

SciArt in America

The background of the cover is a complex, abstract artwork. It features a dense arrangement of organic, cellular-like structures. These structures are primarily composed of various shades of blue and purple, with some areas in brown and tan. The forms are irregular and interconnected, creating a sense of depth and complexity. Some larger, more prominent structures have a central, darker core, while others are smaller and more numerous. The overall effect is reminiscent of a microscopic view of tissue or a complex network of biological cells.

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Letter from the Editor

The beauty and complexity of patterns found in nature serve as inspiration for textile designers, architects, scientists, and artists alike. From the stacking of plant cells to the golden spiral to the branching of trees, the natural world we live in can be delightfully aesthetic.

Our featured Straight Talk artists this issue are Rebecca Kamen and Jody Rasch. Both Kamen and Rasch peer into the cellular, and out to the cosmic. Using the traditional materials of paint and Mylar, these artists pull out the beauty of our natural world too often overlooked.

And then there are the patterns and data visualizations created with the aid of computational power—our lead article *Autonomous Art* looks at art created by algorithms, while one of our Spotlights profiles the work of Iwasa, a molecular animator and biologist. Continuing the discussion of technology in art, E.A.T.—the 1960s art-tech group led by Rauchenberg and Klüver (among others)—sees an update in the Contemporary Jewish Museum's current exhibit "N[ew]EAT," reviewed at the end of this issue.

We here at *SAiA* wish you the happiest of holidays, and thank you once again for your readership.

Sincerely,



*Julia Buntaine,
Founder & Editor-in-Chief*



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In partnership with



STRAIGHT TALK

with Rebecca Kamen

Rebecca Kamen is a visual artist who explores topics including biology, cosmology, philosophy, and history. Using science as a point of inspiration, Kamen creates sculptures and installations out of Mylar. Exhibiting internationally, Kamen is currently a professor emeritus of art at Northern Virginia Community College and a leading advocate for STEM education.



By Julia Buntaine
Editor-in-Chief

JB: *Before we talk about your art, I'd love to hear a bit from you about how you view the role of art and creativity in understanding science.*

RK: Art and science share much in common. Both fields engage in creative problem solving, discover truths related to the notions of aesthetics and beauty, and utilize visualization to make the invisible visible.

Creativity is about problem solving—and those scientists whom I've really connected with are those who are creative thinkers. They tend to be universal investigators. They don't limit themselves to one small area; instead they tend to look at what they are doing in relation to bigger pictures. Creativity in art and science is also about discovery. I can spend hours in my studio trying to solve a problem conceptually before I physically manifest it. It's like chemistry; the notion of transforming materials.

Before the advent of the camera, scientists were natural philosophers who looked more holistically at nature and the universe, using drawing and painting as a way of capturing and recording their observations. My work reconnects scientists to this original way of seeing and experiencing natural phenomena. I have an innate understanding of science, and using my art to interpret scientific discoveries often fascinates scientists. Several have commented on how the artwork captures the aesthetic aspect of science observed in the complexity of a

visual pattern or the beauty found in a series of numbers describing a scientific truth.

Many years ago, I was lecturing to a group of chemists and one of them said, "astrophysicists have all those beautiful Hubble photographs but as chemists we don't have those kinds of beautiful things." I told the group that they had something even more extraordinary as their field deals with transformation. As a chemist, you may investigate how when chemicals come together they transform into something totally different—and that's beautiful. A chemist e-mailed me after seeing some images from my *Divining Nature: An Elemental Garden* project on the Periodic table of elements. She said, "Thank you. I never thought of what I did as a chemist as being beautiful." Her words struck me because many other scientists that I meet do talk about their work in relationship to beauty—a beautiful equation, for example. There is a wonderful aesthetic sense to science that appears when I'm talking to scientists; because they're conversing with an artist, perhaps it's sometimes okay for them to think about their work or explain their work as being beautiful.

JB: *As an artist, you have addressed topics from neuroscience to physics, astronomy, chemistry, and fluid mechanics, to name a few. What drives you towards science as a subject matter?*

RK: An immense curiosity and the process of discovery act as catalysts for the development of my artwork.



