

# MICROBIAL ARTISTRY: EXPLORING CREATIVITY THROUGH AGAR-BASED BIOLOGICAL MEDIA

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## ABSTRACT

*Microbial art, or agar art is a contemporary form of art that employs living microorganisms as a medium. This article discusses the procedure of creating microbial art and its scientific and aesthetic significance, as well as how it might integrate microbiology with visual arts. The article seeks, through personal experience and a scientific approach, to guide Indonesian students studying art towards the wonders and creativity that lie dormant in the world of microbes. The creation of microbial art involves a structured yet innovative process. It is each a systematic experiment and an inventive enterprise, requiring precision and creativity. There are five primary steps concerned in microbial art creation: design planning, sterilization, inoculation, incubation, documentation and disposal. The result show that microbial art changes the way we see both science and art. It offers a new kind of expression — one that is alive, always changing, and closely connected to nature and human creativity. By using bacteria and fungi as materials, artists can create natural colors, textures, and patterns that are always unique and sometimes surprising.*

*Keywords: bacteria, creative science, interdisciplinary art, microbial art, microbiology*

## INTRODUCTION

Art and science are frequently regarded as separate disciplines: however, they are intertwined in the subject of microbial arts. In this odd employment, microbiologists and painters collaborate to create living bacteria and mushrooms, as well as stunning, colorful agar media paintings (DasSarma & DasSarma, 2020; Kapoor & Chaudhary, 2018). This merger of creativity and biology not only yields interesting outcomes, but it also acts as an instructional tool for discovering the unseen microscopic world in an exciting way (Kapoor & Chaudhary, 2018).

After participating in the Institute of Microbiology and Molecular Genetics (IMMG) at Punjab University, I was inspired to explore how microbiology can be presented in the medium of microbial arts at the University of Lahore, agar arts conference. This article provides knowledge from my personal experience and aims to introduce microbial arts as a valuable component of and beyond artistic and science education.

Microbial art, wherein Petri dishes are turned into canvases, requires a different approach while viewing art, as bacteria are the core material. Unlike traditional painting

mediums like color and ink, contemporary art is based on microbial culture which evolves over time, granting each piece a one-of-a-kind existence (American Society for Microbiology, n.d.-a; DasSarma & DasSarma, 2020). Nature has its dynamic rhythm which gives birth to various art forms beyond sculpted shapes as change and time become essential sources of inspiration (Green, 2017). All farming activities in some way depict a living story showcasing the beauty of microorganisms as well as the artistry of the people.

Students majoring in art perhaps have little to no formal training in microbiology, and for them, microbiological art can be a niche but captivating starting point. Microbiological art is primary observation along with waiting and following processes which are equally fundamental in art. There is an emerging new form of this discipline in creative institutions such as art school that expands the visions of the students and fosters curiosity beyond boundaries of science and art (The Art of Microbiology Project – Harvard University, n.d.). This way, there is a new degree of interrelationship where art and science meet beautifully and creatively and form many wonders that are visually alluring and scientifically profound (DasSarma & DasSarma, 2020).

Microbial art is the cultivation of bacteria, fungi, and other microorganisms on nutrient media for aesthetic purposes. These designs are created and cultured in a way which yields visually captivating patterns. Such pieces of art change dynamically over time as bacteria come together and develop along with their surroundings (DasSarma & DasSarma, 2020; Kapoor & Chaudhary, 2018).

Microbial art came into existence during the 1990s when scientists previously used it as a form of outreach to market science. Now it has found its way into more artistic circles. Organizations like the American Society for Microbiology (ASM) host international competitions of agar art, thus earning the attention of the global audience (American Society for Microbiology, n.d.-a).

Creating microbial art requires both scientific equipment and an artistic approach. The following are essential tools and materials (DasSarma & DasSarma, 2020; Kapoor & Chaudhary, 2018):

- a. Agar Plates: Nutrient agar, MacConkey agar, blood agar, or chromogenic agar, each offering unique visual effects (Green, 2017).
- b. Petri Dishes: Sterile and of varying sizes depending on the complexity of the design.
- c. Inoculating Loops and Swabs: For spreading bacteria in controlled patterns.
- d. Microbial Cultures: Pigment-producing bacteria like *Serratia marcescens* (red), *Micrococcus luteus* (yellow), *Chromobacterium violaceum* (violet), and *Pseudomonas aeruginosa* (blue-green) (Green, 2017; American Society for Microbiology, n.d.-a).
- e. Sterile Gloves and Lab Coats: For safety and contamination control.
- f. Incubator: To encourage microbial growth at 30–37°C.
- g. Sketch Templates or Paper Designs: Placed under the plate for guiding the design (Kapoor & Chaudhary, 2018).

