



REVEAL

THE ART OF REIMAGINING
SCIENTIFIC DISCOVERY

WORKS BY REBECCA KAMEN

ALPER INITIATIVE FOR WASHINGTON ART



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The Art of Reimagining Scientific Discovery

WORKS BY REBECCA KAMEN

Curated by Sarah Tanguy

August 28 - December 12, 2021

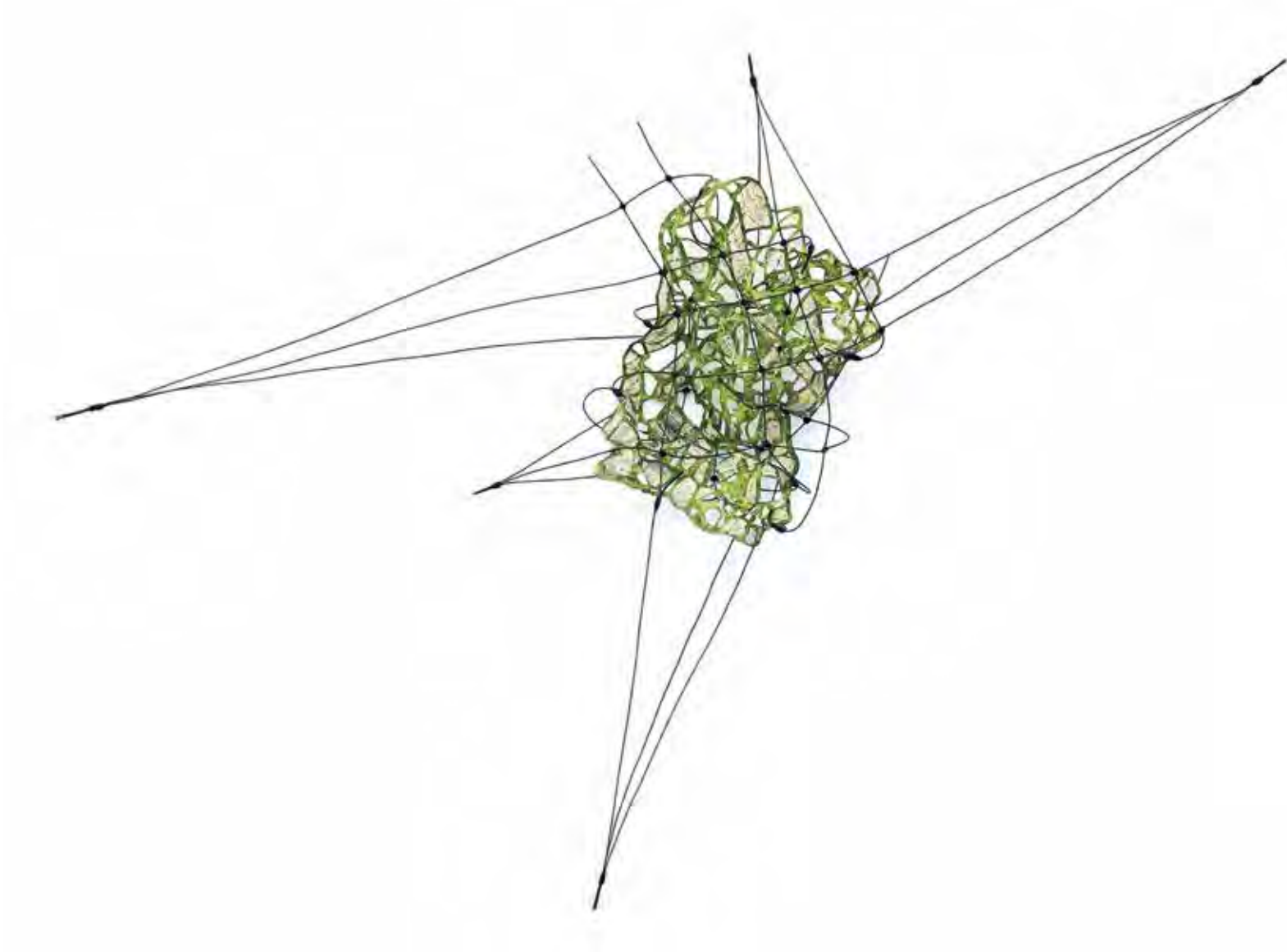
American University Museum
at the Katzen Arts Center
Washington, DC

ALPER INITIATIVE FOR WASHINGTON ART

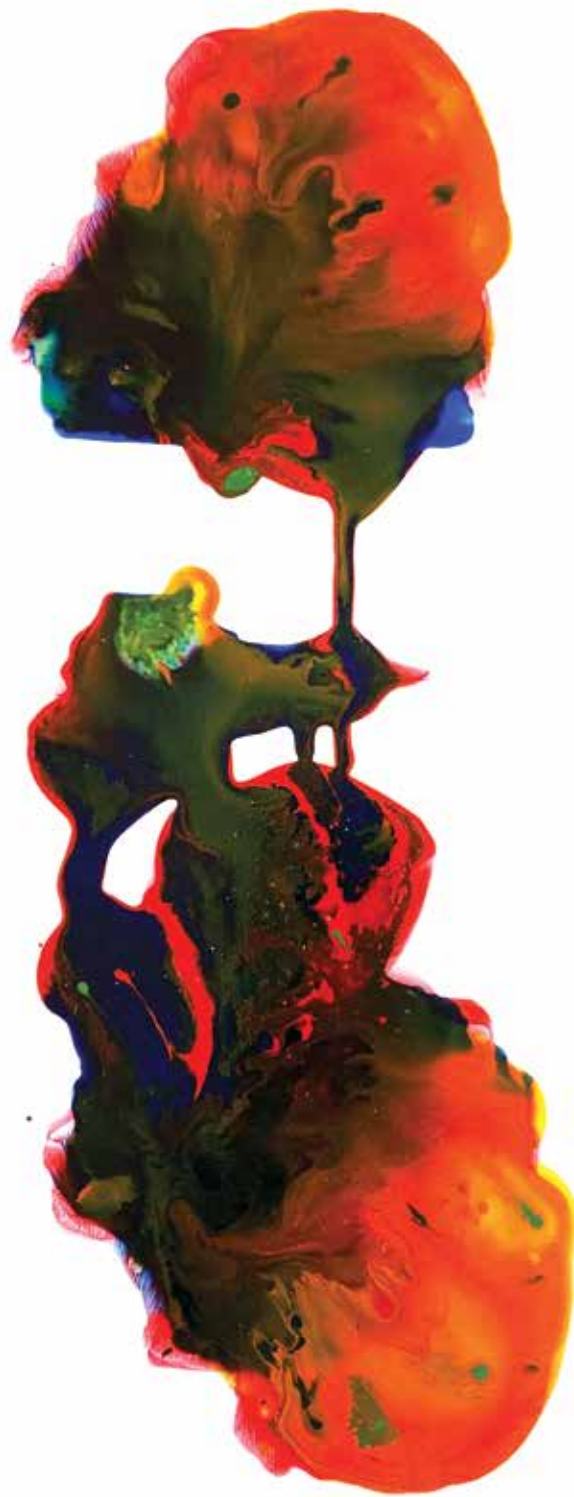
Flare, 2012. Acrylic on mylar, 25 x 21 x 6 in.

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External Wind, 2019. Acrylic on mylar, 49 x 59 x 9 in.



FOREWORD

Sculptor and painter Rebecca Kamen has long been interested in the intersection of art and science. In 2019, she turned her brain tumor diagnosis into a transformative experience where the worlds of neuroscience, physics, philosophy, healing, and art converge. More recently, the pandemic provided her with another opportunity to explore the interrelation of our worlds. You may enter her exhibition *Reveal: The Art of Reimagining Scientific Discovery* with preconceived ideas about these fields of study, only to emerge pondering the intangibles that connect all things.

It is not by accident that American University is showcasing Kamen's work. Her creations extend learning and scholarship beyond disciplinary boundaries while engaging the broader community and expanding world views. She embodies AU's guiding principles (learning, scholarship and community) as expressed in its strategic plan: *Changemakers for a Changing World*. Kamen is a trailblazer who exemplifies AU's focus on STEAM, the education movement where art is prioritized in conjunction with traditional "hard sciences" (Science, Technology, Engineering and Mathematics.). AU's Departments of Neuroscience and Physics help inform the show alongside the museum's programming.

As a clinical psychologist and fellow head injury survivor, I was immediately drawn to Kamen's wide-ranging presentation. At a time when the world struggles with pandemic survival, many people focus on loss. Kamen embodies "positive trauma" and resilience. She is a strong role model for us all, turning pain into shared knowledge. Instead of succumbing to the effects of a tumor that impacted her optic nerve, she depicted the visual distortions it caused.

Not surprisingly, this multidisciplinary professional has been recognized worldwide for her many contributions. Collaborations include The Center for Astrophysics at Harvard University, the National Institutes of Health, The Salzburg Global Seminar in Austria, The Computational Neuroscience Initiative, and the Department of Physics and Astronomy at the University of Pennsylvania.

As an artist who built her career in Washington, DC, it is our honor to welcome Rebecca Kamen and her works to the American University Museum's Alper Initiative for Washington Art. The Initiative was created by philanthropist, artist, and AU alumna Carolyn Alper (1927-2020) to promote the understanding and appreciation of Washington regional art and artists. It is more than an exhibition venue—it is a meeting place for people and ideas. We all owe a debt of gratitude to the family and friends of Carolyn Alper for keeping her vision alive. The continuing support of The Wolpoff Family Foundation and many other individuals have made this catalog possible.

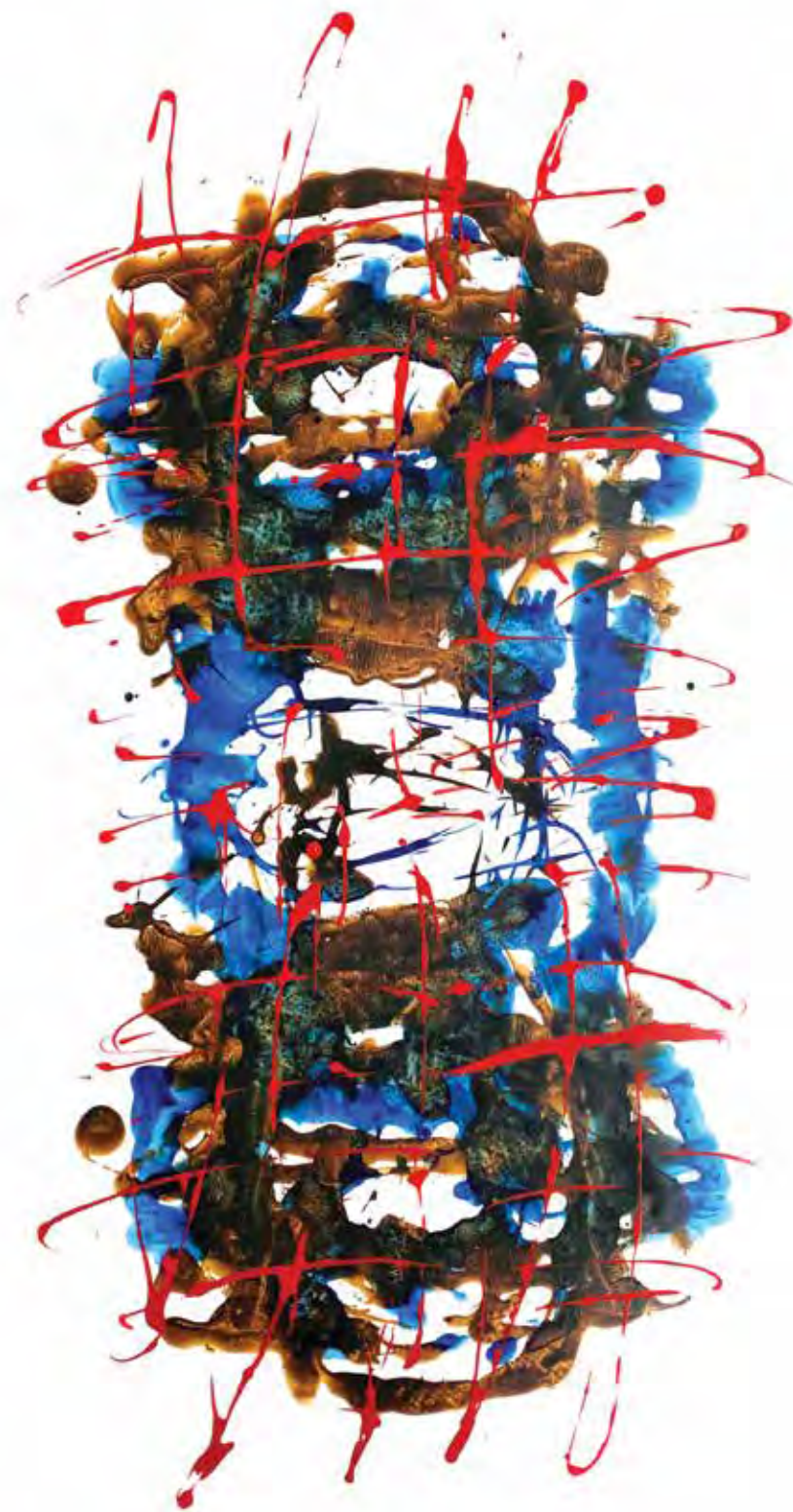
Sara Nieves-Grafals
*Retired clinical psychologist and member,
AU College of Arts and Sciences Advisory Council*

Opposite: *Reverie 13*, 2019. Acrylic on mylar, 24 x 18 in.

