

CULTURAL
PROGRAMS OF
THE NATIONAL
ACADEMY OF
SCIENCES

March 15 – September 15, 2023
NAS Building, Upstairs Gallery
2101 Constitution Ave., N.W.
Washington, D.C.



Blue Dreams

*Rebecca Rutstein and the
Ocean Memory Project*

Introduction

This immersive video installation is inspired by the intricate workings of microbial networks in the deep sea and beyond. From abstract imagery to stunning undersea video footage and computer modeling, it offers a glimpse into the interconnections and resilience of our planet's smallest yet most vital living systems. *Blue Dreams* flows between micro and macro worlds to portray geologic processes at play with microbial and planetary webs of interactivity. Microbes are essential to the functioning of the Earth: they produce the air we breathe, regulate biogeochemical cycles, and are the origins of life on our planet.

Created by multidisciplinary artist Rebecca Rutstein in collaboration with a team of scientists, *Blue Dreams* is a testament to the profound impact that microbial networks have on a global scale. This installation offers a unique and thought-provoking perspective on the interconnectedness and sublimeness of the natural world.

Blue Dreams was created by artist Rutstein in collaboration with Rika Anderson, Samantha (Mandy) Joye, Shayn Peirce-Cottler and Tom Skalak through a grant from the National Academies Keck Futures Initiative (NAKFI) Ocean Memory Project. The Ocean Memory Project is a transdisciplinary group who believe that the ocean and its inhabitants are an interconnected system with agency and memory, where environmental changes are recorded through genetic and epigenetic processes within organisms and through dynamic processes within the ocean structure itself.

Blue Dreams evolved through a year-long collaboration between its five contributors. Anderson, an environmental microbiologist at Carleton College, advised on marine microbial adaptation and resilience, microbial gene sharing networks, and the implications for exoplanet science and astrobiology. Joye, a marine biogeochemist at University of Georgia and explorer of diverse deep-sea environments, provided insight into the biogeochemistry of vent and

seep systems, and the interplay of microbial networks with large-scale ecological processes. Skalak, a bioengineer, provided conceptual vision and insight into methods for abstracting the data into system models, including agent-based simulations that could provoke visualization of swarm and collective behaviors. Peirce-Cottler, professor of biomedical engineering at the University of Virginia, created agent-based models of deep-sea microbial growth patterns generated from color patterns of original Rutstein paintings on the same subject. And multi-disciplinary artist Rutstein researched, synthesized, abstracted, and layered imagery, animation, video, and sound to create *Blue Dreams*.

This exhibition was organized by Cultural Programs of the National Academy of Sciences.

Generous support was provided by Schmidt Ocean Institute.



Additional support provided by Nancy Rabalais, Jody Deming, and Richard Lenski.

Cover photo by Kevin Allen Photo.



Blue Dreams
Rebecca Rutstein and the Ocean Memory Project
2023
Installation photos of the 2 minute and 40 second digital video
Photos by Kevin Allen Photo.

Co-Creative Art-Science and the Origins of *Blue Dreams*

By Tom Skalak

Art and science have long been intertwined. Only in recent generations, with the advent and deepening specialization of experts in all fields, have they been drawn apart. *Blue Dreams* brings art and science together.

Five centuries ago, in Albrecht Dürer's 1514 masterwork engraving *Melencolia I*, the technically-trained artist and observer of the rapidly advancing scientific world could be seen as creatively embracing the empiricism of science and simultaneously offering the imagination of art to the rational world. Today, works of art and science can again provide a unifying social force, particularly when inspired by the remaining facets of the natural world. Our ability to fully model or understand our planet's ecosystems with data science is still very limited, offering compelling opportunities for the next generation of ocean and life scientists while also inviting artistic responses to make visible the unseen undersea realm.

Beyond this element of the unknown and sheer wonder, even awe in the presence of the sublime complexity of life in our oceans - the building of multi-way interconnections from the smallest microbial species up to the top of the ocean food chain offers us a model of our interconnected human society, suggesting solace for any individual viewer feeling their own insignificance, through this glimpse of secular transcendence in ocean memory.

One hope of the collaborating *Blue Dreams* group is to inspire unity among all people through their shared felt empathy with the long reach and ubiquitous human bonds of ocean memories, and perhaps to cause people to lift their eyes and thoughts to the stars, among which lie untold other worlds and likely ecosystems of life.

