.d.). Furthermore, expressive biology is a field that combines existing and emerging technologies with biology, thereby becoming a creative tool for self-expression by merging biology's creativity with technological expertise (Park, 2025). In this study, expressive biology is defined as an approach that views living systems not only as functional tools but also as media capable of sensory and aesthetic expression. In this study, expressive biology is defined as an aesthetic approach that employs biological phenomena and processes as media of creative expression, with the objective of generating new aesthetic experiences and meanings.

2. Bio-Beauty Art

The beauty industry has undergone a substantial transformation, with scientific knowledge and technological innovations extending beyond the conventional realm of cosmetics. Advancements in biotechnology, materials science, and microbiome research have given rise to novel forms of aesthetic expression that increasingly intersect with the realms of science and art. Expressive biology, an artistic approach that incorporates biological principles and life phenomena as creative media, is closely associated with bio-art

discourse. Bio-art, a term coined in the 1990s, employs living organisms as a medium, provoking critical inquiry into life and ethics beyond representation-centered perspectives of art. The concept of art transforms, moving from a state of completion to a process-centered experiment with life (Kac, 2007). Bio-art is an emerging contemporary artistic practice that utilizes a diverse array of traditional and biological artistic media (Myers, 2015). As has been previously discussed, bio-art has been a prominent topic in contemporary art and science-technology discourse (Melkozernov & Sorensen, 2021). In contrast, the development of beauty art has occurred around aesthetic styling mediated through the body. In this context, bio-beauty art is distinguished by its use of biological phenomena as a medium of expression in bodily aesthetics and beauty practice. This artistic approach diverges from bio-art, which encompasses laboratory-based art-science practices. Expressive biology-based bio-beauty art is an artistic practice that incorporates biological principles, materials, and processes, thereby extending conventional beauty art beyond form, color, and technical refinement. Instead, it places biological processes and relationality at the core of aesthetic value. Accordingly, this study defines bio-beauty art as an expressive, biology-based beauty art practice that explores the relationships among life, environment, and beauty through the body.

III. Related Work

1. Bio-based Expression Technology

Bio-based expression technology is a multidisciplinary field that integrates technological and creative approaches. Biological principles, biological materials, and biological processes serve as expressive media in this field. These media have the capacity to sense, display, and communicate information. This perspective builds on research on Living Media Interfaces (LMIs), which involves the incorporation of living organisms into interactive systems, thereby transforming biological entities into active communicative media (Merritt et al., 2020). Research on the design of living systems emphasizes their role as active components in design processes (Szymanski & Calvert, 2018), while studies on engineered living biomaterials demonstrate the transition of biomaterials from passive substances to biologically active, responsive materials (Rodrigo-Navarro et al., 2021). The perspectives collectively provide the theoretical basis for bio-based expression technology.



Fig.1 Testing the pH of four beverages with Nail pHolish app, and results on participants' fingernails.

Nail pHolish (Fig. 1) exemplifies of biocosmetic interfaces, which are defined as the integration of conventional cosmetic products with biotechnology for health monitoring purposes. The Nail pHolish system functions as a hand-fluid interface, thereby enabling biosensing through nail polish that interacts with multiple bodily fluids and environmental substances. In contrast to extant biosensing systems, Nail pHolish has been designed to be compatible with contemporary nail care practices. The compatibility of these solutions is demonstrated using various nail

art designs and the incorporation of buffer solutions (Alistar et al., 2020).



Fig. 2 BioCosMe (a) Colorimetric demonstration across four pH levels (b) Three lip-based products (c) Technical evaluation of four pH levels on forearm.

BioCosMe (Fig. 2), proposed by Sun et al. (2024), integrates colorimetric biosensors into lip-based cosmetics, enabling salivary pH to be expressed through visible color changes (Alistar et al., 2020). This approach demonstrates how biological information can be translated into aesthetic expression, providing a technological basis for expressive biology-based bio-beauty art.

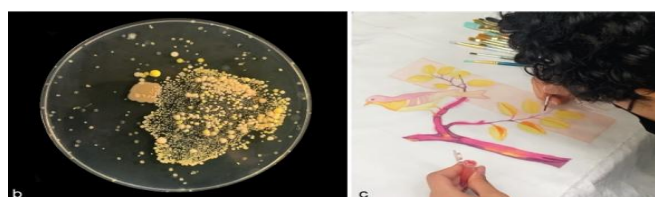


Fig. 3 We explore the skin microbiome, the unseen community of microbes such as bacteria and fungi that live in symbiosis on our bodies, an intimate, nonhuman material for interaction design. We observe how our interactions on a macro scale can cause interactions and impacts on a micro scale by (b) growing microbial samples to a visible level on agar plates. (c) We further create applications for visualizing our microbiome on the body through textiles.

