Different Strokes: Blending Microbiology and Art

Microbiologists collaborating with artists uncover new ways to find beauty and importance in microbes and to make them into art

Jeffrey Maloy

Although Michele Banks is not a microbiologist, she found herself speaking to a packed room of microbiologists at the 2016 ASM Microbe meeting in Boston last June. “It all started with the paint,” she says. “I was working with wet-in-wet watercolor, making abstract paintings with a kind of bleeding look and fuzzy edges. I had a show at Children’s National Medical Center in Washington, D.C., and the art coordinator told me that... my work looked like ‘friendly little things under a microscope.”

The idea was intriguing to Banks, and as she began to look at microscopic images she discovered a new subject for her art: microbes. “[They] appealed to me at the visual level, but I was also really attracted to the idea that there’s this whole microscopic world that we can’t see just with our eyes, that is happening all around us and even inside us all the time.”

Nowadays, Banks is a fixture in the world of microbiology and runs an online store selling her microbe art, Artologica, which was featured prominently in scientific venues such as Scientific American, Wired, and Microbe, among others. And her message to microbiologists during the first microbial art symposium at ASM Microbe is emphatic. “They don’t build museums because art is pretty. They build them because art is important.” Like science, Banks explains, art is a way of understanding the world around us, and microbe art uses microbiology to help us make sense of our humanity.

To illustrate her point, Banks refers to an iconic photograph of an AIDS patient named David Kirby on his deathbed with his mourning family surrounding him. The black-and-white photograph, taken by a young photographer named Therese Frare during the height of the AIDS epidemic in 1990, is devastating. And although the casual observer may not look at the photograph and see the virus, to Banks this photo is a portrait of HIV. “A scientific or clinical view of what a virus can do—replicate, cause infection, eventually kill their host—is not the full view. In the artist’s view, that tiny virus just devastated a whole family.”

Similarly, Banks uses her own microbial art to connect the study of microbiology with the human experience of microbes. In one of her projects, Banks gleaned inspiration from data collected by the Home Microbiome Project, which analyzes microbes on smart phones. The result was a painting she calls “Phonome,” in which Banks depicted microbes as different, brightly colored application icons on a smart phone screen. “Art’s key role in the dissemination of microbiology is to draw people in, to intrigue them,” she says. In this case, by depicting giant colorful microbes on a screen, she hopes to make the science more salient to smartphone users. Her larger goal is that the emotion and sense of wonder experienced by those who view works like Phonome may be harnessed for science advocacy.

SUMMARY

➤ Art, a way of understanding the world around us, can use microbiology to help us make sense of our humanity.
➤ Conversely, the artful use of microorganisms can make the science of microbiology more accessible to the lay public.
➤ Bioluminescent and brilliantly colored microbial species are being used as media for making works of art.
➤ Microbially based artworks can help to interest members of the public in science, giving them fresh opportunities to reflect on scientific issues.
From the Bench to the Kiln: Microbial Pottery as an Elevator Pitch for Science

Peggy Muddles might be considered a living embodiment of Michele Banks’ ambitious vision for microbial art. “I don’t think I ever really spoke to a nonscientist about science before my first art show that featured my microbial ceramic work,” Muddles says. Unlike Banks, Muddles works by day as a laboratory scientist at the University of Toronto Centre for the Analysis of Genome Evolution and Function. But like Banks, she discovered an aesthetic appreciation for microbes early on in her career as a scientist.

“When I started my undergraduate degree in biology, I needed some kind of creative outlet—my brain doesn’t do well with a rigid schedule—but I didn’t have space for an art studio. I discovered a local pottery studio, took a few classes, and fell deeply in love with clay,” says Muddles of her beginnings in microbial art. “When I took my first microbiology class in third year, it was like I had found my spirit animal. Suddenly all I wanted to create was bacteria and viruses and microscopic structures rendered at a relatively massive scale.”

Muddles’ fascination with recreating microbes in clay form has led her on a thrilling journey of science communication and advocacy that she hadn’t entirely expected. “Art shows were my first introduction to the whole notion of science communication, and there was a steep learning curve,” she says. “I quickly learned that sharing my excitement, and the reasons for it, were the keys to engagement. I had to toss out all the jargon and Latin names, and focus on connecting with the public through things they already had some basic knowledge about.”