Why was *Blue Dreams* created?

Because oceans are the cradle of life on our blue planet, a reservoir of remaining mysteries of the deep that resist human experience and storytelling to this day. Oceans are the final frontier of our planet and one that



Albrecht Dürer (German, 1471-1528), *Melencolia I*, 1514, engraving, 9.4 x 7.3 inches.

needs empathetic understanding to sustain human and natural communities into the future.

Because people came together who shared different professional skills but found a common vision and ideas that matter. The essential magic of co-creation.

Each co-creator of *Blue Dreams* also had personal reasons to share in the vision and the creative process. I participated in the original 2015 National Academies Keck *Futures Initiative* (NAKFI) gathering and the session at which the poetic term "Ocean Memory" was created. Having created prior works of art-science and curated artist-scientist collaborations, I had the frame of mind to recognize a truly shared vision and to help visually articulate the final form of the work, welcoming passionate partners to share ideas freely and co-create it. The spark of mutual attraction for me to work with Rebecca Rutstein and vice versa was that we clearly shared a predilection, as Rebecca would say, "for finding brightness and positive, resilient approaches to the world and for taking action,



Doug Aitken, *SONG 1*, 2012, installation view: 360-degree facade of Hirshhorn Museum and Sculpture Garden, Smithsonian Institution, Washington, D.C., Courtesy of the Artist, 303 Gallery, New York; Galerie Eva Presenhuber, Zürich; Victoria Miro, London; and Regen Projects, Los Angeles. Photo by Brian Doyle.

doing something.” I’ve had a lifelong affinity for the sea. I also attended the opening night exhibition of *SONG 1* with artist Doug Aitken (who also attended NAKFI in 2015), and was inspired by his use of monumental displays of moving images and sound on the exterior surfaces of the circular Hirshhorn Museum in Washington, D.C. Viewers of that work were enthralled by the power of the visual work, sound, and interactions with neighboring public spaces and transient passers-by. *SONG 1* was a foundational reference for this group’s conception of a monumental video work of art-science that would capture the magic of the deep blue sea.

Rebecca had previously created a series of abstract visual art works at monumental scale reaching diverse and large audiences in urban as well as in reflective rural sites. She had worked with paint and interactive installations with sculpture and light, but never with moving images, and was attracted as an exploratory creative to this new format. Having been on ocean voyages and deep dives, she had a long-standing connection to hidden systems and processes on both land and sea. Rebecca was an Artist at Sea on the *R/V Falkor* in 2016 and part of Schmidt Ocean Institute’s ongoing traveling exhibitions, most recently in Portugal. So it was natural for her to become involved with an idea for depicting the awe experienced by deep ocean

explorers. As an artist, she is committed to connecting people with the natural world to create empathy for it, inspiring them to positive behaviors and actions. Mandy Joye is an experienced marine ecologist and had collaborated with Rebecca on prior voyages, leading to works of visual art by Rebecca. Mandy was a core element of the group’s work, in providing not only original footage of the microbial mats on the ocean floor, thermal vent dynamics, and other oceanic scenes, but in periodic discussions of the mechanistic basis of the visual phenomena that we were abstracting and capturing in the work. Rika Anderson teaches about microbial networks and astrobiology and provided inspiration to the group to think about connections from our planet’s smallest denizens to the possible forms of life on other worlds. Shayn Peirce-Cottler is a world leader in visual displays of agent-based computer modeling of interacting cells and living systems, which are embedded in the final work. Across each of these discussions, the group agreed to a level of abstraction that would free us from explicit documentary realism and allow the work to elicit awe through abstraction.

Blue Dreams offered “newness” outside all of the members’ professional careers, via the process of co-creating within a diverse group of people. This path did not follow the more common process of scientists doing

science and being observed by or providing data and images to artists. The co-creative process started with a shared feeling that this could really be something, then extensive group discussions of possible content and physical manifestation of the vision, and finally the placing of paint to paper and pixels to the screen.

Artists' Group Statement - by the Five Artists and Five Scientists

"*Blue Dreams* is a work of visual art, with sound and video components, that captures abstract ideas about living systems, designs, and dynamics in the oceans.