Growth Cone 1 (2012). 38" x 16" x 13". Acrylic on Mylar.
Photo credit: Mimi Zang Ho.

Early childhood memories of exploring the world through a microscope and telescope instilled a deep sense of awe and wonder, planting seeds that continue to influence and advance my art-making practice. An active sense of scientific inquiry contributes insight and inspiration for the creation of my art, and provides a visual voice for sharing distinct observations revealed through nature. It also fosters an ongoing, multidisciplinary dialogue, establishing new avenues and innovative ways of seeing unique relationships between art and science.

JB: *Your collaborative work with Susan Alexjander, Divining Nature: An Elemental Garden, was my first introduction to your work. A sculptural garden of forms that represent the naturally occurring elements of the Periodic Table, tonal music accompanies and amplifies the piece, creating a multi-sensory installation. You've just completed another collaboration with*

her. Could you talk a bit about the creation of Divining Nature, and your current project?

RK: *Divining Nature: An Elemental Garden* provided an opportunity to create a large-scale installation exploring the Periodic Table as a three-dimensional object of beauty through sculptures created out of Mylar, inspired by the most ethereal aspect of an element: its orbital pattern. This project also celebrates the interconnections of the Universe. Shapes created by these electron patterns are based on the same principal of 'sacred geometry' that inspired the Fibonacci spiral of the installation layout and that is found in all aspects of nature.

During the conceptualization phase of this project, a sound component was envisioned as part of the installation. Bio-musician Susan Alexjander, with her haunting soundscape inspired by the wave frequencies emitted from atoms in the elements, was the perfect collaborating partner for this aspect of the project. Sound adds a whole new dimension to the experience of the sculpture installation.

Collaborative in nature *NeuroCantos*, the latest sculpture/sound installation, investigates how the brain creates a conduit between inner and outer space through its ability to perceive similar patterns of complexity at the micro and macro scales. The installation, which includes eight suspended sculptures, celebrates how art can form new bridges of understanding between the diverse fields of scientific research, astrophysics, and neuroscience. It explores insights gained by rare opportunities to research at Harvard University's Center for Astrophysics, National Institutes of Health, and the Cajal Institute in Madrid, and illustrates art's ability to re-image science.

The initial seeds for perceiving a relationship between inner and outer space were planted during my tenure as an artist-in-residence in the neuroscience program at National Institutes of Health, researching the work of neuroanatomist Santiago Ramón y Cajal. Trained as both an artist and scientist, Cajal won the Nobel Prize in 1906 for his discovery of the relationship of neurons to the nervous system. His use of metaphor in describing his research continues to be a muse in the development of recent artwork.

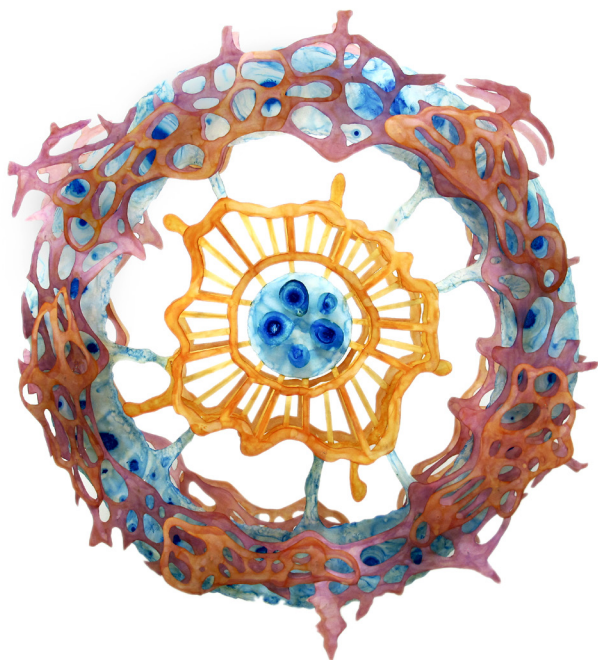
The initial spark for *NeuroCantos* was and continues to be an ongoing dialogue with British poet Steven J. Fowler. This began when we met as fellows at the Salzburg Global Seminar in Austria in February of 2015, during a five-day seminar that explored The Art of Neuroscience. Our burgeoning friendship continues to serve as a catalyst for correspondence investigating the nature of the mind and the poetics of inner and outer space. Within *NeuroCantos*, (loose translation 'brain songs') the suspended, intricately cut cone-shaped sculptures, represent the complexity of neuronal networks in the brain, and the ability of these networks to transform chemical and electrical signals into patterns of perception.