Bell et al. explored the human skin microbiome as a biological medium for living interfaces (Fig. 3). They developed methods for cultivating and visualizing microbial communities at a visible scale and examined the environmental conditions that influence microbial colors and patterns. Integration of these microbial communities into wearable and textile-based applications, the study demonstrates the potential of the microbiome to function as an expressive medium that senses, displays, and communicates biological information (Hamdan et al., 2021). The present work provides a theoretical and technological basis for expressive biology-based bio-beauty art by establishing symbiotic microorganisms as media for aesthetic expression.

2. Sustainable Aesthetics

In contemporary aesthetic discourse, sustainability has emerged as a core paradigm that is shaping the realms of contemporary art and design (Smith, 2019). As the climate crisis, microplastic pollution, and the destabilization of the planetary boundaries intensify, art increasingly functions as a form of ecological practice. Sustainable aesthetics, which are rooted in ecological art and aesthetics, emphasize integrating environmental, cultural, and aesthetic values into creative practice (Clark & Harley, 2020). The concept of sustainability is not confined to environmental or technological concerns; rather, it is understood as an aesthetic framework that integrates ecological responsibility, cultural significance, and creative practice (Daugelaite & Grazuleviciute-Vileniske, 2020).



Fig. 4 End-of-Life Strategies for Biobased Nail Interfaces: The mechanical method involves separating the layers and pulling out the electronics. The chemical method dissolves the substrate biomaterial in water or vinegar. The biological method decomposes the biomaterial substrate in a soil mixture containing micro-organisms. These methods can be combined for more effective degradation.

Bio-e-Nails (Fig. 4) exemplify a sustainable approach to beauty interfaces by using biobased materials that can undergo chemical dissolution, mechanical reforming, and biological decomposition. The study posits that the circular life cycle of materials can be conceptualized as an aesthetic practice grounded in reuse, transformation, and ecological responsibility (Alistar, David, & Vasquez, 2025). Integration of sustainable material design with interactive functionality, Bio-e-Nails demonstrate how biological processes themselves can become a medium for aesthetic expression while reducing environmental impact (Vasquez et al., 2025).



Fig. 5 Myco-accessories using lamination techniques for embedding electronics.

a) Necklace. (b) Crown. (c, d) Bracelets.



Fig. 6 Myco-accessories life cycle.

Myco-accessories (Fig. 5) exemplify a sustainable approach to wearable design by employing mycelium-based biodegradable materials and proposing a product lifecycle in which the material returns to nature after use. The mycelium-based components are fully biodegradable throughout the production and disposal process, from prototyping to the final product (Lazaro & Vega, 2019). As demonstrated in the lifecycle model (Fig. 6), the process includes the cultivation of mycelium, the embedding of electronic components, the recovery of reusable electronics, and the return of the mycelium skin to natural conditions for decomposition.

(Science Learning Hub, 2008). This approach positions biological decomposition as an integral part of the design process, extending aesthetic practice beyond the finished object to encompass ecological regeneration.

Recent studies have intergrated of biodegradable biomaterials into wearable and beauty interfaces to implement sustainable aesthetics in practice. By using biological materials as expressive media, these studies highlight ecological responsibility and the principles of circular design.

3. Bio-inspired Aesthetics

Bioaesthetics is an interdisciplinary field that integrates biology, psychology, philosophy, and art to investigate aesthetic perception from multiple perspectives. The objective of this field of study is to investigate aesthetic perception by integrating from these distinct disciplines. Recent research suggests that the concept of beauty is not exclusively a cultural construct; rather, it is influenced by biological factors (Matuzava, n.d.). Bioaesthetics is the scientific study of the evolutionary origins of aesthetic cognition in humans and other animals. Bioaesthetics extends the concept of aesthetics beyond human artistic activity to encompass sensory and cognitive capacities evolved across living organisms (Westphal-Fitch & Fitch, 2018). This perspective provides a theoretical foundation for expressive biology-based bio-beauty art by framing the forms, processes, and transformations of living systems as sources of aesthetic expression.