United by a sense of optimism and faith in the resilience and adaptability of the ocean, we created a work of art for video projection that can reach a vast audience and inspire a sense of the sublime. The video projection is synthesized from abstracted imagery, deep sea video footage, and agent-based modeling that portrays the sheer magnitude of marine microbial networks and the role they play in ocean memory and mediating complex processes in the deep sea, on our planet, and across the universe. Through beauty and a dynamic portrayal of our oceans and its microworlds on a macroscale, utilizing moving images and technical/design animations that reveal the complexity, colors, and connectivity of marine microbial networks, the work presents a compelling and abstract visual narrative to generate awe and empathy. By bridging art and science, the work inspires and educates. By connecting humanity with the ocean using the evocative metaphor of memory, we foster a dialogue about ocean conservation in the face of human impacts, including climate change."

There is a long tradition of arts being seen as the creative, intuitive, and non-analytical side of human creation, while science, engineering, and design are viewed as being analytical, machine-like, rote, mathematical, and otherwise devoid of qualitative decisions and creativity. Nothing could be further from reality. Every morning, an artist and a scientist must do the same thing – decide how to spend their day. A blank canvas is not filled with a masterpiece in a single stroke, rather the artist wends their meandering way to the final work by solving problems small and large until a final vision emerges. In like manner, the scientist, coder, or engineer, in similarly solving problems, often

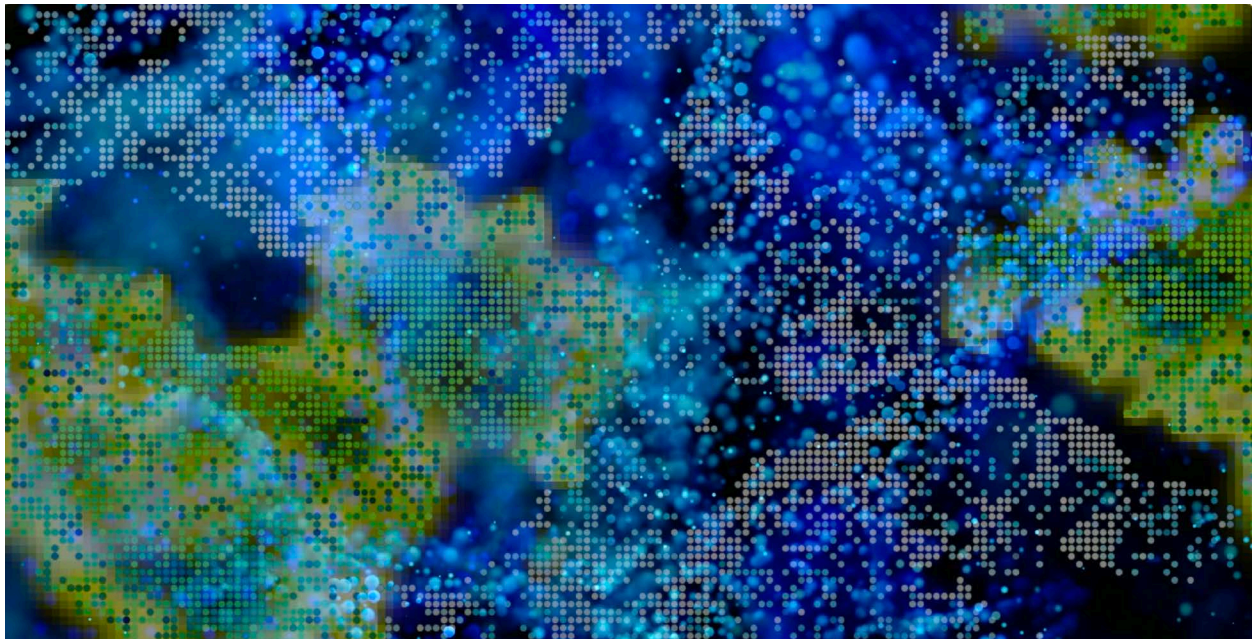
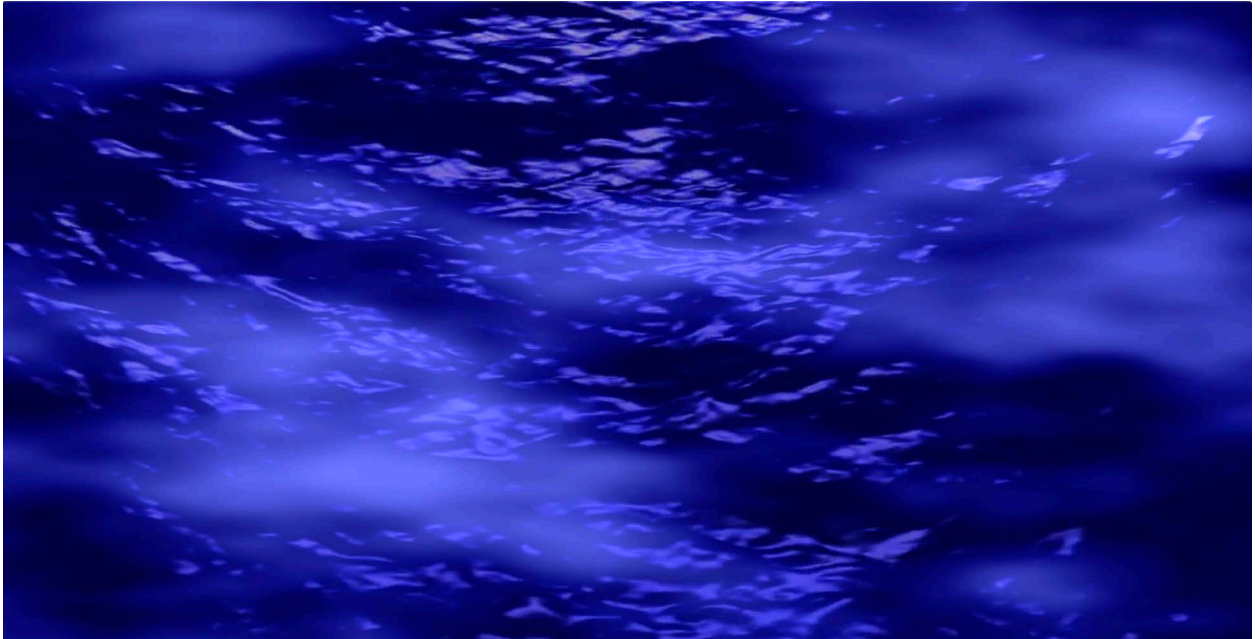
seeks novel creative visions of a phenomena they've encountered for the first time, that requires abstraction, or that resists traditional elucidation. They create new tools, new ways of looking, and new ways of seeing nature and reality. In the end, artists and scientists both use all facets of our human capacity to see, to reflect, and to act on a new vision of the mind and heart.