PORTALS OF POSSIBILITY

By Sarah Tanguy
Curator

It doesn't take much to turn your world upside down. For Rebecca Kamen it was the sudden diagnosis of a brain tumor. But this crisis had unforeseen benefits. It awakened a cycle of healing and discovery, and inspired *Reveal*, an exhibition where Kamen alchemizes her study of the human brain, solar flares, and more recently, the novel coronavirus, into resonant works of ethereal beauty.



Warming 5, 2020. Acrylic on mylar, 24 x 18 in.

The artist's passion for science started long ago. As a child, she spent hours taking things apart and inventing science fair projects with her chemistry set. Through a simple microscope and cardboard telescope, she marveled at the magical workings of cellular and cosmic phenomena. Summers were spent on the Jersey Shore gazing at the ocean's rhythms and wondering how things moved in space. Back in Philadelphia, school was another matter. A visual learner, she could easily maintain focus and follow instructions, but had difficulty with reading and recall. It was only much later that she found out she had dyslexia. By then, her fascination with movement and dynamics had taken a firm hold, as had her interest in cognition and the creative process. Being wired differently, she realized, enabled her to intuit novel connections and turn challenges into opportunities. Looking back on her childhood, it was her parents' gift of Rachel Carson's book *The Sense of Wonder* (1965) that gave her lasting encouragement.

Fast forward to 2005, the year that launched Kamen's current trajectory of exploring the intersection of art and science. That spring, she took part in an exhibition commemorating the 100th anniversary of Albert Einstein's General Theory of Relativity at the American Center for Physics. In less than six weeks, she created wire and metal sculptures that captured the very essence of Einstein's thought experiment of chasing a beam of light. That experience had a profound impact, fueling new research, new connections, and new art. It grew into collaborations with scientists and mathematicians, remarkable ventures given her lack of formal training beyond 11th grade chemistry. And it led to the planning of the current exhibition whose focus on curiosity and the creative process was inspired by the groundbreaking work of Perry Zurn, faculty in American University's Philosophy Department, and his twin Danielle S. Bassett, physicist and neuroscientist at the University of Pennsylvania. Kamen clearly resonates with the dancer, one of Zurn's three models of curiosity: "the dancer [may] rupture knowledge and social networks by either jumping to a new idea or throwing existing ideas into a new frame."¹

Reveal spins an engrossing account of Kamen's far-reaching collaborations with her own recent experience. Guiding the narrative is physicist John Archibald Wheeler, whose vision, grasped through observation, details a participatory universe where everything—at once particles, fields, and information—interacts with each other. From the macro to the micro and the outer to the inner, Kamen mines the mysterious realms and cosmic forces hidden to the naked eye. With exhilarating leaps of the imagination, she unlocks curiosity as a dynamic link between the arts, the humanities, and the sciences, and exposes the symbiotic relationship behind scientific research and artistic production. Through painting, sculpture, and installation, she harnesses the visual poetics of abstraction to humanize



Unidentified, Angels and Devil Tessellation, n.d.
Hand painted resin, 4 1/2 x 3 1/2 x 3 1/2 in.



Unidentified, Crystal, n.d. Quartz, pyrite, 10 x 6 x 3 in.



Unidentified, Icosahedron, n.d. Glass, 16 x 16 x 16 in.

scientific breakthroughs in unexpected directions. In the process, the exhibition becomes part incubator, part laboratory, shedding light on the many and diverse connective threads of her own artistic progress during the last three years.

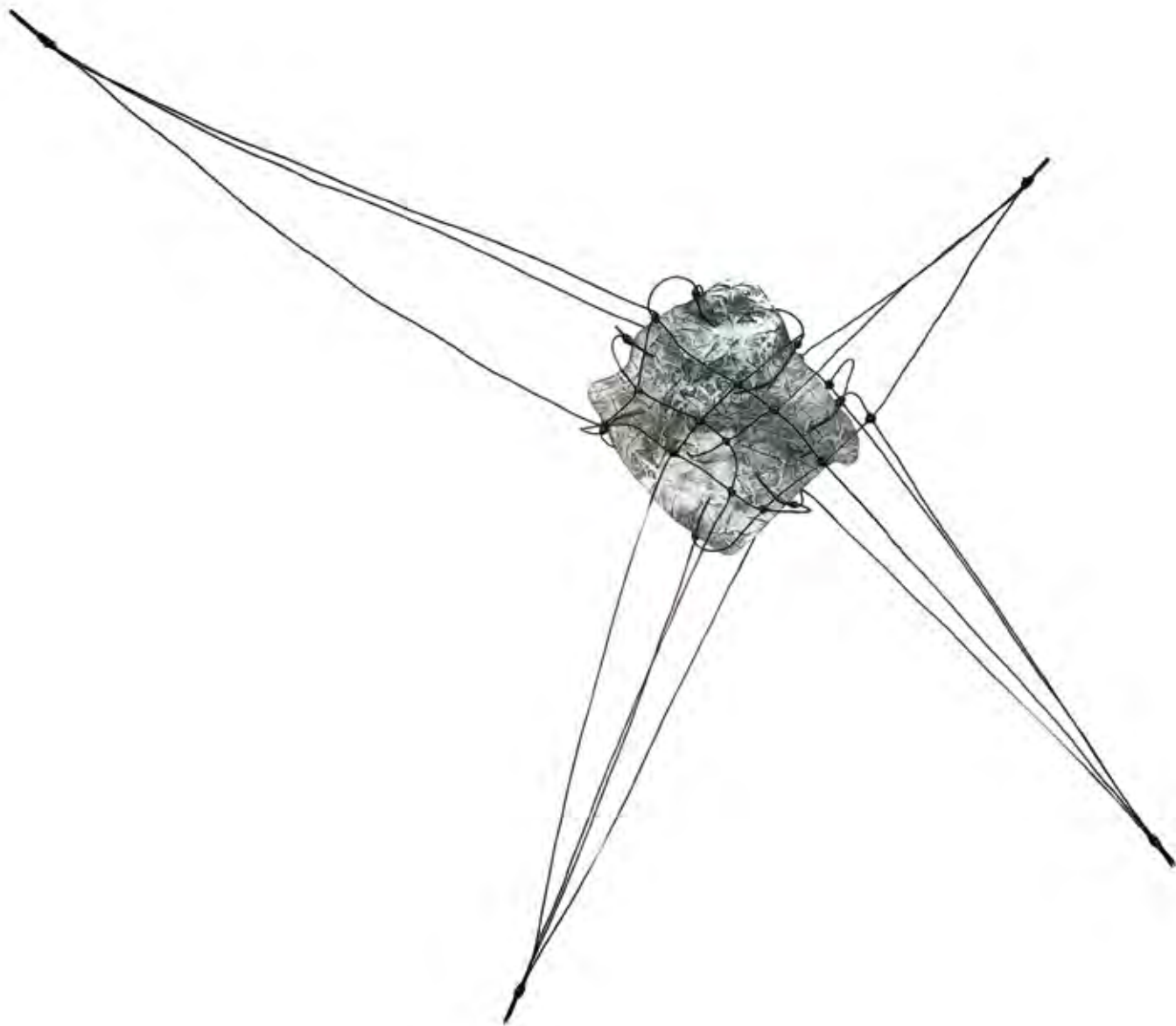
At the outset, a cabinet of curiosities beguiles with an amalgam of natural and manmade objects holding personal significance to the artist. From an assortment of rare quartz crystals, whose glyphic surfaces she finds accessible, and an antique astrolabe, a device used to calculate planetary positions, to a *lukasa*, a memory board handled by Luba shamans in the oral retelling of history, these objects speak to her in hushed whispers, exhorting her to plunge down the proverbial rabbit hole and test unfamiliar paths across time and place. A glass icosahedron, for instance, attracted her for its transparent and reflective properties, fueling a current body of work based on the Platonic solids. More recently, a spherical replica of M.C. Escher's drawing *Angels and Bats* stoked her imagination for its tessellations that resemble those in quantum quilts and in the structure of a virus. Each object in her collection presents special insight and quiet joy, and as a group, they form a portrait of the artist's encyclopedic psyche.

A series of interrelated sections follow, starting with *Sparkling Curiosity*, an eye-dazzling composition that charts the complex architecture and connective paths of Kamen's brain as she conceived and created artwork for the show. Developed at the University of Pennsylvania's Complex Systems Lab by Danielle S. Bassett, David M. Lydon-Staley, and Dale Zhou, in conjunction with Perry Zurn, the semantic network visualization involves translating words through algorithmic sequencing into generative diagrams. In both animated and still versions, darting zigzags of color-coded dots and lines offer a rare glimpse into her evolving quest for knowledge.

Coursing through the exhibition, a body of mylar paintings captures the temporary double vision Kamen experienced in the fall of 2019, after an episode of vertigo served as a messenger, revealing a tumor on her optic nerve. More than records, these brightly hued and emotionally charged expressions were unlike any previous work: they were direct links between her inner and outer eye, in which automatic marks and overlapping patterns seem to fly off the surface. In some, thick blobs spread out and congeal atop the translucent mylar, and in others, orbital swirls surround washes splashing out from open cores or densely packed nodes. In time, Kamen understood that her tumor was a catalyst to visualize new ideas for the show. She titled many of these fantastical works *Reveries* (2019), in homage to neuroanatomist Santiago Ramón y Cajal who described the beauty of grey matter cells as "the mysterious butterflies of the soul."



Reverie 1, 2019. Acrylic on mylar, 18 x 24 in.



Quantum Quilt 2, 2019. Graphite on mylar, wire, 48 x 36 x 4 in.

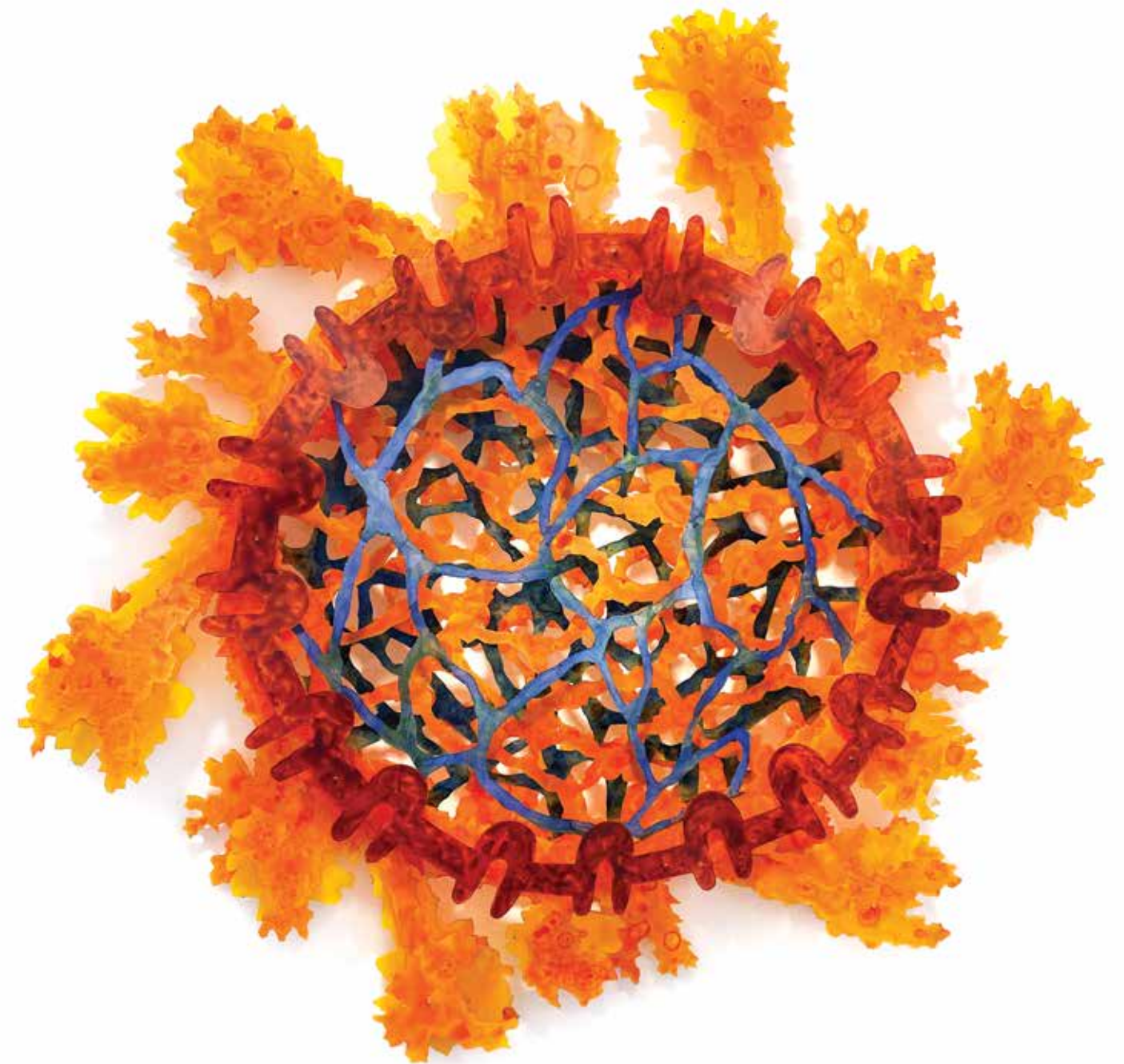
A section in the show devoted to neural complexity systems marks Kamen's first pairing of the *Reveries*, with previous sculptures in this case. While both series employ mylar, the paintings radiate spontaneity; the sculptures, on the other hand, entail rigorous calculations before cutting and assembling the shapes by hand. Over the years, as she has honed her simple geometric aesthetic infused with organic poetry, she has come to prize mylar for its malleability. She enjoys transforming its translucent surface through paint and graphite and manipulating its inherent flatness into form. In *Hemispheres* (2019) (p. 45), a bilobal sculpture inspired by the cerebellum work of neuroscientist Catherine Stoodley at American University, a wire skeleton cradles a grey, undulating mass whose crosshatched surface pulses with a network of cobalt lines. By contrast, wire segments stretch diagonally into points and barely contain the topographical folds in *Quantum Quilt 2* (2019), a work informed by research of Nathan L. Harshman, Professor of Physics and Director of the NASA DC Space Grant Consortium at American University. Here, as elsewhere, the tensile compressions of the sculptures counterpoint the atmospheric openness of the paintings even as compositional similarities emerge.