Divining Nature: An Elemental Garden (2009). 25' x 25' x 36".
Mylar, fiberglass rods. Photo credit: Angie Seckinger.



Portal Installation (2014). 25' x 25' x 5'. Mylar, fossils. Sound design by Susan Alexjander. Photo credit: Gary Freeburg.



Cellular Dialogue (2012). 36" x 36" x 10". Acrylic on Mylar. Photo credit: Mimi Xang Ho.

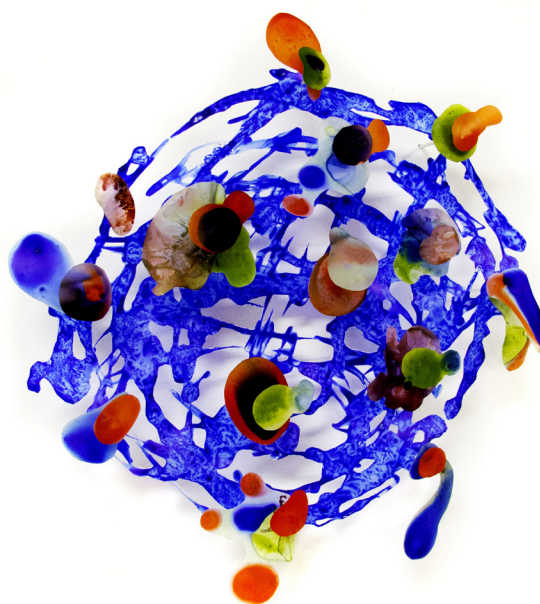
Below the cones are circular, overlapping cutout shapes symbolizing the similarity of patterns at both the micro (the brain) and the macro (outer space) levels, serving to create a bridge through patterns between astrophysics and neuroscience. Placed in the center of the circular forms are rocks mimicking similar shapes and representing a connection to nature. These patterns are similar to those found within inner and outer space.

The installation is further enhanced by Susan Alexander's spoken word soundscape exploring how the brain interprets fragments of information in creating new meaning and understanding.

Terry Lowenthal's video projection of *Moving Poems* adds a kinetic element to the content of the installation. Utilizing Cajal's famous 'butterflies of the soul' quote, bookended by fragments of Steven Fowler's poems, the video adds another level to the complex patterning inspired by the poetics of inner and outer space.

JB: *The majority of your sculptural work is playfully colorful and built from a sort of web-like pattern which is applied differently in each piece. Could you describe your artistic process, from conception to finish?*

RK: Much of my sculpture explores an interest in nature as a mapping system of energy. I am informed and inspired by both micro and macro views of the universe as well as other scientific visualization mod-



Catalyst (2013). 10" x 10" x 2.5". Acrylic on Mylar. Photo credit: Mimi Xang Ho.

els such as fluid mechanics and fluorescence microscopy. The choice of colors on my Mylar sculptures is purposeful: to interpret and make visible the fluid energy of matter, creating a bridge between art and science.

The artistic process is rather intuitive and starts with inquiry into an area of scientific interest. At the moment, I am extremely interested in the similarity of patterns observed in the dynamics of complex systems at both micro and macro scales.

My initial research starts with visualizations related to a specific scientific area. This process enables me to observe visual relationships to other scientific areas I have studied. These visual relationships become the catalyst for the direction of the artwork. The ideas generated by observation are then translated into painted, abstract shapes and cut out to form the sculpture. For many of the neuroscience-inspired sculptures, such as *Growth Cone #1*, the vibrant color and complexity of the cutout network of forms expresses the active nature of these dynamic structures.