In *Blue Dreams*, the "scientists" took the visual artwork to places an artist couldn't have created alone, and the "artists" saw ocean life in new ways, even provoking new scientific questions about the controlling variables for microbial life in the ocean. This was a highly synergistic process, in which ideas were frequently exchanged in multiple directions. Within this process, Rebecca Rutstein is a scientist, and Shayn Peirce-Cottler is an artist.

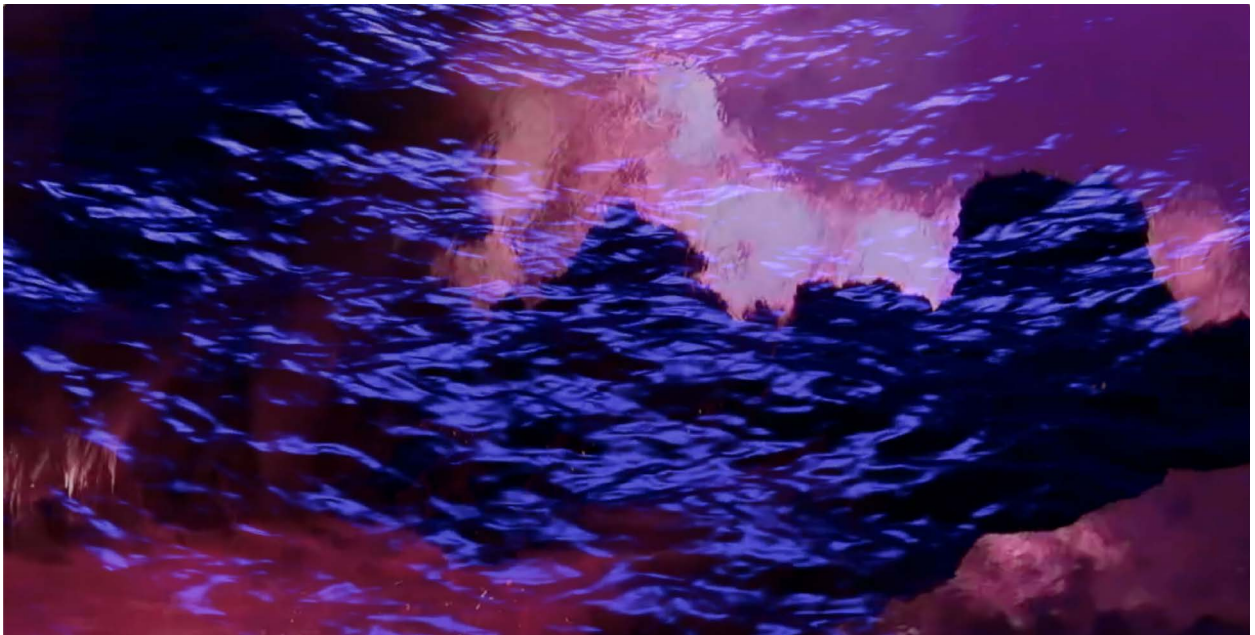
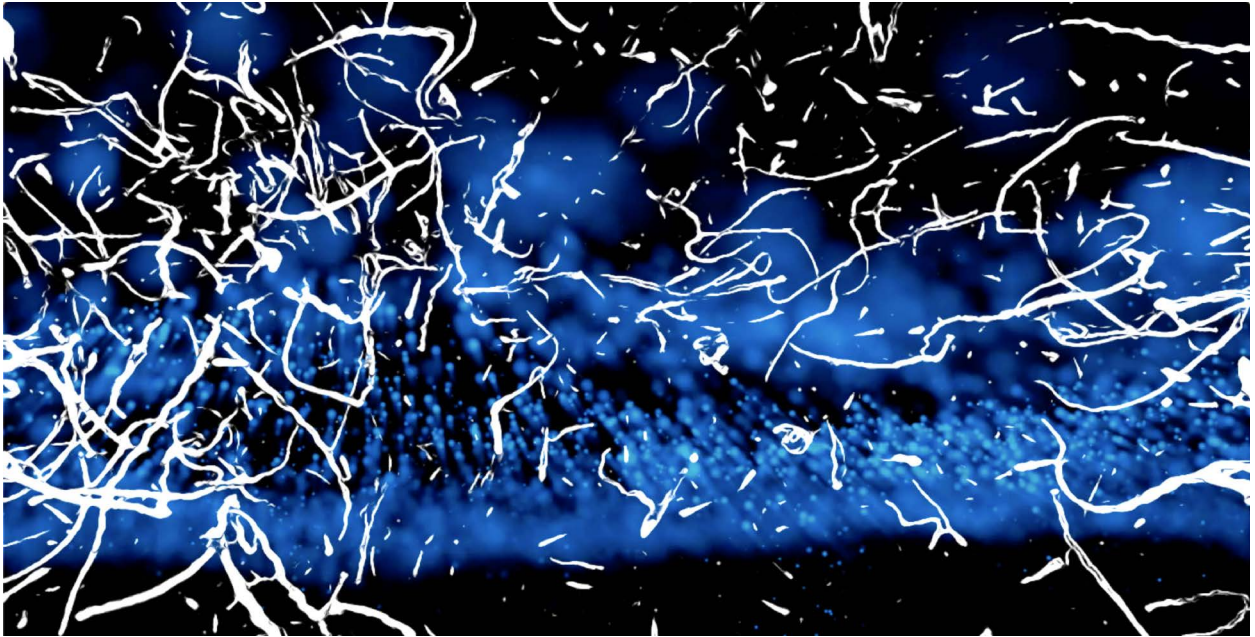
If there is one enduring impact of *Blue Dreams*, perhaps it would be the human realization that we all harbor and engage elements of art and science in our lives and work throughout our lifetime, everywhere on earth. Even in the fast-moving world of AI (artificial intelligence) today, the primacy of "options discovery" – deciding what to do next, out of infinite algorithmic possibilities – is clear and perceived to be of high value. An art-science team will likely help define this issue. In schools and in our increasingly "expertise-based" work lives, this realization might help usher in an era of more equitable engagement with the planet's resources, enhanced human dignity for all people, sustainable co-existence of human and natural communities, and reduced conflict across the world.