An uncanny convergence sparked the next section, which explores the corona structure at both the macro scale of a solar corona and the micro scale of a virus. The *Emissions* series interprets solar phenomena. In these paintings, frenetic bursts of yellow and orange erupt from glowing cores as they dissipate into gaseous swirls. Their origin can be traced back to a 2012 tour of the Solar Lab at Harvard University after Kamen had presented a lecture for the Astrophysics Center, while a powerful outbreak of solar flares was taking place.

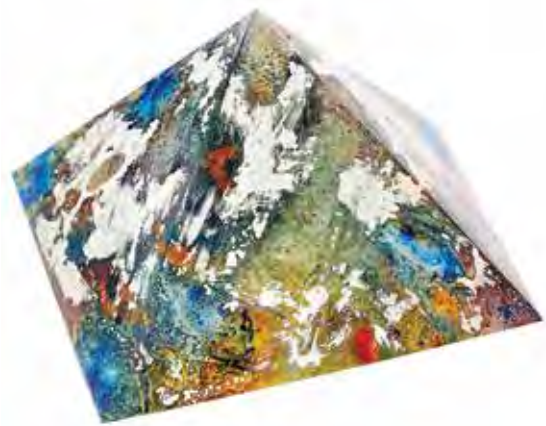
Everything seemed on fire to her, and she wondered how conditions so far away could impact the course of the planet. When the full scope of the pandemic became clear in 2020, she found herself pondering the opposite—how something so small as a virus could affect all of us—and shifted her focus to the novel coronavirus. Sourced in part by colorized SARS-CoV-2 electron microscopic images captured by the NIAID/NIH team at Rocky Mountain Lab, the *Corona* sculptures all feature a nested core with overlays of blue, orange and green lines that project into fiery spikes in *Corona 1* and 3, and elliptical loops in *Corona 2*. Like the flaming halo of the Dancing Shiva, the Hindu deity who incarnates the cosmic cycles of creation and destruction, this high-energy work boldly conjures shape from chaos and flux.

Nearby, a corollary series about the impact of solar flares and global warming grew out of dialogues she initiated with heliophysicist Silvina E. Giudoni during her residency at American University. Titled *Warming*, the body of work centers around a spherical sculpture whose topography exhibits the powerful effects of invisible forces. Wire filaments weave in and out of openings that have pierced its layered folds, and its brittle surface, the color of molten lava, has been stained by a blood-red skein. Off to the sides, four companion paintings improvise on the shape of an elongated vertical mass. In some areas of these works, viscous splats of blue and orange coalesce into darkened pools, while in others, pockets of paint distill into a matrix of open and closed lines and spontaneous dots.

Further contemplation of these macro and micro phenomena catalyzed a body of work where Kamen examines their underlying geometry. She found their common shape to be the 20-faceted icosahedron, originally one of the five Platonic solids that the ancient Greek philosopher associated with water.



Corona 3, 2020. Acrylic on mylar, 18 x 18 x 4 in.



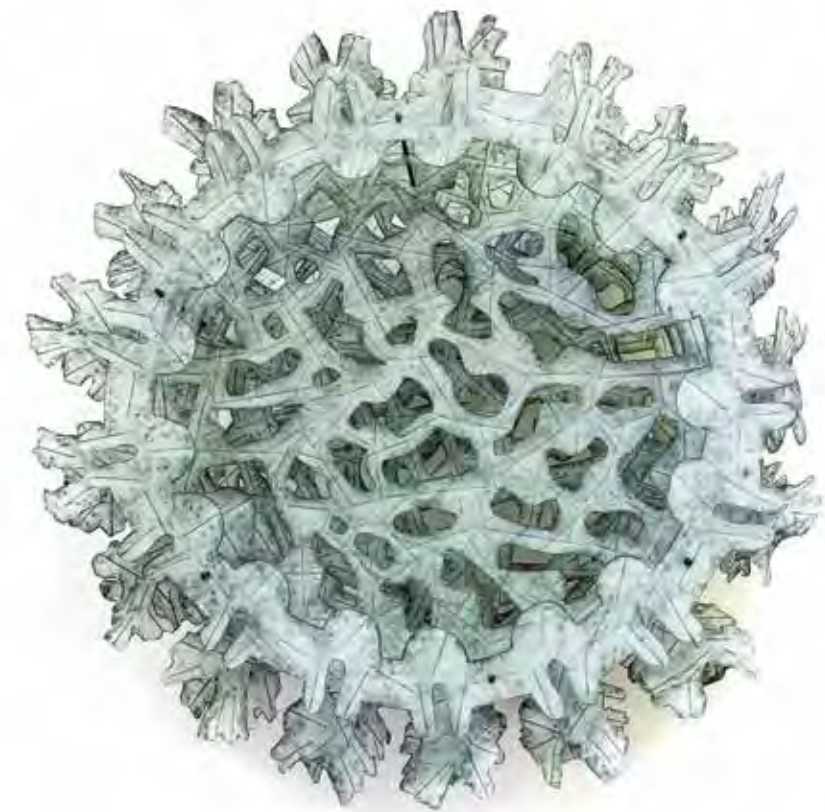
Illumination 2, 2020. Acrylic on mylar, 9 x 9 x 6 in.



Illumination 5, 2021. Acrylic on mylar, 9 x 9 x 6 in.

At only 9 inches per side, the tiny mylar structures in *Illuminations* depict wondrous landscapes that spread over the entire surface, their angular projection from the wall lending an aerial perspective. While these intricate scenes have their own defining character, they share an elaborate network of lines, marks, and pools, all done in a rich, polychrome palette. The overall experience is visceral, the works' shape-shifting capacity defying words. Some recall a walk in a forest like the first *Illumination*; others resemble a ravaged battlefield; and still others dissolve into fluid abstraction. To add complexity, one facet is hinged allowing visual penetration. Reminiscent of the glass polygon in her collection, these elemental sculptures generate myriad inner and outer views as they engage the ambient light and objects of their surroundings.

The exhibition culminates in *Silent Spread*. Featuring twenty-eight diaphanous spheres, the immersive, mylar and graphite installation interprets the migratory pattern of COVID-19 found on an SIR map. Rendered in a serene palette of silvery grey, the composition extends gracefully along a central axis, one side a near inverse of the other. Up close, each element spins its particular magic of gentle creasing, delicate tracery, and tonal nuance. And together, these intimately scaled works of various size generate a polyphonic harmony: In Kamen's hands, the lethal organism has been transformed into a group of sensuous blooms with fluttering petals. As a response to *Silent Spread*, Shodekeh Talifero composed *Virion Breaths*, an enveloping soundscape that reimagines the individual sculptures as a cycle of expanding and contracting



Silent Spread, 2020-21. Graphite on mylar, 28 components, dimensions variable.

breaths. Akin to the *musica universalis*, an all-encompassing description of celestial motion dating back to classical metaphysics, the aural and the visual blend into a haunting, meditative state where the edge between dreams and reality blur.

Throughout *Reveal*, the works emerge as catalysts and enlist the power of metaphor to manifest scientific discovery in new ways. A mirror for self-reflection, the exhibition chronicles Kamen's passionate search for patterns interlinking seemingly disparate fields, and her collaborative practice involving chance, experimentation, and repetitive gesture. Just as the virus has raised awareness of our global dependence, the ever-curious artist illuminates the value of uncertainty and flux. As she continues to seek insight and a positive outcome from difficult circumstance, she coaxes works into being that inspire a fresh perspective, while forging a dynamic model for both individual and societal inquiry. From the deep shadows of turmoil and loss, the inherent beauty of nature is revealed along with the promise of growth.

¹ Perry Zurn, "Busybody, Hunter, Dancer: Three Historical Models of Curiosity," in *Toward New Philosophical Explorations of the Epistemic Desire to Know*, ed. Marianna Papastephanou (Cambridge: Cambridge Scholars Press, 2019), 26-49.

A POETIC RESPONSE

By SJ Fowler

SIR, the 28 spheres of Kamen's harmony.

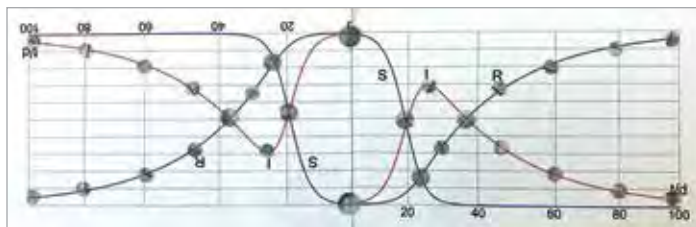
Susceptible, inferred, immense, actual - the electron microscopy provides images of the virus long in memories.

It shows grey spinning, transforming this (I point to the past fifteen months) into orbs.

Here they are, grown enormous, before you in place, not within you in space.
For what else can it become but the potential for indifferent attractiveness.

A memory, this spread; a novel micrography.

The SIR diagram is a mirror that creates a migratory pattern in the mind, as one would imagine birds flying, out of sight.



Of birds then. The diagram is a symbol that brings nets down, and what gets trapped in nets, as it is expelled from our hands, and rid by water, is a thing, that reflects, traces, and symbolizes.

Both the virus, and us.

The universe participates in making the artist well, and an instigator.

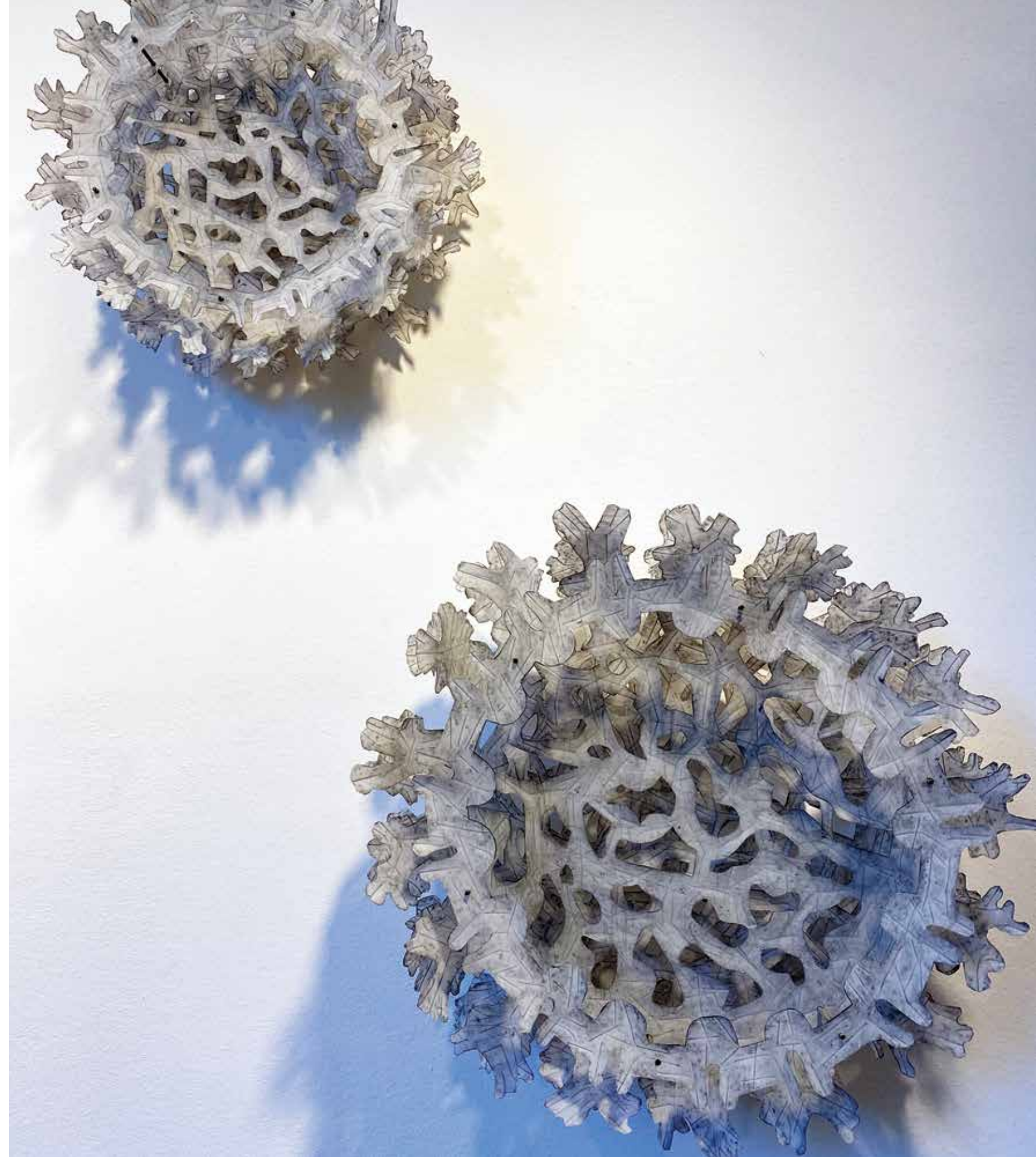
The participation of the invisible moves the virus into view.