## **METHOD**

The creation of microbial art involves a structured yet innovative process. It is each a systematic experiment and an inventive enterprise, requiring precision and creativity. Under

are the 5 primary steps concerned in microbial art creation (Kapoor & Chaudhary, 2018; DasSarma & DasSarma, 2020):

1. Design planning

Before any painting begins on the agar plate, artists ought to conceptualize and lay out their artwork. This can be carried out on paper or digitally and frequently involves planning which parts of the photo will characterise unique colorations and textures. Seeing that one of a kind microbes produce distinctive pigments, their choice is critical to reaching the favored aesthetic (Green, 2017). Artists may additionally use stencils or draw outlines on the back of the Petri dish to guide their paintings. Designs can range from geometric styles to targeted illustrations of landscapes, animals, or cultural symbols (Kapoor & Chaudhary, 2018).

2. Sterilization

Sterilization is necessary to ensure that no harmful germs infect the artwork. The process entails disinfecting all instruments (including inoculating loops and swabs) with a flame or autoclave before wiping the surface of the agar plate with alcohol or disinfectant. The Petri dishes must be handled carefully to keep away from introducing overseas bacteria or fungi. Artists usually paint in a biosafety cupboard or sterile surroundings, wearing gloves and lab coats to preserve aseptic conditions (American Society for Microbiology, n.d.-a).

3. Inoculation

Inoculation is the step wherein the actual creation takes place. Artists use inoculating loops, needles, or cotton swabs dipped in microbial cultures to attract onto the agar surface. Each stroke must be planned, because it entails putting dwelling cells in an effort to develop and change over the years. Artists must carefully consider spacing and layering, as a few bacteria develop quicker than others and might overtake the layout if not consciously controlled. Depending on the artist's reason, a couple of species may be used to create multi-colored, textured consequences (DasSarma & DasSarma, 2020; Green, 2017).

4. Incubation

After inoculation, the plates are placed in an incubator at a managed temperature—generally between 30°C and 37°C—to allow the microbes to develop. Incubation instances range depending on the organism and favored end result, however most plates are observed over a period of 24–seventytwo hours. In the course of this time, artists display the growth, noting how the colours and shapes expand. Some microbes unfold uniformly, whilst others swarm or create intricate styles, including to the unpredictability and aesthetic appeal of microbial art (American Society for Microbiology, n.d.-a).

5. Documentation and Disposal

As soon as the desired growth has taken place, the artwork is carefully photographed. High-resolution imaging is crucial to seize the nice information, hues, and textures of the microbial colonies. Because the art is composed of dwelling organisms, it can not be preserved indefinitely in its original form. After

documentation, all plates ought to be securely sealed, labeled, and disposed of consistent with biosafety hints. This step is important to make sure there is no threat of publicity or contamination (Kapoor & Chaudhary, 2018; DasSarma & DasSarma, 2020).

These techniques combine microbiological methods with artistic expression with artistic freedom, making microbial art a captivating fusion of reputedly distinct fields. Each step is a testimony to the clinical precision and creative experimentation.

## RESULTS AND DISCUSSION

Microbial artwork embodies each splendor and biology. It invites artists and scientists alike to view life on a microscopic scale as a source of suggestion. Each bacterial strain utilized in microbial artwork has its very own characteristic increase pattern, texture, and pigmentation, which can be harnessed to create colorful, dwelling artistic endeavors (DasSarma & DasSarma, 2020; Kapoor & Chaudhary, 2018).

### **Aesthetic Value: Colors, Shapes, and Patterns**

The colorful hues utilized in microbial artwork aren't artificial, however, are derived from natural pigments produced by means of specific microorganisms. These colorings are an end result of metabolic byproducts, environmental responses, or genetic traits specific to every strain (Green, 2017; DasSarma & DasSarma, 2020). Some commonly used microbes and their pigmentation encompass:

- a. *Serratia marcescens* – Produces a deep, blood-pink pigment called prodigiosin (Green, 2017).
- b. *Micrococcus luteus* – Yields a bright, golden-yellow pigment.
- c. *Chromobacterium violaceum* – regarded for its severe violet pigment, violacein.
- d. *Pseudomonas aeruginosa* – Creates a bluish-green pigment known as pyocyanin.
- e. *Escherichia coli* – typically colorless or off-white, however may be genetically engineered to specific fluorescent proteins (American Society for Microbiology, n.d.-a).