Fig. 7 A model wearing a red Social Prosthesis headpiece.

The Social Prosthesis (Fig. 7) was developed as part of an artist residency project that combined make-up techniques with on-body miniaturized technology. The project, social interaction through 3D dynamic makeup, employs dynamic three-dimensional make-up inspired by the organic forms of microbial cultures and insect antennae to create novel facial structures (Chen et al., 2023). The project demonstrates the potential for bioaesthetic principles to expand bodily expression and reimagine the relationship between the body and living systems by translating biological forms into wearable aesthetic expression.



Fig 8. Body Painting Inspired by Passive Camouflage.



Fig 9. Body Painting Inspired by Active Camouflage.

Biomimicry-based camouflage body painting represents a form of bodily expression inspired by the camouflage strategies of living organisms. This approach is characterized by two distinct forms of camouflage. Passive camouflage (Fig 8), recreates protective coloration and crypsis through pictorial body-painting techniques, whereas active camouflage (Fig 9), employs adventitious resemblance and self-decoration by attaching environmental materials, such as grass and twigs, to the body. By transforming biological adaptation strategies into aesthetic expressions, this approach demonstrates how bodily appearance can mediate relationships between humans and ecological systems (Park, 2020).

The observation of biological species provides a visual and conceptual foundation for the artistic reinterpretation of living organisms (Zhang et al., 2023). Their formal beauty and ecological characteristics provide a theoretical basis for expressive biology-based bio-beauty art, demonstrating how biological phenomena can be translated into aesthetically expressive forms of body art.

IV. Characteristics of Expressive Biology-Based Bio-Beauty Art

1. Process-Oriented Aesthetics

Process-oriented aesthetics in expressive biology-based bio-beauty art is predicated on the emphasis of biological transformation, emergence, and relationality as dynamic aesthetic processes, as opposed to static artistic objects. This perspective is in alignment with the argument that aesthetic perception engages with phenomena as processes rather than objects (Perullo, 2022). Bio art conceptualizes the growth and transformation of living organisms as the primary locus of aesthetic experience (Shin & Yun, 2017), thereby providing a theoretical basis for understanding expressive, biology-based bio-beauty art through a process-oriented aesthetic framework. Bio-beauty art is distinguished by its departure from conventional beauty art, which prioritizes the final appearance of a given aesthetic. Bio-beauty art ascribes aesthetic value to the dynamic processes of living systems, encompassing growth, transformation, and relational interactions.

2. Ethical and Ecological Relationality

Ethical and ecological relationality refers to an aesthetic orientation that recognizes the interconnected relationships among humans, nonhuman organisms, and ecological systems, and integrates this awareness into creative practice (Kac, 2007). Within the discourse of sustainability, aesthetics integrates ecological responsibility and cultural meaning into artistic practice (Daugelaite & Grazuleviciute-Vileniske, 2020). The field of sustainability science posits that contemporary creative practices should contribute to the

transformation of human relationships with ecological systems by fostering new forms of environmental awareness and responsibility (Clark & Harley, 2020). In this context, expressive biology-based bio-beauty art regards living materials and biological processes as components of artistic expression. The employment of biodegradable biomaterials, living organisms, and regenerative processes serves to underscore the inherent interdependence of humans and living systems. Furthermore, it encourages aesthetic reflection on ecological relationships and environmental responsibility.

3. Reconceptualization of the Body

Reconceptualization of the body is a dynamic process of becoming, continuously shaped through interactions with technology, non-human agents, and living systems (Yurttas, 2023). The body is both the subject and the medium of artistic inquiry, evolving into an open, mutable platform. In the 21st century, the posthuman body is not static but dynamic, with a complex interplay between biological materiality, technological mediation and cultural inscription (Abbiatici & Mastroianni, 2025). Furthermore, posthumanism interprets human existence through the lens of technology, focusing on the modification of bodily qualities rather than on transcending them. This technopolitical process has been demonstrated to reorganize somatic structures, thereby rendering the body susceptible to new possibilities. Posthumanism discourse reconceptualizes the body as a relational and continuously evolving entity (Marchesini, 2025). This reconceptualization provides a theoretical foundation for expressive biology-based bio-beauty art, which aims to expand bodily expression through living materials, biotechnology, and bio-based creative practices. Expressive biology-based bio-beauty art is a reconceptualization of the body as a dynamic site where biological materials, living systems, and technological interventions continuously reshape aesthetic expression.