Muddles’ commitment to public engagement has paid off. “As I’ve become better at explaining my art, I’ve gotten a lot more nonscientist customers,” she says. “I love that it’s possible to convince the lay public to wear a virus around their neck by getting them excited about something incredibly technical like capsid self-assembly. I love that they learn enough about it to explain it to their friends. It’s incredibly gratifying to see their eyes light up when they grab the person they came with and proudly explain what they just learned through my art.”

Bioluminescent Bacteria in Research and Art

While artists like Michele Banks and Peggy Muddles use microbes as their inspiration, others are beginning to explore the use of microbes as the medium for their art. Consider Siouxsie Wiles, head of the Bioluminescent Superbugs Lab at the University of Auckland in New Zealand. Her research focuses on bioluminescent bacteria as a potential source for antibiotics and as a means for developing bioluminescence-based animal models of bacterial infection. However, a few years ago Wiles realized that bioluminescent microbes readily pique the interest of nonscientists.

When a friend asked Wiles to participate in a local art show called Art in the Dark, Wiles collaborated with an artist to prepare a three-dimensional vessel in the shape of a Hawaiian bobtail squid, which forms a symbiotic relationship with bioluminescent bacteria, Vibrio fischeri. She filled the squid-shaped vessel with V. fischeri, and let Art in the Dark participants handle it.

Their response was phenomenal. “When peo-
ple find out the light is being made by living microbes, their interest takes on a whole different dimension and the questions start!” Wiles says. “Are the works really made of living bacteria? How do the bacteria make light? Why do the bacteria glow? Where do the bacteria normally live?” Another upshot is this art display enabled Wiles to share her research with the public in a curiosity-driven manner. “Chatting with people about the artwork usually leads on to further questions about the research my lab does, which is using bacteria like Staphylococcus aureus, Pseudomonas aeruginosa, and Mycobacterium tuberculosis, which we engineered to produce the same kind of light, to find new antibiotics, and to understand how nasty bacteria cause disease.”

Later, Wiles harnessed this public enthusiasm for this artwork to further her research goals. “All of the artists who I have worked with allow me to sell merchandise made from photos taken of their works to support my research lab,” she says. For instance, Wiles uses a website called RedBubble to sell t-shirts, phone cases, notebooks, and more items that are based on the bioluminescent artwork she produced with her collaborators. About 10–15% of the sales revenue from those products goes directly to support her research. “We don’t make a lot of money,” she says. “But every little bit counts.”

Wiles continues to produce a variety of living bioluminescent art pieces, including “sculptures” and a photo booth. “I love all of the works [I have produced] in different ways,” she says. “But I think my favorite project was the very first exhibition I curated, as part of Think Science Day at the Auckland Arts Festival. I brought together seven different artists and challenged them to ‘paint’ with bacteria, giving them a collection of square petri dishes so that their ‘canvas’ was about 1 meter high and 1 meter wide. Just seeing what they produced was fantastic.”

**C-MOULD: Bacteria Collected for Use in Art**

Like Wiles, Simon Park, a bacterial geneticist, recognizes the power of microbial art to engage
the public. His journey began 10 years ago, while teaching a first-year undergraduate microbiology lab course at the University of Surrey in the United Kingdom (UK). As a fun side project, Park had his students make simple drawings on agar plates using pigmented bacteria. Out of the blue, he received a call from an artist named Jo-Wonder, who told him that she wanted to try working with bacteria in her art. The two applied and received funding from the Wellcome Trust to make a version of John Millais’s painting “Ophelia” entirely from bacteria. The ambitious project required Park to curate a library of pigmented bacteria, with about 20 different types to provide different hues. The Park and JoWonder collaboration was a hit, receiving plenty of press in and outside the UK.

“I was inspired by the way that the beauty of the painting drew people in, and then by peoples’ reaction as they discovered it was made entirely by bacteria and thus things that normally invoke disgust,” says Park. “This was when I became really interested in art and biology and its ability to engage people in ways that more formal scientific processes often don’t.”