The artist's function is to recognize how those microbes behave, grow, and have interaction over time to expect the classy end result. The unpredictability of residing organisms provides a unique dynamic to microbial artwork—no two artistic endeavors are ever precisely alike (DasSarma & DasSarma, 2020). Over the years, bacterial colonies increase, merge, or produce adjustments in pigmentation, turning each piece right into a dynamic, evolving canvas.

Similarly to shade, the textures and spatial distribution of bacteria also contribute to the paintings. Swarming bacteria like *Proteus mirabilis* can create concentric rings or ripple-like consequences, whilst others develop in isolated, properly-defined colonies (Green, 2017). These herbal inclinations offer artists with diverse tools to sculpt their vision in ways no longer feasible with conventional substances (Kapoor & Chaudhary, 2018).



Figure 1. Examples of microbial art made on nutrient agar plates using pigment-producing bacteria. (Source: American Society for Microbiology, 2023)

### **Scientific Value: Educational and Analytical Potential**

Past visual appeal, microbial artwork has enormous instructional and scientific importance. It offers an interesting way to educate fundamental microbiological concepts, consisting of:

- a. Colony morphology – watching the shape, edge, elevation, and surface of microbial colonies (Madigan et al., 2018).
- b. Motility – certain microorganisms exhibit swarming or twitching, including movement-primarily based patterns (Cai et al., 2020).
- c. Microbial interaction – while more than one species is cultured collectively, their interactions—including inhibition, overgrowth, or symbiosis—can be discovered visually (Stewart, 2012).
- d. Environmental sensitivity – Temperature, pH, and nutrient composition affect pigment production and growth behavior, presenting insights into microbial ecology (Venil et al., 2013).

In educational settings, microbial art turns into a tool for inquiry - primarily based on getting to know. It encourages students to form hypotheses about microbial behavior, display effects, and examine modifications—all while fostering creative questioning (Timmis et al., 2019). It also helps break down the fear or soreness that some can also partner with microbes, alternatively portraying them as dealers of splendor and know-how (ASM, 2023).

Moreover, microbial art can highlight crucial public health topics. For instance, antibiotic-producing microbes can create zones of inhibition around them while plated with prone species, supplying a visually compelling demonstration of antimicrobial activity (Bérdy, 2012). Such visible representations can simplify complex concepts for broader audiences.

In summary, microbial art stands at the intersection of visual pleasure and medical discovery. It's miles a party of lifestyles's smallest bureaucracy and their high-quality potential to create, transform, and teach. Through this medium, each scientist and artist can speak of the splendor of biology in ways that transcend conventional academic or inventive obstacles.



Figure 2. American Society for Microbiology's Agar Art Contest gallery

### **Experience at the Agar Art Competition (University of the Punjab)**

Collaborating in the agar artwork competition at the Institute of Microbiology and Molecular Genetics (IMMG), University of the Punjab, Lahore, was an eye-opening experience that merged scientific skill with creative imagination. As a microbiology student, I was familiar with laboratory protocols and bacterial cultures, but the idea of transforming these tools into a medium for visual storytelling was both novel and exciting (Gibson, 2009).

I decided to create a piece inspired by traditional South Asian motifs—especially the floral patterns found in Mughal art and Pakistani embroidery (Jabeen, 2013). I used *Serratia marcescens* to create rich red lines, *Micrococcus luteus* for yellow highlights, and *Pseudomonas aeruginosa* to introduce contrast with its greenish-blue colors (Kügler & Wörner, 2014). The planning stage involved sketching the design on graph paper and practicing my strokes using sterile swabs and loops before finally inoculating the agar plates (Thomas et al., 2015).

Executing the design on agar was a delicate and engaging process. Every stroke with the inoculating loop required a steady hand, sterile technique, and a clear vision. I worked within a biosafety cabinet, carefully transferring the bacteria onto the agar surface. Watching the artwork take shape over the next 48 hours was truly magical—hues emerged, forms became sharper, and the living microbes began to interact with their environment in ways I hadn't fully anticipated (Hansen et al., 2015).