A speck, a spread, a tiny writing in the air, a diagram, an avian metaphor, an object installed to illuminate. All of this, completely noiseless.

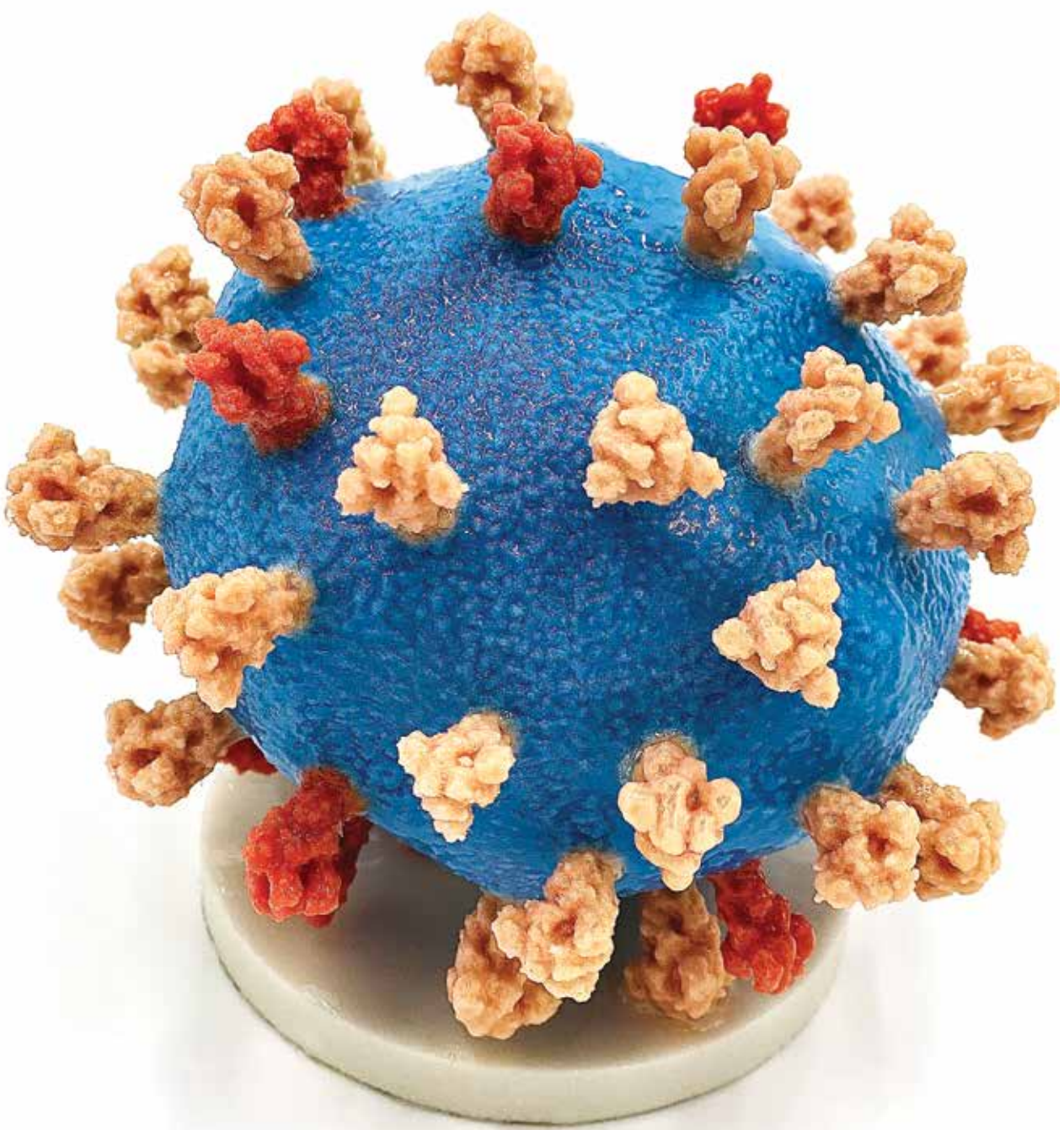
And this is why I write to you, in order to not speak the word, and have it just be seen.

London-based SJ Fowler is a writer, poet, artist, playwright, and filmmaker whose work has been commissioned by Tate Modern, BBC Radio 3, Somerset House, Tate Britain, London Sinfonietta, Southbank Centre, National Centre for Writing, National Poetry Library, Science Museum and Liverpool Biennial amongst others. His writing has explored subjects as diverse as prescription drugs, films, fight sports, museums, prisons and animals. Fowler has pioneered the fields of performance literature, literary curation, collaborative poetry and Neuropoetics. He was part of the first ever Hub residency at Wellcome Collection, and is currently poet-in-residence at J&L Gibbons architects and associate artist at Rich Mix. www.stevenjowler.com

Opposite: *Silent Spread*, 2020-21. Graphite on mylar, 28 components, dimensions variable.



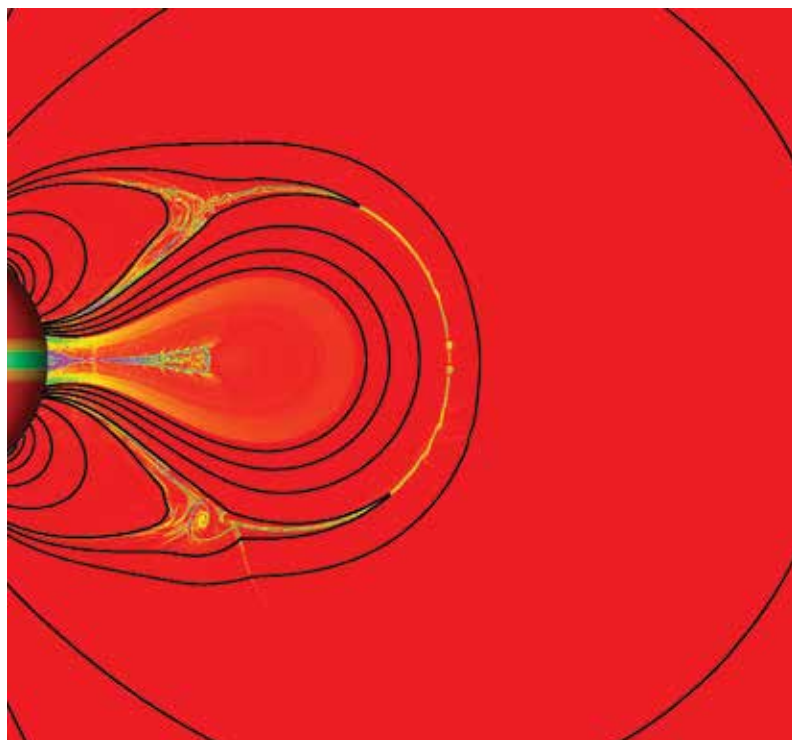
SARS-CoV-2 VIRION MODEL
Courtesy of NIAID / NIH



THIS 3D-PRINTED MODEL OF THE SARS-COV-2 VIRUS IS ON LOAN TO THE *REVEAL* EXHIBITION FROM THE NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASE AT THE NATIONAL INSTITUTES OF HEALTH (NIAID/NIH). IT WAS CREATED BY IMAGE SPECIALISTS AT NIAID USING ELECTRON MICROSCOPY AND PROTEIN CRYSTALLOGRAPHY DATA.

NIH 3D Print Exchange, 3DPX-013323, SARS-CoV-2 Virion Model, 2021. 3D-printed in calcium sulphate powder and colored binder, infused with epoxy resin, 8 x 8 in. Courtesy of the National Institute of Allergy and Infectious Diseases, National Institutes of Health.

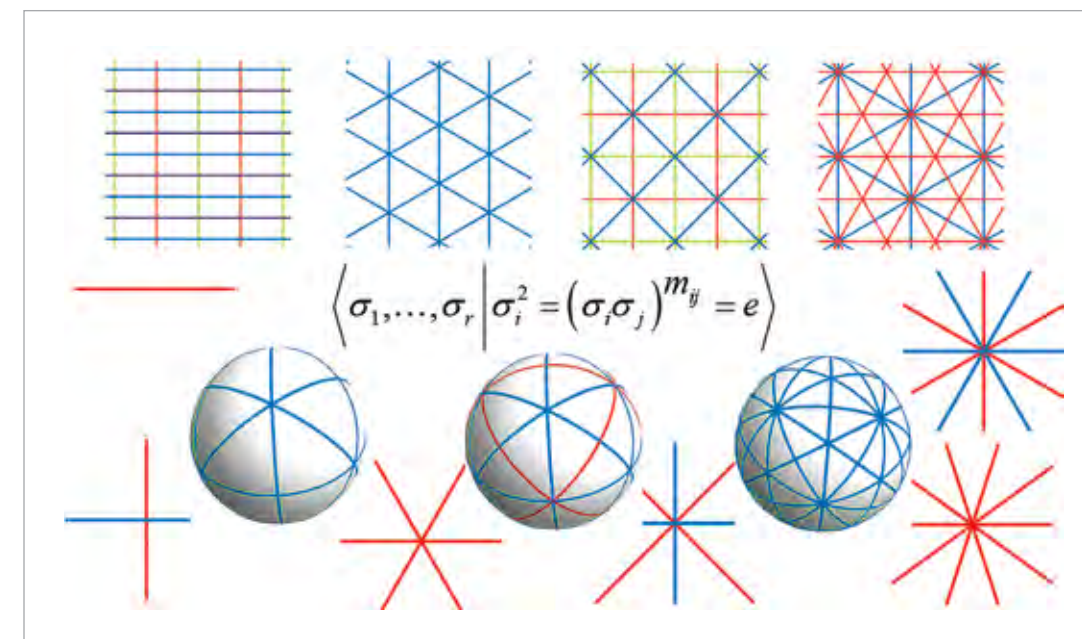
COLLABORATING SCIENTISTS: RESEARCH STATEMENTS AND IMAGES



Snapshot of a massively parallelized simulation of a solar eruption. The spherical surface to the left represents the solar surface and is colored by the magnitude of a component of the magnetic field. The background color depicts electric current in the solar corona. Selected magnetic field lines are shown in black.

Silvina E. Guidoni, PhD | Assistant Professor in Physics
American University | Washington, DC

My conversations with Kamen about Heliophysics and her artwork have always been delightful. Her enthusiasm for learning about my area of research and her knowledge of the history of scientific discovery have been sources of inspiration for my work. Rebecca's skilled and creative artwork invites us to explore interdisciplinary connections. I hope this exhibition helps bridge the artificial gap we often see between the sciences and the arts, both of which are full of beauty and precision.

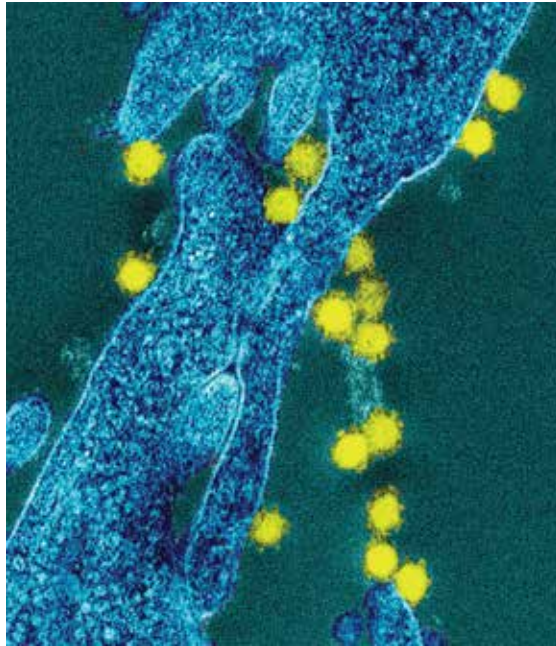


In this representation, the central equation gives the formal definition of an abstract Coxeter group in terms of reflections. Depending on the values of the matrix elements, Coxeter groups can be finite or infinite, simple or complex. The diagrams surrounding the central equation are realizations of abstract Coxeter groups as geometrical symmetries of points, planes, and spheres. The lines in these diagrams indicate planes of reflection symmetry. Lines of different colors are different classes of reflection. Coxeter groups also describe symmetric tiling of spheres and planes, including hyperbolic planes, so evocatively captured by artist MC Escher.

Nathan L. Harshman, PhD | Professor of Physics
Director, NASA DC Space Grant Consortium
American University | Washington, DC

Quantum Quilts

Symmetries are abstract mathematical structures possessing a universality inherited from logical inevitability. Their power in the natural sciences is that they provide frameworks for characterizing and distinguishing discrete possibilities of geometry and dynamics, with categorizing power for everything from atoms and viruses and stars and galaxies. Despite this underlying universality, each physical manifestation of a symmetry is necessarily contextual and approximate. Kamen's art expresses this tension between the particular and the universal in the production of objects that reveal and distort underlying symmetries. Like points on the infinite boundary of a fractal, her work explores the ragged edge where the cosmos of universal symmetry breaks and the chaos of the particular and the individual emerges.