V. Creative Potential of Expressive Biology-Based Bio-Beauty Art

1. Expansion of Aesthetic Values

Expressive biology-based bio-beauty art represents an extension of conventional understandings of beauty. This is achieved by acknowledging biological processes and ecological relationships as sources of aesthetic value. Conventional beauty art accentuated the visual elements of the finished appearance, whereas expressive biology-based practices ascribed aesthetic value to processes of growth, transformation, and interaction. Bioaesthetics is the concept that aesthetic cognition possesses biological origins, extending beyond human artistic production to encompass forms and processes throughout living systems (Westphal-Fitch & Fitch, 2018). Bio art exemplifies the notion that living organisms and biological change can function as artistic media and aesthetic experience sources (Myers, 2015). The practical implications of this expanded aesthetic perspective are evident in expressive biocosmetic interfaces. Systems such as Nail pHolish and BioCosMe transform cosmetics from passive pigments into bio-responsive media, thereby visualizing physiological changes and bodily interactions. As posited by Bell et al. (2023), μ Me renders the skin microbiome perceptible at a macro scale, thereby unveiling human-microorganism symbiotic relationships as aesthetic appreciation objects. These practices suggest that beauty art is an ecological and relational process grounded in biological change and interspecies connections. Expressive biology-based

bio-beauty art represents an expansion of aesthetic values beyond external appearance, incorporating biological transformation and ecological relationships as dimensions of aesthetic experience.

2. Sustainable Creative Practices

The development of regenerative creative practices is facilitated by expressive biology-based bio-beauty art, a concept that integrates ecological relationships and biological life cycles into creative processes. Within the paradigm of sustainable aesthetics, creative practice reconfigures human relationships with ecological systems, thereby cultivating environmental stewardship (Clark & Harley, 2020). Bio-beauty art is an artistic approach that integrates the life cycle of biological materials—from cultivation to decomposition—into the creative process. The advent of bio-based and engineered living materials exemplifies this capacity. Bio-e-Nails presents a circular beauty interface with materials that can be mechanically reformed, chemically dissolved, or biologically decomposed. Moreover, myco-accessories are a class of mycelium-based wearable artefacts that undergo a return to natural soil conditions following utilization. The utilization of biological materials in creative practices has been demonstrated to be conducive to regeneration and material cycles, as opposed to linear production and consumption. Expressive biology-based bio-beauty art is defined as a regenerative creative practice that integrates the concepts of growth, transformation, and decomposition into the creative process.

3. Expanded Modes of Bodily Expression

The reconceptualization of the body as an open and relational entity engenders novel possibilities for bodily expression in the field of bio-beauty art. Expressive biology-based bio-beauty art is predicated on the notion that the body should not be regarded as a static, cosmetic representation surface. Instead, it is to be regarded as a dynamic medium that interacts with living materials, biological processes, and technological systems. Bodily expression is expanded through living biomaterials, responsive biosystems, and biologically inspired forms that are in a state of continuous change and evolution. Projects such as social prosthesis illustrate the integration of biological patterns and living-inspired structures, thereby generating novel aesthetic experiences and promoting novel modes of perceiving and expressing the body. Expressive biology-based bio-beauty art may be considered an extension of bodily expression that transcends conventional cosmetic practices.

VI. Conclusion

This study contributes to the development of the field of beauty art by proposing the concept of expressive biology-based bio-beauty art. The conceptual framework developed in this study explores the relationships among life, the environment, and beauty as they are expressed through the body. Three core characteristics were identified: process-oriented aesthetics, ethical and ecological relationality, and the reconceptualization of the body. Together, these characteristics reveal the creative potential of expressive biology-based bio-beauty art to expand aesthetic values beyond external appearance, foster regenerative and sustainable creative practices, and develop new modes of bodily expression by integrating living systems, biological materials, and emerging technologies.

This study explores the potential of bio-beauty to transcend conventional discourses on functionality and sustainability, thereby underscoring their inherent aesthetic and artistic value. This

approach has the potential to expand the scope of contemporary beauty art and establish a new artistic category grounded in posthuman perspectives and ecological awareness. However, this study is primarily theoretical, drawing on conceptual development and case analysis. Future research should develop expressive biology-based bio-beauty artworks and investigate their aesthetic potential through practice-based research and empirical evaluation.

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