Energy Landscape interprets the structure and folding process of proteins, and is inspired by a conical landscape visualization of this process. I am currently researching in the fields of neuroscience and astrophysics and my work references observed similarities in fractal patterns of neuronal networks and the complexity of the cosmic structure of galaxy filaments,

with the intention of creating a visual bridge between inner and outer space.

The smallest sculpture in the neuroscience-inspired series, *Catalyst*, utilizes bright colors and scale to reference the small but complex dynamics of chemical reaction.

JB: *While your titles like Flare, Cellular Dialogue, and Glial give away the scientific inspiration behind your work, aesthetically your work lies in the realm of abstract art. I'm interested to hear your thoughts on this conscious (or unconscious) choice?*

RK: Scientific observations expressed through the language of art and my own personal vision allows me to link and transform the similarity and significance of patterns in art and nature. Investigating nature as a dynamic mapping system, my artwork re-imagines what scientists see, so on some level the creation of each work, to answer your question, is both a conscious and unconscious act and choice.

As an artist, viewing abstract artwork continues to reveal new things. Recently while looking at one of the circular elements from the *NeuroCantos* installation I began to see the shape as a human eye viewing a rock. My mind allowed and created this new interpretation. It was not obvious or naturally visible. This experience was reminiscent of a quote of neuroanatomist Santiago Ramón y Cajal from his book *Advice for a Young Investigator*: "The object here is to focus the train of thought on more and more complex and accurate associations between images based on observation and ideas slumbering in the unconscious."

A similar experience related to the unconscious nature of viewing art occurred during my residency at National Institutes of Health. A neuroscientist viewed my sculpture *The Measure of All Things* which explores the principles of sacred geometry as a visual mapping system for the human body, portrayed by two large wave-shaped forms. This geometric waveform also maps a harmonic in music, referencing how mathematics creates a language between man and all things in nature. The smaller blue circular forms symbolize the relationship of water in the body and its connection to larger bodies of water in nature (symbolized by the larger circle in the center). Upon viewing this sculpture, the neuroscientist commented that she saw it as the physics phenomenon of

constructive interference. Our dialogue confirmed my title choice was appropriate, since constructive interference is 'the measure of all things'.

Another sculpture referenced in your question, *Cellular Dialogue*, explores how water and cells create a dialogue between man and the ocean. The small circular form in the center represents the significance of water in the cell, and is surrounded by yellow radiating lines referencing the cell's actin cytoskeleton. The larger blue circle symbolizes the ocean, the home to cellular organisms such as radiolarians, expressed through cutout shapes suspended above the circle. Blue paint applied as a stain references Nissl, a dye solution used in specimen preparation to make the invisible visible. *Cellular Dialogue*, like many of my sculptures, uses science as a point of departure on a journey of personal discovery.

JB: *What is your favorite piece that you've made in the past ten years, and why?*

RK: *Divining Nature: An Elemental Garden*, because of its positive impact on both scientific and non-scientific communities and its ability to serve as a catalyst for changing the way people think about the Periodic table and chemistry.

If I could choose a second favorite piece it would be *Portal*, (another collaborative project with sound artist, Susan Alexjander). Inspired by gravitational wave physics and the notion of Gedankenexperiment (thought experiment), this installation utilizes sculpture and sound to interpret the tracery patterns of the orbits of binary black holes, and celebrates the 100th anniversary of Einstein's discovery of general relativity. It also creates a visual dialogue between geological and space-time.

JB: *What artists would you put on your artist family tree?*

RK: There have been several artist/scientists throughout the history of science who have influenced my work including Leonardo da Vinci, the natural philosopher Athanasius Kircher, biologist Ernest Haeckel, and Santiago Ramón y Cajal. In terms of more contemporary visual artists, my artist family tree would include: Eva Hesse, Andy Goldsworthy, and James Turrell, to name a few.

Below: The Measure of All Things (2012). 25" x 144" x 6". Acrylic and graphite on Mylar. Photo credit: Mimi Xang Ho.