This transmission electron micrograph shows a cross-section of a lab-cultured cell (in blue) and the virus that causes COVID-19, SARS-CoV-2, (in yellow). The virus is emerging from the surface of the cell. Photo Credit: NIAID/NIH

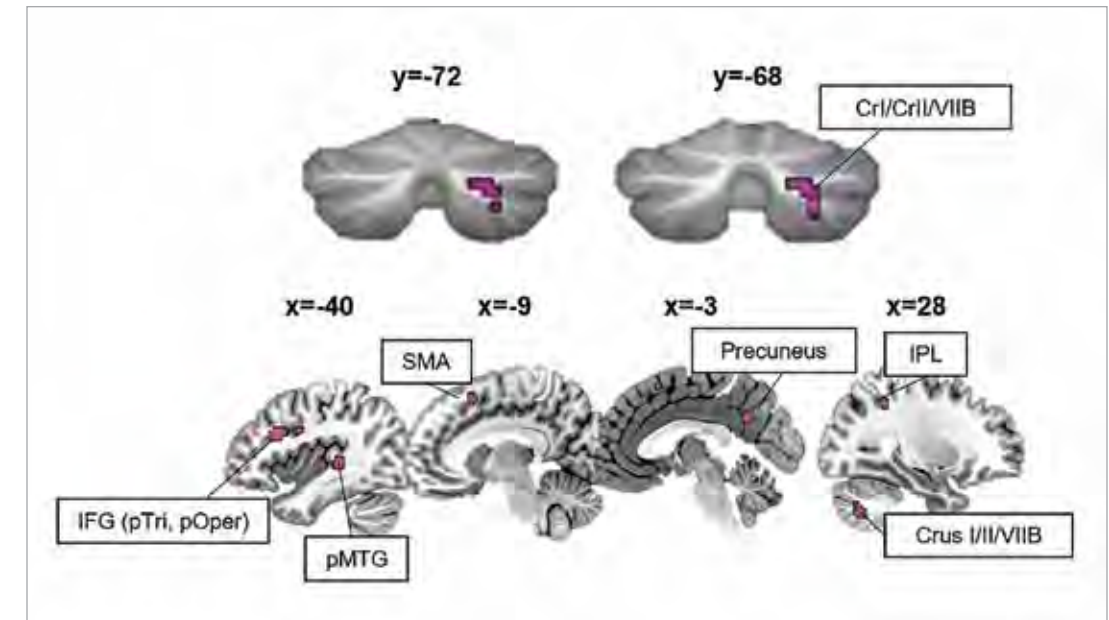
Elizabeth R. Fischer, PhD | Acting Chief, Research Technologies Branch
Head, Microscopy Unit | Rocky Mountain Lab / NIAID / NIH

Anita Mora | Visual Information Specialist
Division of Intramural Research | Rocky Mountain Lab / NIAD / NIH

Olivia Steele-Mortimer, PhD |
Chief, Salmonella-Host Cells Interactions Section
Deputy-Chief, Laboratory of Bacteriology | Rocky Mountain Lab / NIAID / NIH

Electron microscopes (EM) are a window into the unseen world, providing scientists with a detailed understanding of how pathogens cause disease and reveal an inherent and natural beauty. I have created EM images for decades, ranging from HIV to Ebola virus and antibiotic-resistant bacteria. None have captured the attention of the world to quite the same extent as have the SARS-CoV-2 images. Microscopes reveal an inherent and natural beauty to the world of viruses and bacteria. When Kamen introduced herself and asked to learn more about the SARS-CoV-2 images, we began a dialogue on the symmetry and beauty of this small world. We also acknowledged the value of effectively communicating science to the public. Her quest to accurately portray and share the discovery of the unseen world reminds me of the importance of sharing these images globally. By giving people a glimpse into the microscope, together we can face and learn about friendly immune cells protecting us from disease, enemy viruses needing treatment and prevention, or something new and unknown in need of discovery. Find more images at NIAID's Flickr pages: <https://www.flickr.com/photos/niad/>

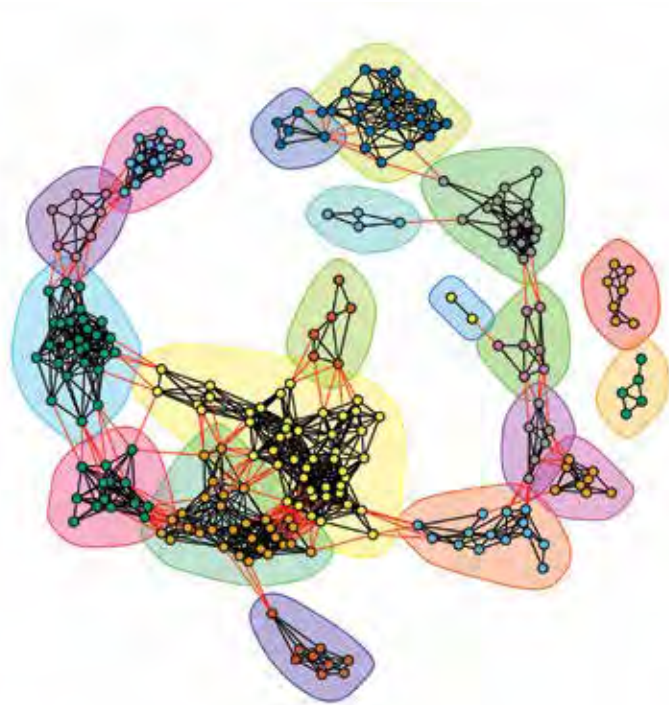
– Elizabeth R. Fischer



D'Mello et al 2017 Figure 3_Cerebellar tDCS Modulates Neural Circuits during Semantic Prediction: A Combined tDCS-fMRI Study

Catherine Stoodley, DPhil | Associate Professor of Neuroscience
American University | Washington, DC

Rebecca Kamen's sculpture Hemispheres captures the shape, activity, and intricacies of the cerebellum, one of the most beautiful brain structures. The cerebellum contains over half the brain's neurons packed into about 10% of the brain's volume, which is made possible by the cerebellum's deeply folded outer layer. Our research focuses on the contribution of this brain structure to cognitive function in humans, and much of our work uses brain imaging to visualize the engagement of the cerebellum while participants perform various tasks. The dynamic online processing that we are able to capture with brain imaging has completely changed our understanding of the function of the cerebellum.



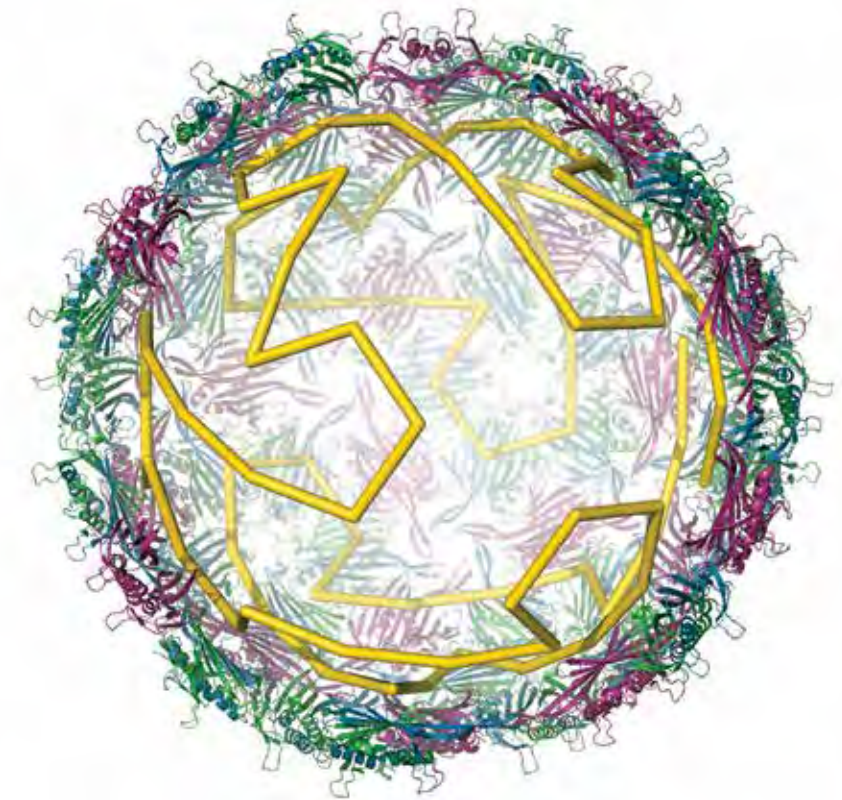
The diagram represents a person's movement or a "walk" on an underlying collective (or otherwise a priori existing) knowledge network. This collective space is built by our shared use of language, as inscribed in encyclopedias of history, science, and culture like Wikipedia. As each person takes their walk, they build their own individualized knowledge network composed of informational units (nodes) and informational similarity (connections). The colors enveloping sets of nodes represent distinct communities of ideas that are more like each other than the rest of the network. The black connections pair nodes within a community, while the red connections pair nodes between communities. You could think of this network diagram as a map of the routes you traversed in an abstractly structured space.

Danielle S. Bassett, PhD; David M. Lydon-Staley, PhD; Dale Zhou, PhD |
Complex Systems Lab
University of Pennsylvania | Philadelphia, PA

Perry Zurn, PhD
American University | Washington, DC

Capturing the dance of curiosity: A case study of knowledge networking building with artist Rebecca Kamen

When we are free to act on our curiosity, there is an almost limitless store of information we could seek out. This unbounded nature of curiosity results in marked differences in the ways people seek out information. Some people have a preference for sampling diverse concepts, always seeking novel information. Others sample closely connected concepts, satisfied only when they have filled in all of the gaps around a topic of interest to them. Others still, like Kamen, break with traditional pathways of investigation, take leaps of creative imagination across traditionally siloed areas of knowledge, and, in the process, produce new concepts. By building and interrogating semantic networks of interviews with Kamen about her artistic process, we formally investigate her artistic process as a bounding dance across a growing network of concepts. We find that Kamen's work, informed by wide-ranging research into cosmology, history, and philosophy, involves connecting common threads that flow across various scientific fields that often go unnoticed.



Reidun Twarock, PhD | Professor of Mathematical Virology
University of York | United Kingdom

Kamen's inspirational artwork illustrates geometric features of viruses that are essential for the mechanisms by which these pathogens infect their hosts. The diagram shows a Hamiltonian path, a mathematical bookkeeping device of how the viral shell assembles from its components. That has played a key role in the discovery of packaging signal mediated assembly, currently exploited as a novel drug target.

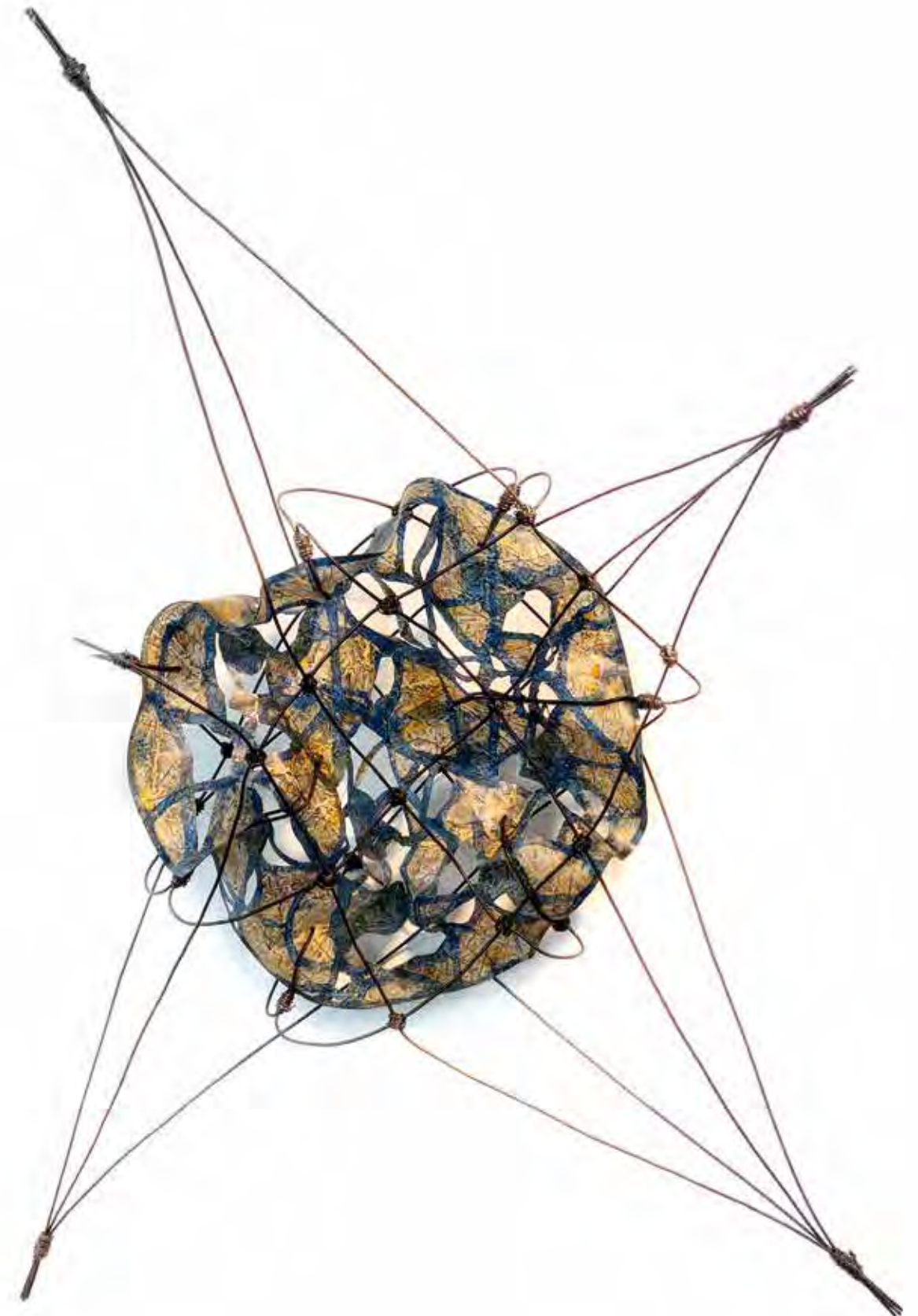
Reidun Twarock's research in Mathematical Virology, an area she pioneered, focuses on the development of mathematical and computational techniques to elucidate how viruses form, evolve, and infect their hosts.