Creating a Template for an NAS Exhibit with Wide Cultural Influence

Because *Blue Dreams* stems from a National Academies program and would enable new exhibition capabilities in the National Academy of Sciences (NAS) building, J.D. Talasek, director of Cultural Programs at the NAS, championed the exhibit and also envisioned that the construction of this immersive video/sound wall would enable diverse future exhibits at the NAS. These might deal with climate science, the impact of AI and digital media on art-science projects, complex physical phenomena such as fluid dynamics, new materials for the clean energy transition, or exploring the Arctic to name only a few possibilities.



Blue Dreams
Rebecca Rutstein and the Ocean Memory Project
2023
Stills from the 2 minute and 40 second digital video



Blue Dreams
Rebecca Rutstein and the Ocean Memory Project
2023
Stills from the 2 minute and 40 second digital video

The role of a curator with vision is often underestimated within the art world, as well as in the world of science and engineering. Many of the most influential and inspiring works of art, science, design, and art-science throughout history have emerged after ideas and artistic possibilities were shared and interwoven by the vision of a curator. J.D. was such a visionary for *Blue Dreams* and for this inaugural exhibit of the work. In the co-creator's earliest discussions with him, J.D. was able to see the potential of the work, encourage and inspire the group to the final instantiation of the video creation, and work hand in hand with the creators to build the envisioned immersive interior exhibition space needed to convey the power of the oceans at an effective visual scale. So this group of artists and scientists, in reality, was a team of six, including the visionary co-creative role of J.D.

Evolving technology necessitates the need for even more collaboration. Drew Doucette and Adam Hager, with expertise in art video and time-based media, provided the technical guidance and worked alongside J.D. and Rebecca to transform a traditional gallery space into an immersive environment, and ensure that the scaled-up visual imagery preserved the original intention.

Another highly enabling feature of this realized art-science work is the freedom to create and explore which was made possible by the NAKFI vision and the Deep Blue Sea meeting in 2016, led by NAKFI director Kimberly Suda-Blake, experienced art-science creative David Edwards, by the continuing support for the *Blue Dreams* team's vision by members of the Ocean Memory co-leadership group and advisors, including Jody Deming (a member of the NAS and a lifelong ocean scientist who has hosted ocean art exhibitions at the oceanographic center at University of Washington) and Margot Knight (an experienced curator of art-science creatives), and by the visionary support of ocean exploration and this *Blue Dreams* work of art-science by the Schmidt Ocean Institute, including founders Eric and Wendy Schmidt. These gifts of time

and resources to create were invaluable to *Blue Dreams*, and by their nature send their own message to the world that human creativity and the oceans matter to us all.

Perhaps the ocean's memory is getting "smarter" or "more capable" at a faster rate than the human race or than silicon systems and the internet of things. And if so, then our awe, empathy, and reverence for the oceans ought to increase along with this realization.

Echoing the concluding sentiments in *The Great Gatsby* about the irresistible attraction of a vast continent, the co-creating group collectively felt the pull of ocean memory and mystery. Early in the exchange of project ideas, we wrote:

"For all of enchanted history, people must have held their breath in the presence of the ocean, compelled into an aesthetic contemplation they neither understood nor desired, face to face then, now, and for all of the uncertain future with something commensurate to our capacity for wonder."

Tom Skalak, Ph.D., is a science strategist, biomedical engineer, writer, and artist. He is the co-creator of *Blue Dreams*. Tom was the founding Executive Director of the Paul G. Allen Frontiers Group with the Microsoft co-founder, is Vice President for Research Emeritus at the University of Virginia, and currently serves as Senior Advisor to the Founders at the Joe and Clara Tsai Foundation. His sculptural work "Watch." is on permanent exhibit at the private Djerassi Ranch in Woodside, CA. Tom has logged over 10,000 hours in the Pacific and Atlantic oceans over four decades.

Artist at Sea Series

Rebecca Rutstein

Multidisciplinary artist Rebecca Rutstein created the *Artist at Sea* paintings as an artist in residence during several expeditions at sea including aboard the *R/V Falkor* sailing from Vietnam to Guam, the *R/V Atlantis* in the Guaymas Basin, and the *R/V Rachel Carson* in the Salish Sea. On each voyage, she set up a makeshift art studio and collaborated with scientists, working with satellite, multi beam sonar mapping, or marine microbial data being collected. Separate from the *Blue Dreams* exhibition, the National Academy of Sciences has acquired these 12 paintings for its permanent art collection.