Following his first experiment with microbial art, Park continued to explore the diversity of bacteria through art. “Bacteria are important for many other reasons than just producing color,” he says. These interests led him to curate the world’s largest collection of microbes, called C-MOULD, for use in the arts. In this collection, Park maintains more than 50 different types of bacteria with properties that make them intriguing for artistic purposes. “In the C-MOULD collection, I have bacteria that can generate gold (from gold salts), make nanocellulose (for textiles/paper), form electrically conductive nanowires, and detect quorum-sensing signals.” Park and others are using these microorganisms for a variety of projects, ranging from microbial paintings to a new book cover for an edition of The Origin of Species. That cover is based on pigmented bacteria drawn onto a cellulose canvas made entirely from a hyper-cellulose producing variant of Gluconoacetobacter xylinus.

Through his microbial art, Park discovered a means for engaging the public in microbiology that often is overlooked. One larger aim, he says, “is to change the perception that bacteria are primitive and simple, and to reveal their complex social lives and amazing abilities.” Acclaim for these artistic collaborations as well as for his art blog (www.exploringtheinvisible.com) helps him in furthering this goal.

Moreover, like Siouxsie Wiles, Park finds that his involvement in artistic endeavors leads him along new avenues of research. Earlier, he focused on the molecular biology of Campylobacter jejuni and other organisms involved in foodborne illness. Some of his new research directions include “pattern formation in liquid cultures of bioluminescent bacteria and the characterization of bacteria that detect and respond to physical forces in their growth environment,” he says. Although his interest in foodborne illness continues, “working with bacteria through art has given me now a much broader perspective of the microbiological world.”

From Micro to Macro: Cultural Implications of Microbial Art

“Both art and science can be ways of exploring the world,” says microbiologist T. Ryan Gregory of the University of Guelph in Ontario, Canada. “For me, BioArt is a fascinating way to connect
with the organisms that are often used in scientific research as well as a means of appreciating a lot of hidden biological diversity that is normally too small for us to notice.”

As an evolutionary biologist, Gregory got his start in microbial art when he set out to create an exhibit honoring Darwin in 2009, the 200th anniversary of Darwin’s birth and the 150th anniversary of *The Origin of Species*. “I wanted my lab to contribute something living that would change over time,” he says. “Painting with microbes turned out to be perfect for this.”

After the exhibit, Gregory remained interested in microbial art, and began curating an online collection of many of the best examples (www.microbialart.com). Although he agrees that microbial art is an important tool for outreach, Gregory maintains that it has a deeper role in shaping the collective scientific culture.

“BioArt can be used not just as a way to get the public interested in science, but also to give them an opportunity to reflect on issues raised by science, such as our place in nature, the diversity of life (much of it unseen), our interactions with microbes (both positive and negative), and so on,” says Gregory. “BioArt provides a very useful venue for exploring issues related to ethics, the human condition, the impact of science on our lives, and the way people understand what science is and what it does and does not do. As with any high-level artistic endeavor, BioArt can elicit emotions and stimulate reflection about the current state of society. Given how prominent biology is in modern societal issues, I think that BioArt could have a very important role to play in this regard.”

To underscore his view of the cultural impact of microbial art, Gregory cites leading BioArtist Eduardo Kac, who described BioArt as the first artistic movement of the 21st century. To hear him discuss BioArt, one gets the impression that Gregory sees it as the “Wild West” of microbiology. And like generations of microbiologists before him, from Anton van Leeuwenhoek to Robert Koch, its mysteries draw him in.

“I don’t think the BioArt movement is sufficiently well developed or defined yet to draw clear boundaries of what is and isn’t ‘legitimate’ art in
that domain,” Gregory says. He points to the variety of artistic mediums employed by others, including Banks, Muddles, Wiles, and Park, as examples of the incredible diversity of microbial art. “BioArt continues to evolve, and having a diversity of explorations out there is, in my view, a good thing.”

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**Artists**

Michele Banks: artologica.blogspot.com  
**Peggy Muddles:** thevexedmuddler.com  
**Siouxsie Wiles:** www.redbubble.com/people/siouxsiew  
**Simon Park:** www.exploringtheinvisible.com  
**T. Ryan Gregory:** www.microbialart.com

**ASM Agar Art**

No discussion of microbial art would be complete without a mention of ASM’s own Agar Art contest, in which submitters can express their creativity through cultures grown on agar plates. See the 2016 winners on the Microbe World site:  