RADICLE CURIOSITY

By Perry Zurn and Danielle S. Bassett

Curiosity and radicality are inextricably linked at the edges of our society. Radical movements exist at the fringe, led by curious thinkers who question how the world is and ask what it could be. Radical or “rad” experiences, concepts, persons, or things break from what is boring, creating a fracture, an edge between the ordinary and the extraordinary. Our English word “radical” comes from the Latin *radicalis* meaning “relating to a root,” from the earlier *radix* meaning “root.” The radical sign in mathematics, a checkmark with a fantastically flamboyant flying cap, indicates the root of a number—that quantity which when multiplied only by itself creates the number. In a less well-known part of mathematics dealing with the study of rings, an ideal is a subset of the ring’s elements, just as our ideal future is a subset of life’s possibilities; the radical of an ideal contains root elements whose power(s) are in the ideal. Whether in the obscure recesses of mathematics or the farthest fancies of civilization, the radical asks for the root, the fundamental basic essence of a thing, and curiously calls it into question. Curiosity—a radical curiosity—roots and uproots in the hinterlands. It finds the edge and flourishes there. As spaces between, where ideals can be ruptured, edges exist everywhere; in the sky above us, in the earth beneath us, and, perhaps most of all, within us.

Opposite: *The Architecture of Knowledge*, 2019. Acrylic on mylar graphite, wire, 24 x 17 x 10 in.



At the edges of the sky, curiosity haunts the stars. As eons of human records attest, there is a kind of curiosity drawn irrepressibly to celestial bodies and their mysterious circuits. In 1511, bemoaning a too-blithe investigation of the heavens, Erasmus called such curiosity a “madness,” the sort that drives men not only to “measure the stars, their motions and effects,” but to “explore beyond the range of the furthest stars.”¹ Giordano Bruno, a devotee of Erasmus, thought otherwise. For him, astronomy sustained neither delusion nor pretension, but rather a staid humility. When he looked up at the stars, he saw an infinite universe. Compelled by the recent Copernican turn, he imagined solar system after solar system, as far as the eye could see. For him, the centrality of human existence was permanently displaced. At the time, however, this was heresy. And Bruno paid with his life. His ideas threatened to rupture hundreds, even thousands of years old commitments. They cracked heaven, while the earth opened to receive his remains.

Curiosity is not simply starstruck; it turns to the earth beneath us and hovers humbly over the fungi underfoot. In her ethnography of matsutake mushrooms, Anna Tsing insists on the necessity of “radical curiosity” in and among multispecies worlds.² For her, we humans are too often swept away by our own hubris, trapped in the narrative of linear progress and triumph over nature. Knowing exactly where we are going, we dull our sensibilities to the incongruities of life at our limits. The fact of environmental degradation and social upheaval, however, calls for a recovery of curiosity. Here in places of instability and precarity, where dreams are broken and illusions relinquished, attention takes a different shape. It pauses over the “knots and pulses of patchiness” left in progress’ wake.³ It lingers over histories of encounter rather than domination, of engagement rather than exploitation. It aims to notice what has long been ignored, and to reckon with what has been sidelined. Radical curiosity finds the deliciousness of multispecies life—embodied in matsutake—in uncultivated as much as disturbed spaces, from old growth woodlands to burned and clear-cut forests. Such curiosity tracks life at the edges, and relationships in the cracks.

Not limited to what populates the land or hangs in the sky, curiosity homes in on the seedling’s root. Charles Darwin, in his study of plant movement, writes of the incipient root of the plant, the *radicle*.⁴ Across species and locations, the radicle moves in a spiral pattern, or by circumnutation, to find its way from buried seed to steady base. Always bending its tip, as though giving a nod (or *nūtō*) to life, the radicle nods roundly about, oscillating in its shape and direction as it circumnutates the soil. The plant’s kinematics, then, are driven by adaptive movement. And that adaptive movement is decided by the radicle’s tip which, highly sensitive, manifests the “power of discrimination.” “The tip of the radicle,” Darwin writes, “acts like a brain.”⁵ Avoiding obstacles, negotiating gravity, and searching

for nutriment, the root probes. Head in the dirt, it lifts its torso above ground and waves its leggy leaves to the sun; and at night, it walks among the stars. The radicle’s curiosity is never a straight shot; there is no progress narrative here, but rather a history of encounter. Fungi also nutate, as do stars and comets. A curious world, indeed.

Perhaps human curiosity is not unlike the movements of stars, fungi, and roots. Perhaps we channel a greater natural power to circumnutate, to crack and to create. In *The Writing Life* (1989), Annie Dillard characterizes the craft of literary artistry. The writer, she muses, takes up “the line of words” and “probe[s] with it, delicate as a worm.”⁶ The writer “plays the edges,” where “reason balks and poetry snaps; some madness enters, or strain.”⁷ And they do so in order to “nudge the bounds” of the seeable and the sayable. “And to enclose what wild power?”⁸ Artistic curiosity is radicle curiosity. It finds the edge, cracks it, and circumnutates a space within which to plant the possibilities of new affective and phenomenological life. But is this not also the curiosity of the biologist, the ethnographer, and the astronomer? Might this be curiosity plain and simple? For all of us?

It is almost a truism that curiosity is transgressive, unsettling. It crosses the boundaries of what can or should be known, and it posits relations that existing worldviews simply cannot sustain. It is the sort of thing that uproots, yes, but also the sort of thing that finds its wandering way to planting the most vulnerable of roots in the soil, so that new knowledge, new ways of coming to know with and through one another might grow. Curiosity breaks—it breaks with, breaks through, breaks in. But it also connects, and in connecting, it creates. Radical, certainly, but also radicle.

¹ Desiderius Erasmus, *In Praise of Folly*, trans. Clarence Miller (1511; New Haven: Yale University Press, 2003), 51.

² Anna Lowenhaupt Tsing, *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins* (Princeton: Princeton University, 2015), 144.

³ Ibid., 6.

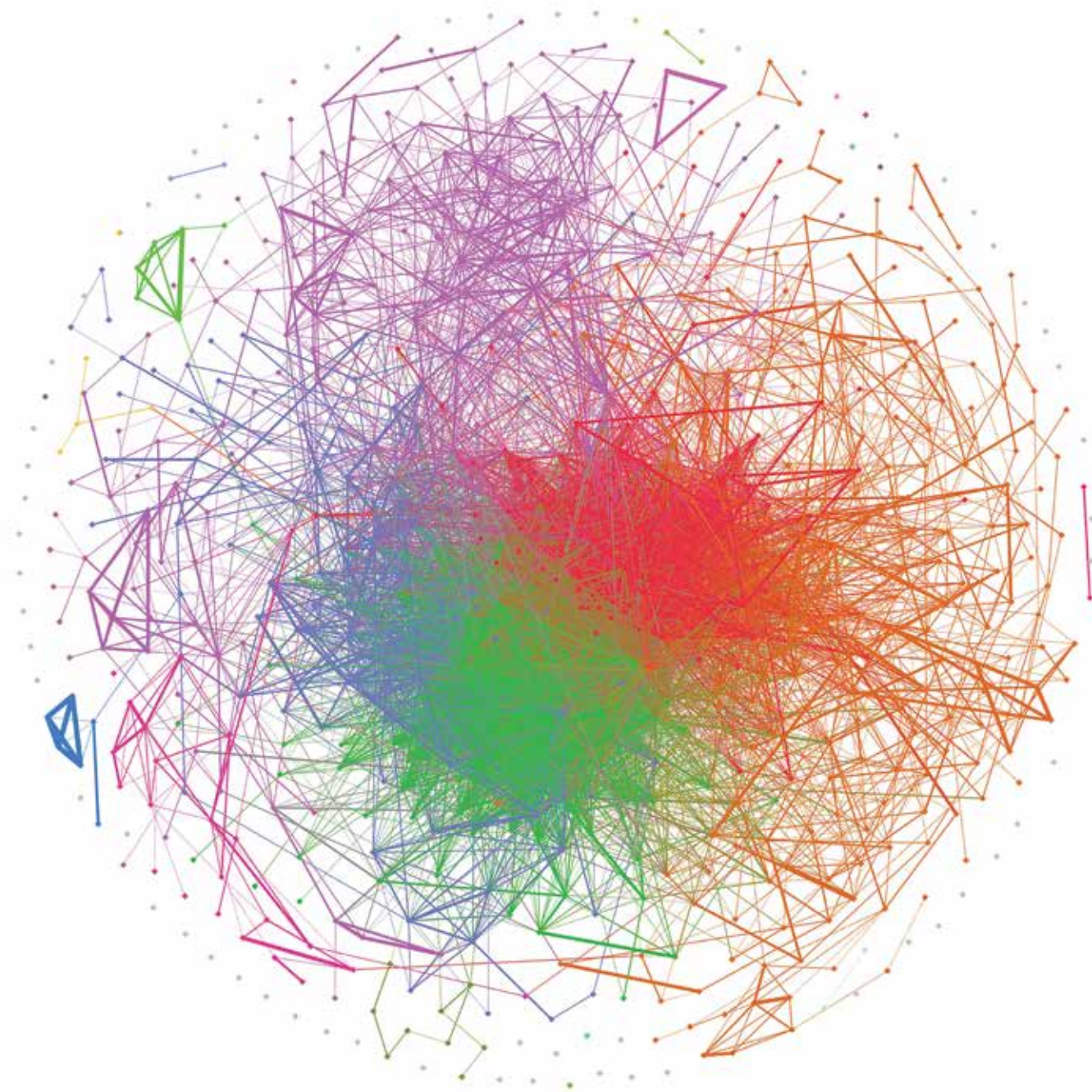
⁴ Charles Darwin, *The Power of Movement in Plants* (London: John Murray, Albemarle Street, 1880).

⁵ Ibid., 573.

⁶ Annie Dillard, *The Writing Life* (New York: Harper Perennial, 1989), 7.

⁷ Ibid., 69.

⁸ Ibid.



Sparkling Curiosity, 2021. Courtesy of Danielle S. Bassett, PhD; David M. Lydon-Staley, PhD; Dale Zhou, PhD, University of Pennsylvania and Perry Zurn, PhD, American University.

Sparkling Curiosity depicts the network dynamics of Rebecca Kamen's art process. This network was created from transcribed interviews, where each circle represents a word describing an idea that shaped her artistic journey; and each line indicates how similar those words are to each other. The colors represent communities of ideas that are more alike.

REVEAL

The Art of Reimagining Scientific Discovery

WORKS IN THE EXHIBITION

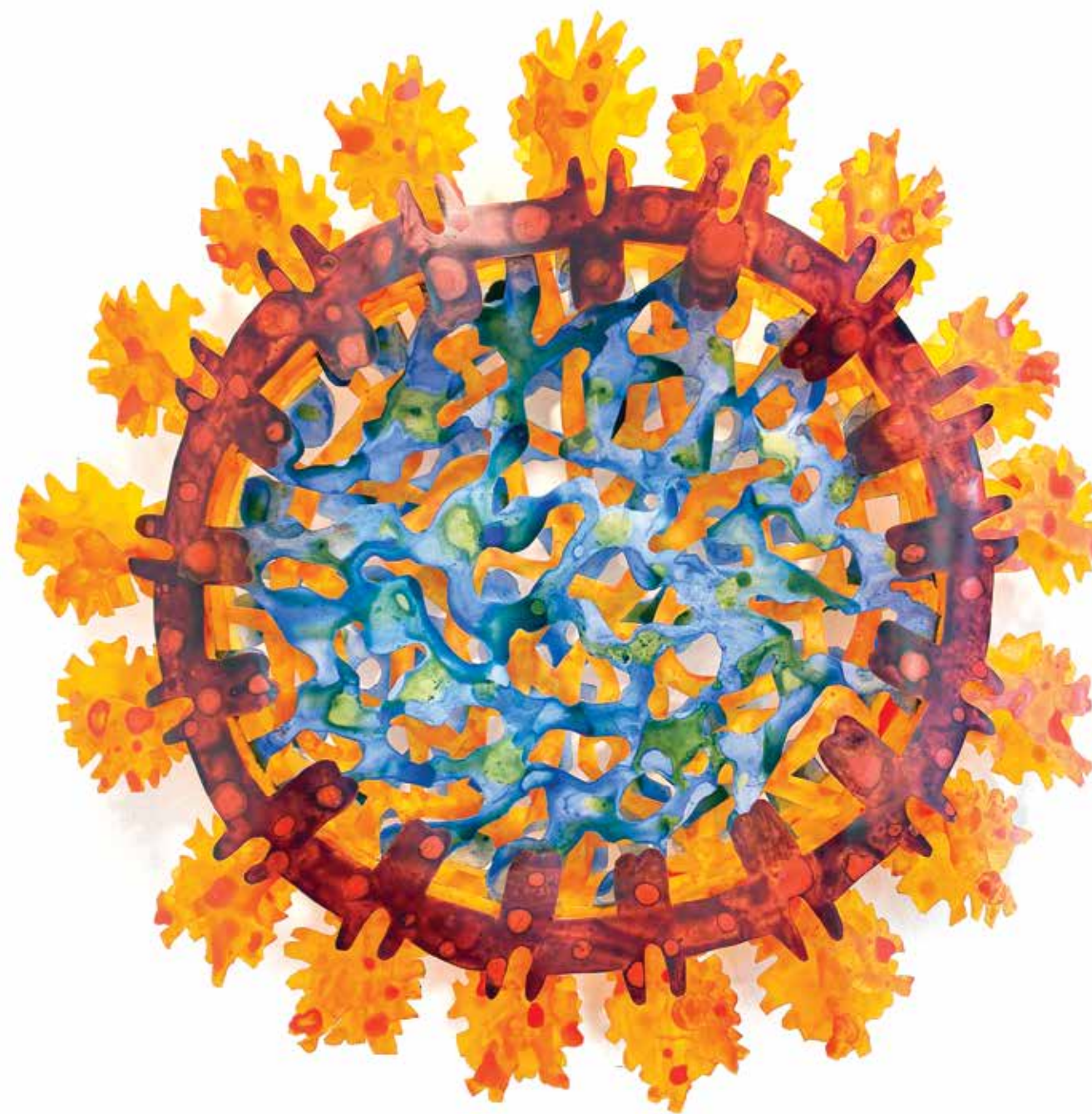


Unidentified, Luba Memory Board, n.d. Carved wood, beads, 16 x 5 x 2 1/2 in.