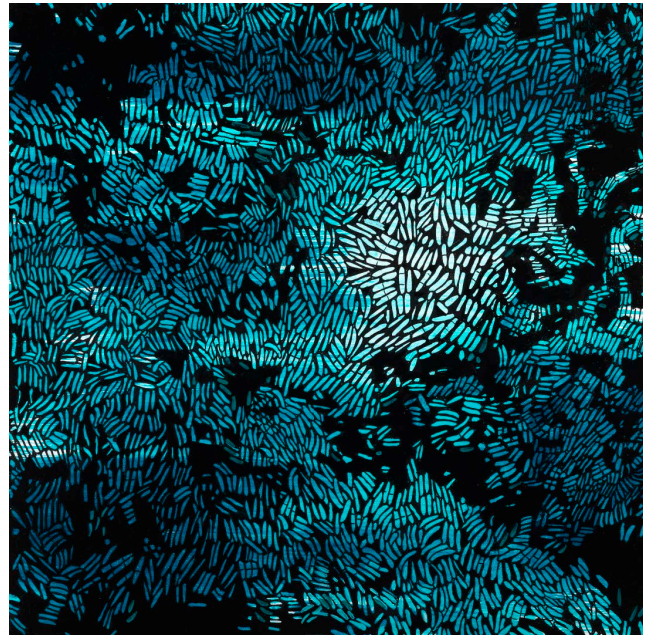
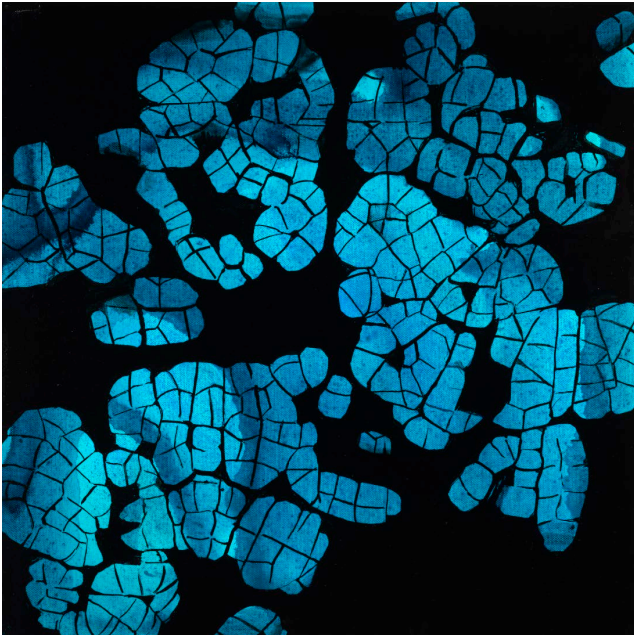
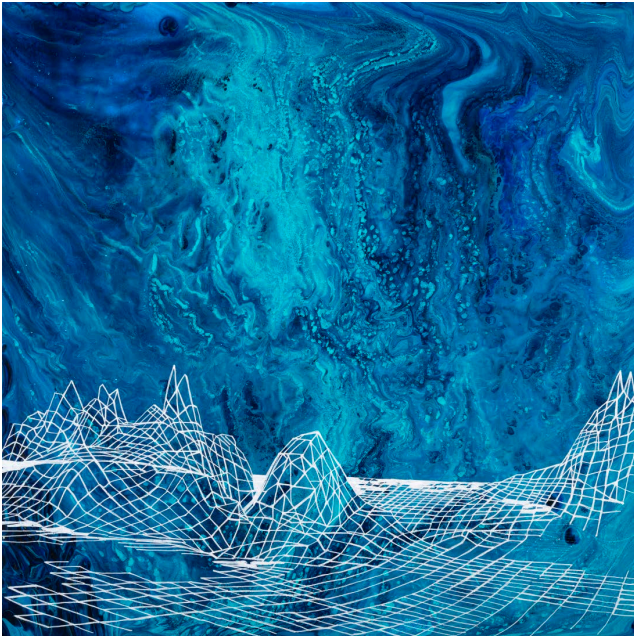
During her residencies Rutstein also recorded the ship's motion by pouring paint and allowing the heave, pitch, and roll to influence its dispersion on the canvas. These expeditions have been invaluable opportunities for cross pollination and synergy between artists and scientists, who are both keen observers and share a curiosity about the world around them.