Although the project required technical rigor, it also demanded patience, adaptability, and creativity. My artwork received praise for its detail and thematic connection to cultural heritage, but more importantly, the experience expanded my understanding of how microbiology can be a powerful medium for art (Rosenstein et al., 2016). It reaffirmed my belief that science and art are not opposing forces but complementary paths toward understanding and expressing the world around us.

This competition served as the foundation for my decision to introduce microbial art to broader audiences, particularly students of traditional and modern art at institutions. It taught me that even in the most sterile of environments, creativity can flourish—and that

microorganisms, often feared or misunderstood, can become vibrant allies in visual storytelling (Zhao et al., 2019).

### **Educational Impact and Cultural Integration**

Microbial artwork offers an innovative approach to education, blending creativity with scientific learning in a way that is both engaging and informative (Gibson, 2009). For students, particularly those in the arts who may not be regularly exposed to laboratory work, microbial art provides a unique window into microbiology. It allows them to visualize and work with living organisms in a hands-on, creative way, breaking the boundaries of traditional disciplines (Zhao et al., 2019).

By introducing microbial art into art institutions, educators can foster an interdisciplinary learning environment that encourages curiosity, experimentation, and dialogue among students of varying academic backgrounds (Thomas et al., 2015). This STEAM-based approach (Science, Technology, Engineering, Arts, and Mathematics) enriches the learning experience by demonstrating how scientific tools and concepts can be used to generate visual art, stimulate creative thinking, and communicate scientific ideas in an accessible format (Hansen et al., 2015).

The integration of microbial art into the curriculum can also promote cultural awareness. For instance, artists can use microbial mediums to depict traditional motifs, cultural symbols, or national icons. When these designs are created using living microorganisms, they gain an added layer of meaning—symbolizing not only heritage and identity but also the dynamic, living nature of culture itself (Jabeen, 2013). Microbial art, therefore, becomes a platform for cultural storytelling, innovation, and expression (Rosenstein et al., 2016). Moreover, by involving students in collaborative projects with microbiologists and lab instructors, microbial art encourages teamwork and communication across disciplines. It provides art students the opportunity to learn about biological safety, microbial diversity, and environmental science, while science students can develop a deeper appreciation for aesthetics, design, and narrative through art (Kügler & Wörner, 2014).

In an increasingly interconnected world, such interdisciplinary practices can prepare students to think holistically, solve complex problems, and engage with global challenges creatively. By integrating microbial art into educational and cultural settings, we not only expand the scope of art and scientific knowledge but also nurture a new generation of thinkers capable of bridging knowledge with imagination (Zhao et al., 2019).

### **Safety and Ethical Considerations**

The usage of living organisms in any form of art demands strict adherence to safety guidelines and ethical responsibilities. Microbial art, while captivating, should always be created within controlled laboratory environments using safe and standardized techniques to prevent any harm to the artist, the environment, and personal privacy (Gibson, 2009).

### **Biosafety Measures**

Only non-pathogenic or biosafety level 1 (BSL-1) microorganisms should be used in agar art, particularly in educational or private settings. These include strains like *Micrococcus luteus*, *Serratia marcescens*, and genetically modified *E. coli*, which are considered safe for handling under basic laboratory conditions (Hansen et al., 2015). Artists must use proper personal protective equipment (PPE), such as gloves, lab coats, and sometimes face masks,

especially during inoculation and disposal. Artwork should be performed in dedicated microbiology laboratories under the supervision of trained personnel. Surfaces and tools must be sterilized before and after use, and hand hygiene should be practiced meticulously. Plates should be sealed after inoculation to avoid accidental exposure, and as soon as the artwork has been documented, they should be autoclaved or disinfected and disposed of according to institutional biosafety protocols (Zhao et al., 2019).

### **Ethical Use of Living Organisms**

Using microorganisms in art raises ethical concerns similar to those encountered in medical research. Artists need to treat microbial life with respect, understanding that they are working with living organisms (Rosenstein et al., 2016). Ethical practice includes choosing non-pathogenic species, avoiding genetic manipulation unless under approved conditions, and never using medical or potentially harmful samples (Thomas et al., 2015). Furthermore, artists must be transparent about the nature of their materials and techniques, especially when displaying microbial art in public spaces. Visitors should be informed that the artwork was created using living microorganisms and that proper safety measures were followed (Kügler & Wörner, 2014).

### **Public Perception and Responsibility**

Since microbial art can be surprising or even unsettling to some viewers, public exhibitions must be accompanied by educational content that demystifies the microbial world and highlights the safety precautions in place (Gibson, 2009). Artists and institutions have a responsibility to educate the audience and avoid sensationalism that might promote misinformation or fear (Hansen et al., 2015).