Unidentified, Astrological Astrolabe, n.d. Wood, compass, 15 x 9 x 9 in.

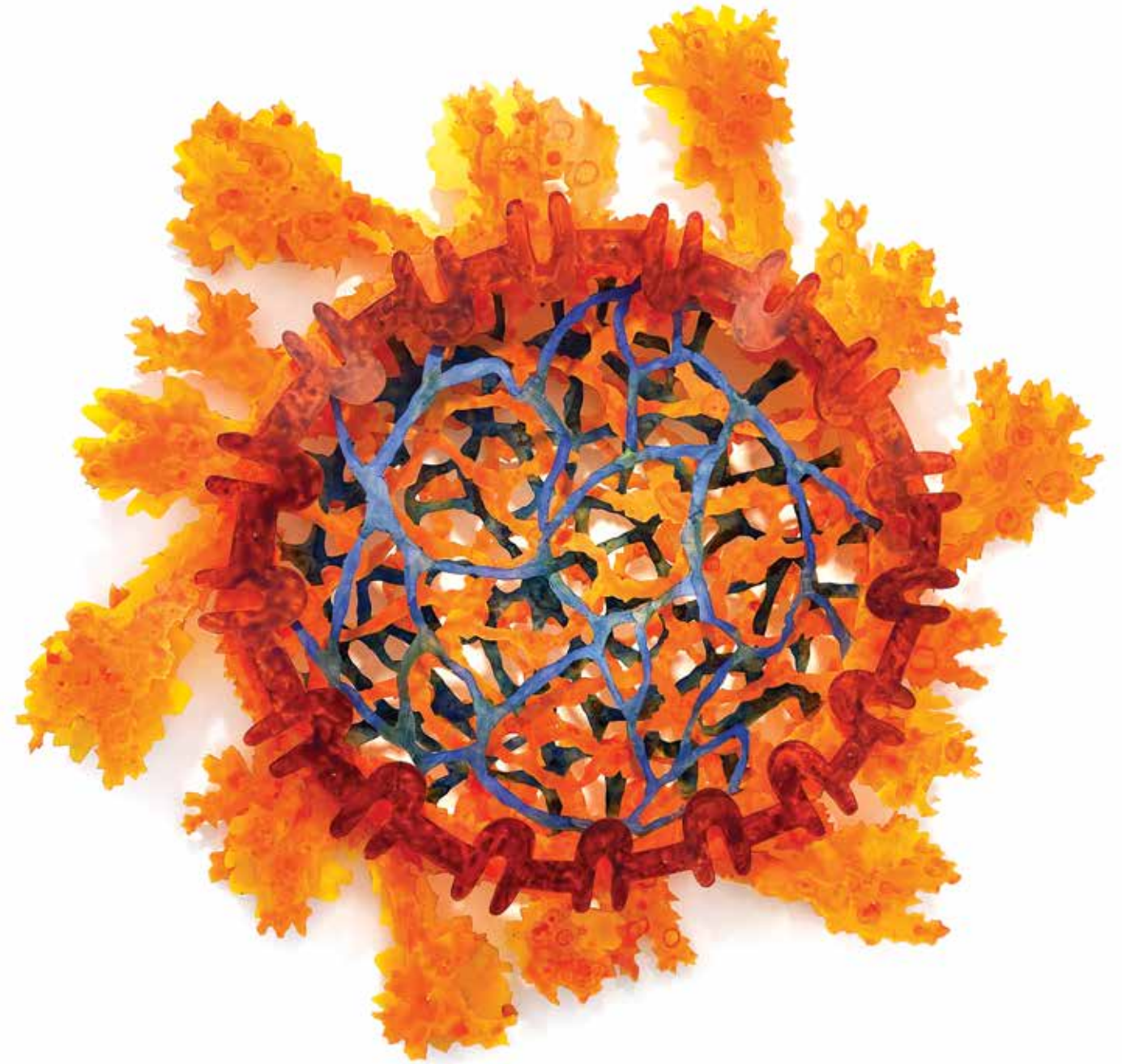
THE AIM OF ART IS TO REPRESENT NOT
THE OUTWARD APPEARANCE OF THINGS,
BUT THEIR INWARD SIGNIFICANCE.
— ARISTOTLE



Corona 1, 2020. Acrylic on mylar, 18 x 18 x 4 in.



Corona 2, 2020. Acrylic on mylar, 30 x 30 x 4 in.

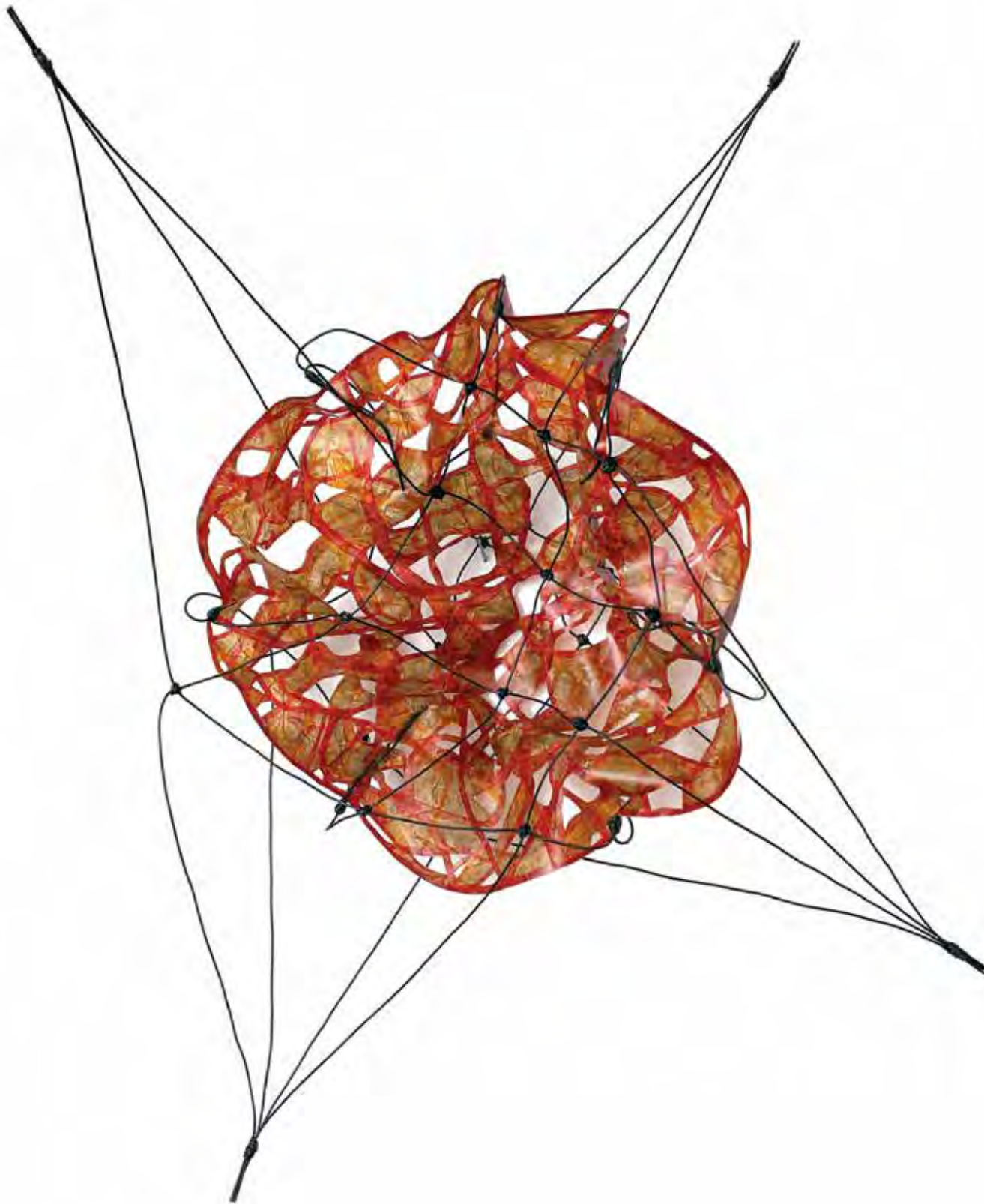


Corona 3, 2020. Acrylic on mylar, 18 x 18 x 4 in.



IT IS THROUGH SCIENCE THAT WE PROVE,
BUT THROUGH INTUITION THAT WE DISCOVER.
– HENRI POINCARÉ

Opposite: *Emissions 2*, 2019. Acrylic on mylar, 24 x 18 in.



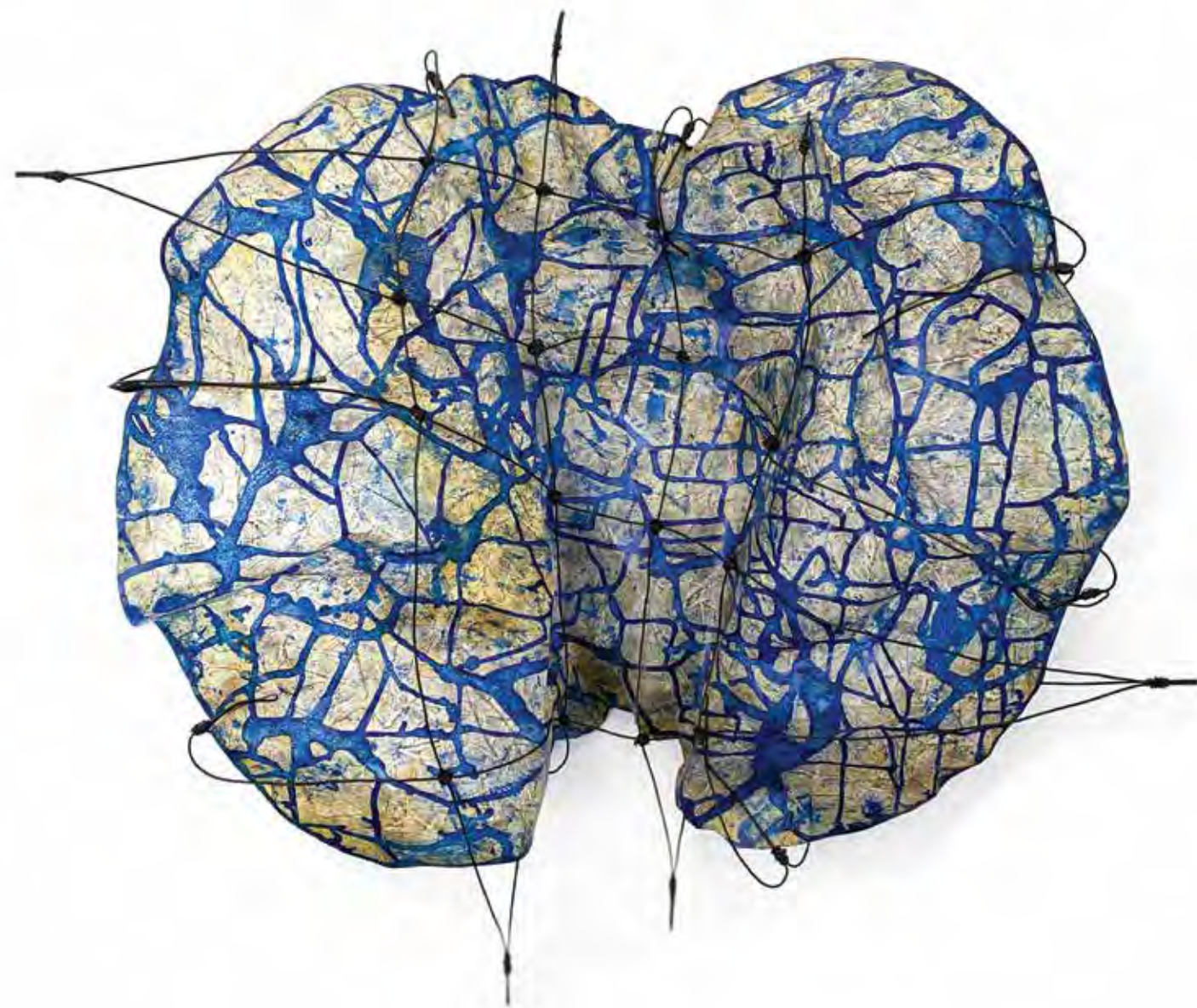
Warming, 2020. Acrylic, graphite, mylar, wire, 28 x 19 x 12 in.



Warming 3, 2020. Acrylic on mylar, 24 x 18 in.



Warming 4, 2020. Acrylic on mylar, 24 x 18 in.



Hemispheres, 2019. Acrylic on mylar, 30 x 26 x 8 in.



Reverie 18, 2019. Acrylic on mylar, 18 x 24 in.



Butterflies of the Soul, 2019. Acrylic on mylar graphite, wire, 18 x 24 in.



Reverie 30, 2019. Acrylic on mylar, 24 x 18 in.



Reverie 15, 2019. Acrylic on mylar, 24 x 18 in.