For over twenty years, Rutstein has created painting, sculpture, interactive installation, and public art inspired by the natural world. She has been an artist in residence on seven expeditions at sea and two dives to the ocean floor in the *Alvin* submersible. Her collaborations with oceanographers, ecologists, microbiologists, molecular scientists, and geologists gives her a unique perspective and broad view of the interconnectedness of systems in the natural world.

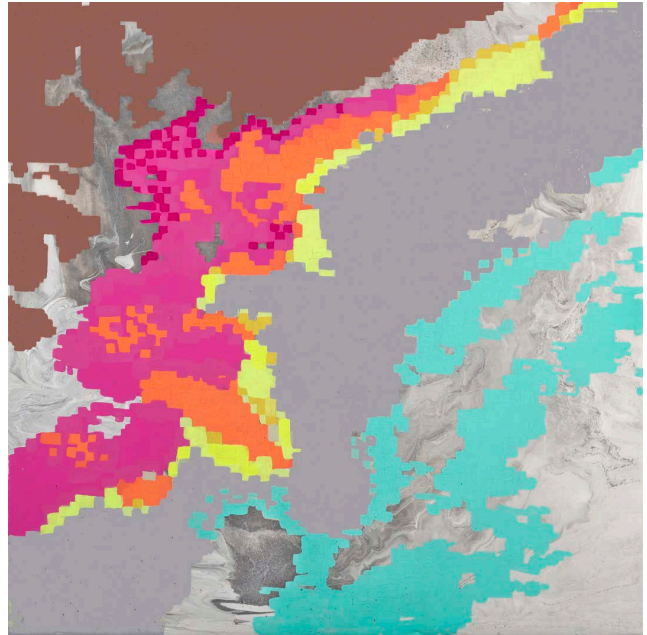
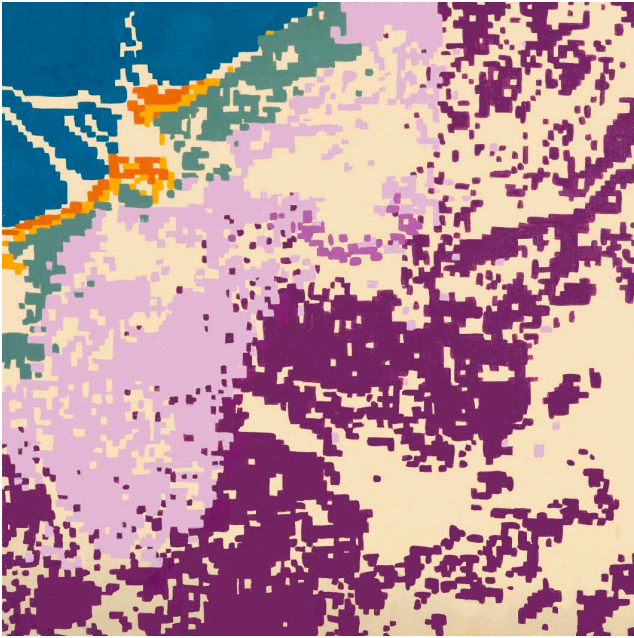


Rebecca Rutstein emerging from the *Alvin* submersible.

Through visual and immersive experiences, her work sheds light on the places and processes that are often hidden from view, to foster a deeper connection with nature, and inspire wonder, empathy, and stewardship in the face of our climate crisis.



From left to right, top to bottom:
Guaymas Basin Series I, 2018, acrylic on canvas, 18 x 18 inches
Guaymas Basin Series VI, 2018, acrylic on canvas, 18 x 18 inches
Guaymas Basin Series VII, 2018, acrylic on canvas, 18 x 18 inches
Guaymas Basin Series VIII, 2018, acrylic on canvas, 18 x 18 inches



From left to right, top to bottom:
Plume III, 2016, acrylic on canvas, 18 x 18 inches
Salish Sea Series III, 2019, acrylic on canvas, 18 x 18 inches
Salish Sea Series VI, 2019, acrylic on canvas, 18 x 18 inches
Plume II, 2016, acrylic on canvas, 18 x 18 inches



From left to right, top to bottom:
Salish Sea Series X, 2021, acrylic on canvas, 18 x 18 inches
Salish Sea Series I, 2019, acrylic on canvas, 18 x 18 inches
Salish Sea Series VII, 2019, acrylic on canvas, 18 x 18 inches
Salish Sea Series XI, 2021, acrylic on canvas, 18 x 18 inches