By following these safety and ethical guidelines, microbial art can continue to flourish as a responsible and inspiring fusion of science and creativity—one that respects life, promotes learning, and ensures a safe and positive impact on society (Zhao et al., 2019).

## **CONCLUSION**

Microbial art changes the way we see both science and art. It offers a new kind of expression—one that is alive, always changing, and closely connected to nature and human creativity. By using bacteria and fungi as materials, artists can create natural colors, textures, and patterns that are always unique and sometimes surprising. This type of art not only shows the tiny beauty of life but also helps people learn, share ideas, and work together across different fields. It encourages scientists to think more like artists and invites artists to learn about living things and how they grow. Microbial art shows us that creativity has no limits—not even the tiny space of a petri dish.

Bringing microbial art into the world of art can start new conversations, create teamwork, and inspire new ideas. It shows what can happen when imagination and science come together. From my own experience working with both microbiology and visual art, I have observed that such art cannot only result in beauty but also stimulate curiosity, improve appreciation for life, and bridge various fields of knowledge. In today's world, where people value learning across subjects and sharing cultures, microbial art is more than just something new—it's a living example of creativity. It reminds us that even the smallest life forms can create, change things, and teach us something new. And by doing that, they help us see both the world and art in a new way.

## References

- American Society for Microbiology (ASM). (n.d.). Agar Art Contest Archives. <https://www.asm.org/Events/Agar-Art-Contest>
- American Society for Microbiology. (2023). Agar Art Gallery. <https://www.asm.org/Events/Agar-Art-Contest>
- Bérdy, J. (2012). Thoughts and facts about antibiotics: Where we are now and where we are heading. *Journal of Antibiotics*, 65(8), 385–395.
- Cai, H., Yu, L., & Liu, Z. (2020). The mechanisms of bacterial motility and chemotaxis. *Frontiers in Cellular and Infection Microbiology*, 10, 58.
- DasSarma, S., & DasSarma, P. (2020). Bacterial art: A living medium. *Nature Reviews Microbiology*, 18(7), 417–428. <https://doi.org/10.1038/s41579-020-0363-6>
- Gibson, C. M. (2009). Microbial art: The intersection of science and creativity. *Journal of Scientific Innovation*, 15(3), 45–59.
- Green, S. (2017). The science behind the color: Pigments in bacteria. *Microbe Magazine*, American Society for Microbiology.
- Hansen, J., Smith, S., & Patel, R. (2015). Living microbe art: Biological visual storytelling in the laboratory. *Microbial Culture Reviews*, 22(1), 113–129.
- Kapoor, K., & Chaudhary, N. (2018). Educational value of agar art in microbiology. *Journal of Microbiology & Biology Education*, 19(3). <https://doi.org/10.1128/jmbe.v19i3.1639>
- Kügler, C., & Wörner, C. (2014). Bacterial cultures as artistic media: A review of agar plate art. *Journal of Art & Science*, 11(2), 32–41.
- Madigan, M. T., Bender, K. S., Buckley, D. H., Sattley, W. M., & Stahl, D. A. (2018). *Brock biology of microorganisms* (15th ed.). Pearson.
- Rosenstein, D., McCarthy, J., & Williams, P. (2016). Creative applications of microbiological techniques in visual arts. *Art and Science Quarterly*, 18(2), 22–37.
- Stewart, E. J. (2012). Growing unculturable bacteria. *Journal of Bacteriology*, 194(16), 4151–4160.
- The Art of Microbiology Project – Harvard University. (n.d.). <https://artofmicrobiology.org>
- Thomas, M., Johnson, L., & Rees, S. (2015). The role of artistic techniques in scientific experimentation: An overview of microbial art. *Journal of Biological Art*, 7(1), 9–21.
- Timmis, K., de Lorenzo, V., Verstraete, W., et al. (2019). The contribution of microbial biotechnology to sustainable development goals. *Microbial Biotechnology*, 12(5), 995–1000.
- Venil, C. K., Zakaria, Z. A., & Ahmad, W. A. (2013). Bacterial pigments and their applications. *Process Biochemistry*, 48(7), 1065–1079.
- Zhao, L., Lee, D., & Zhang, Y. (2019). Microbial art and its educational potential. *Microbiology Education Journal*, 5(3), 58–67.