GEOMETRY DRAWS THE SOUL TOWARDS TRUTH.
– PLATO



Illumination 7, 2021. Acrylic on mylar, 9 x 9 x 6 in.



Illumination 1, 2020. Acrylic on mylar, 9 x 9 x 6 in.



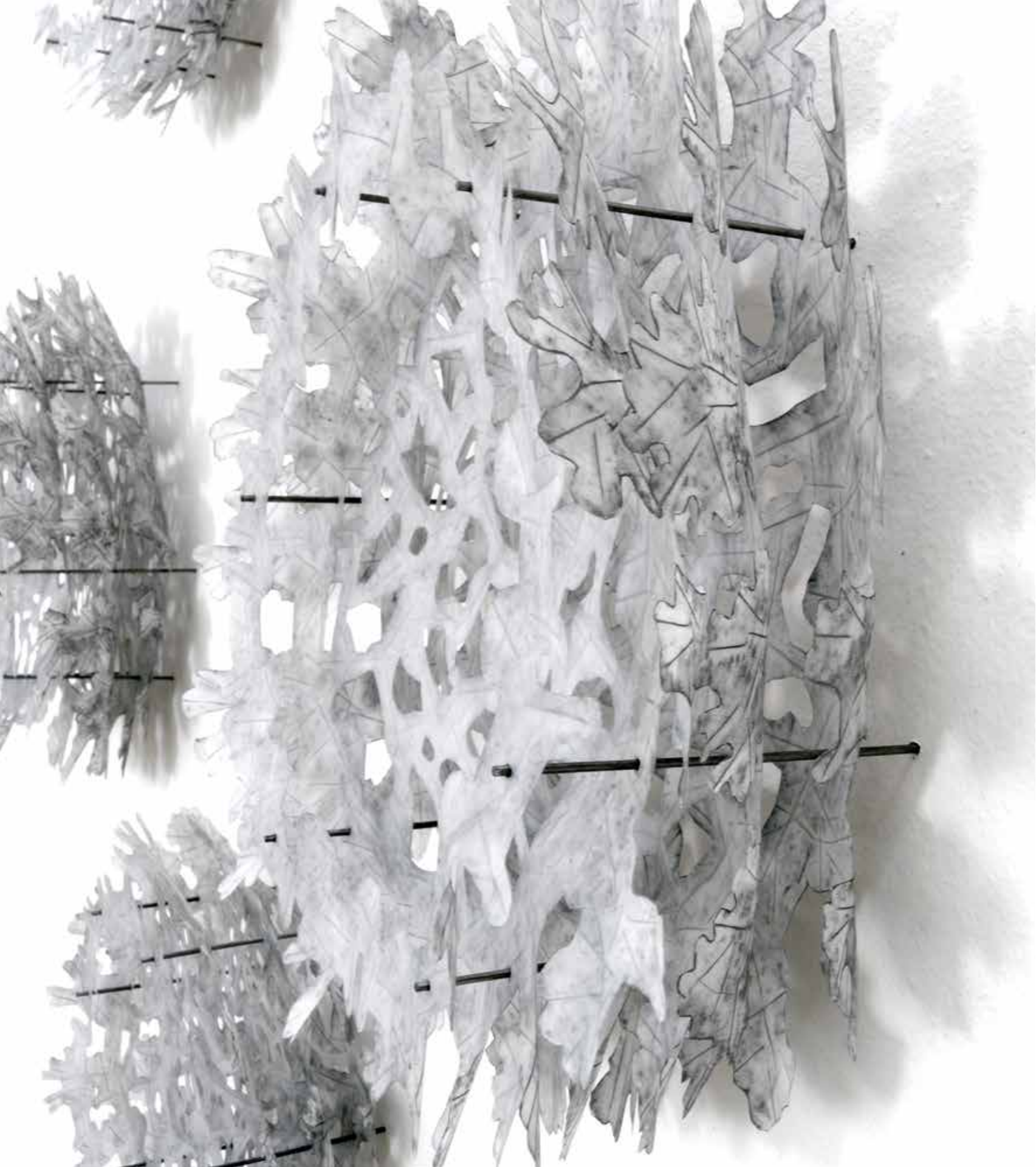
Illumination 6, 2021. Acrylic on mylar, 9 x 9 x 6 in.



Illumination 3, 2020. Acrylic on mylar, 9 x 9 x 6 in.



Illumination 4, 2020. Acrylic on mylar, 9 x 9 x 6 in.



Virion Breaths is a “Breath Art” / creative breathing compositional exercise of myself exploring all of the possibilities of when the human breath becomes isolated as a musical instrument for Rebecca Kamen’s *Silent Spread*. As defined and described by the National Institutes of Health, “The virion, that is the complete infectious virus particle, includes a genome comprising one or a few molecules of either DNA or RNA, surrounded by a morphologically defined protein coat, the capsid.”

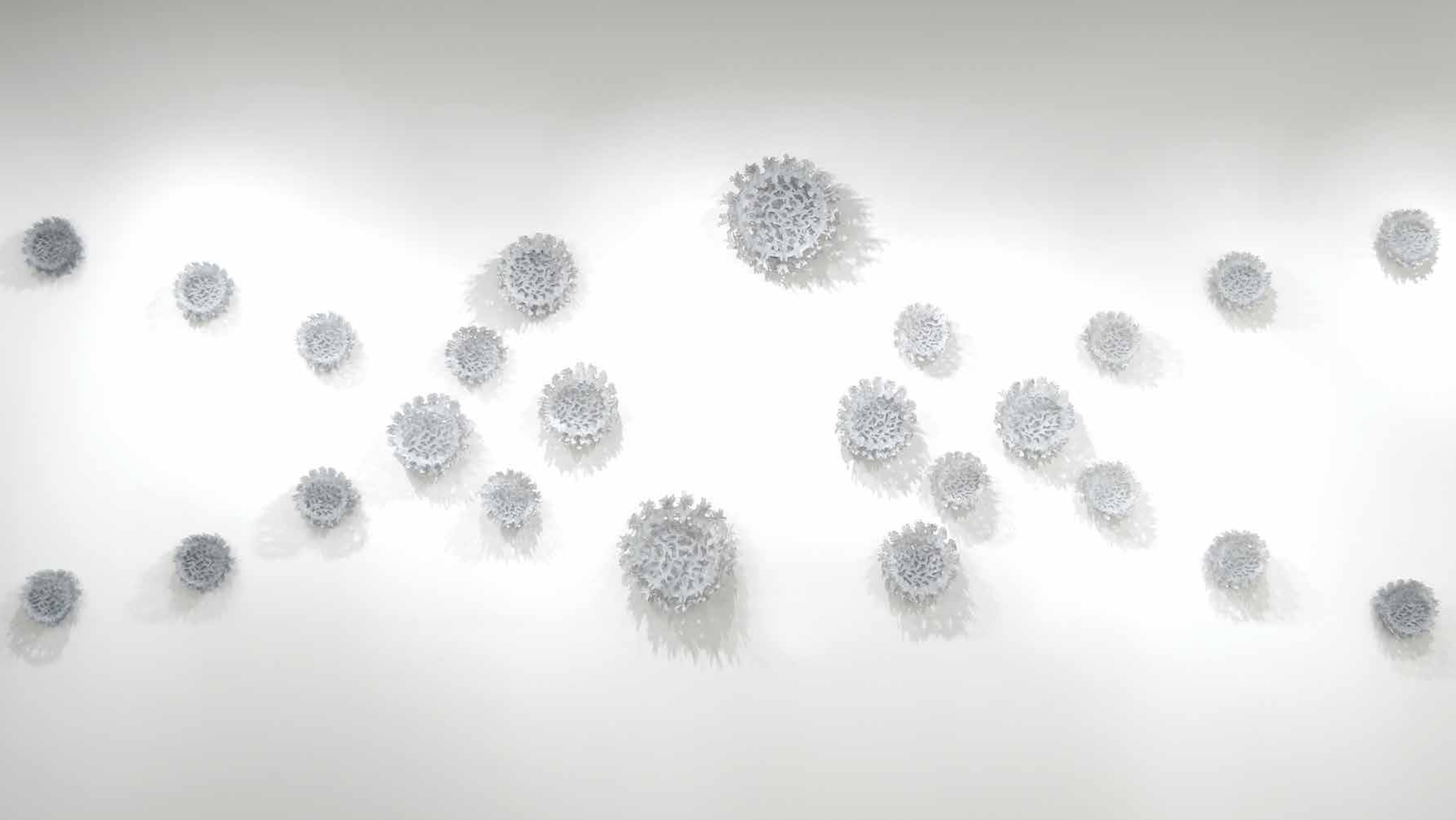
While attempting to understand better a musical world of “Breath Art,” and recording 28 unique micro-compositions at the recording studio of Dr. Erik Spangler for each and every *Silent Spread* sculpture, I also find myself trying to imagine a more illuminated zeitgeist and understanding of “Breath Culture,” where many of our “social virions,” from economics and politics to education continue to persist even as they are impacted by the virus in a world that has been so greatly challenged by the ongoing pandemic.

In experiencing the musical breath pieces while taking in the visual representations of the COVID-19 virus, you may find yourself on a linear timeline from when the pandemic first emerged in late 2019 or early 2020; or you may find yourself in a more non-linear timeline reflecting recent developments; or perhaps, you’ll find yourself at a place of a much larger “time sphere,” when a larger convergence of tragedies began to manifest, following the death of George Floyd.

No matter what your aural experience may be in this exhibition, allow your relationship to your own “breath narrative” serve as your guide. See yourself, or maybe a part of yourself, in the breath compositions that you hear. Whether it’s wind, ocean waves, an inhalation, an exhalation, or a more extended, experimental typology of creative breath, the air that I live with is yours just as much as it is mine. These are our challenges, our expressions, our stories, our collective breath, and hopefully, faithfully, our opportunities for a greater transcendence.

– Dominic Shodekeh Talifero

Opposite and pages 58-59: *Silent Spread*, 2020-21. Graphite on mylar, 28 components, dimensions variable. Photo: Greg Staley.



REBECCA KAMEN

Rebecca Kamen is a painter, sculptor, and lecturer who explores the intersections of art and science. Her practice is informed by observation and wide-ranging research into cosmology, history, philosophy, and the search for common threads that flow across various scientific fields to capture and reimagine what scientists see.

As catalysts for her artwork, Kamen has investigated scientific rare books and manuscripts at the libraries of the American Philosophical Society, the Chemical Heritage Foundation, and the Cajal Institute in Madrid. She has also worked on collaborative projects at the Center for Astrophysics at Harvard University, the Kavli Institute at Massachusetts Institute of Technology, Rochester Institute of Technology, and at the National Institutes of Health. Selected as a Salzburg Global Seminar fellow in 2015, she participated in a seminar titled: *The Neuroscience of Art: What are the Sources of Creativity and Innovation?*

Kamen has exhibited and lectured both nationally and internationally including in Australia, Austria, Chile, China, Egypt, Hong Kong, Korea, Spain, and Singapore. She has been the recipient of a Virginia Museum of Fine Arts Professional Fellowship, a Pollock-Krasner Foundation Fellowship, two Strauss Fellowships, and a Travel Grant from the Chemical



Heritage Foundation. While artist in residence in the neuroscience program at National Institutes of Health, Kamen interpreted and transformed neuroscience research into sculptural form. Her artwork is represented in many private and public collections.

Kamen is a professor emerita of art at Northern Virginia Community College, and currently serves as artist in residence in the Computational Neuroscience Initiative and the Department of Physics and Astronomy at the University of Pennsylvania.

CONTRIBUTORS

With thirty-four years of personal, professional, and community-based experience, **Dominic “Shodekeh” Talifero** is a groundbreaking and highly adept vocal percussionist, breath artist, and beatboxer, who continues to make musical strides with textural, polyrhythmic compositions that push the boundaries of the human voice within and outside the context of hip hop music and culture. Growing up, he discovered beatboxing as his way out of a difficult

childhood, and adopted the stage name Shodekeh, an African name of Nigerian origin meaning “warrior; one who fights for what he believes.” Among his many collaborations, he has performed with the globally renowned Alash, a leading Tuvan Throat Singing ensemble, and currently serves as Towson University’s very first Innovator-in-Residence at the College of Fine Arts & Communication.

Sarah Tanguy is an independent curator and arts writer based in Washington, DC. A strong believer in hands-on collaboration and in the power of art to connect with our lived experience, she enjoys exploring the intersection of art with such topics as food, tools, books, and science. The daughter of a US diplomat, she holds a BA in Fine Arts from Georgetown University and a MA in Art History from the University of North Carolina, Chapel Hill. After interning at the Hirshhorn Museum and Sculpture Garden, Tanguy worked at the National Gallery of Art, the International Exhibitions, the Tremaine Collection, the International

Sculpture Center, the Smithsonian Institution Traveling Exhibition Service, The Hechinger Collection, and the Office of Art in Embassies, US Department of State, where she curated temporary exhibitions and permanent collections for US diplomatic facilities overseas. Recent projects include *Traces* (2020–21) at The Kreeger Museum and *Twist-Layer-Pour*, at the American University Museum (2017), as well as an ongoing exhibition program for the American Center for Physics. In addition to exhibition-related essays, she contributes to *Sculpture* and *Metalsmith*, among other publications.

ALPER INITIATIVE FOR WASHINGTON ART

MISSION STATEMENT

The Alper Initiative for Washington Art promotes an understanding and appreciation of the art and artists of the Washington Metropolitan Area. We provide and staff a dedicated space located within the American University Museum, to present exhibitions, programs, and resources for the study and encouragement of our creative community.

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Front cover: *Reverie 18*, 2019. Acrylic on mylar, 18 x 24 in.

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