

ArtNano Innovations: Envisioning Solutions To Global Challenges

Todd Siler in collaboration with nanochemist Geoffrey Ozin

“Nature invents. *Humanature* innovates.” Todd Siler

“Nature did it First. Nature has solved the problem of designing and synthesizing materials with structures that have been optimized to make them hard, tough and strong enough to house, protect and brace living organisms. Optimization of these properties, refined by slow evolutionary engineering, serves to enhance the chances of survival.” Geoffrey Ozin

Thinking SMALL is the new big thing, realizing nature’s creative potential. Siler's metaphorical artworks explore *what nature makes and what we make of nature on the nanoscale* (1-100 nanometers, or billionths of a meter). They build on the possibilities of manipulating matter on an atomic and molecular scale. This visionary concept took root over 50 years ago when scientists envisioned creating the tiniest human-made functional structures that could enhance the performance of technology we use to survive and thrive. Today, the NanoWorld includes energy systems (solar cells, fuel cells, batteries, supercapacitors), bioengineering systems, advanced medicines that help fight cancers, as well as environmental devices for improving global climate control.

Siler’s art interprets the process of designing nanomaterials for a multitude of practical applications in which “size matters.” The scale of these works of art range from nanometers to meters. For instance, in “Synthesizing Nature on the Nanoscale,” the macroscopic sculptures of nanoscopic phenomena give form to six nano-concepts (size, shape, surface, self-assembly, degree of imperfection, and utility). These concepts are used to sculpt nanomaterials in real life. Siler makes them larger-than-life, to emphasize the process of self-assembling nanomaterials. He connects this process of self-assembly to the related, yet different, dynamic self-assembly of neurons, genes and other biological matter. The neural-like sculpture serves as scaffold for supporting the development of nano materials and as a connection-making tool for linking biological and nonbiological matter.

In “Metaphorming Nature,” three paintings are excerpted from one multi-part artwork composed of 360 inter-related paintings. Each painting explores an innovation in nanoscience and nanotechnology, such artificial photosynthesis, which offers a clean, renewable energy system. “Metaphorming Nature” can be configured in both linear and nonlinear ways—creating novel narratives with each configuration that may spark innovative thinking in a curious mind. When completed, it will measure 6ft. x 5,280ft. (or 1 mile) and can be seen *without any technological aids* other than a pair of comfortable walking shoes! It will also be viewable through a scanning electron microscope, since the nanoscopic dimensions of this massive artwork will measure 1,828,800,000 nm x 1,609,344,000,000 nm. That’s about the size of a large particle of dust in Marcel Duchamp and Man Ray’s photomontage, “Breeding Dust” (1920), a Dadaist artwork that’s part of Duchamp’s portable art exhibition, “Box in a Valise.”

“Metaphorming” is a word Siler coined over three decades ago to describe the creative process of connecting and transforming all information (data, knowledge, concepts, theories, experiences, etc.) in personally meaningful and useful ways. Human beings have been metaphorming for millennia, as we make connections through associative thinking to understand the world. Siler, who has a background in neuropsychology, suggests the brain uses various symbolic languages (“metaphorms”) to constantly learn, create, innovate and communicate. Metaphorming enables us all to create new meanings and purposes for everything.

The chemist/poet Roald Hoffmann has observed: “The images that scientists have as they do science are metaphorical. The imaginative faculty is set in motion by mental metaphor. Metaphor shifts the discourse, not gradually, but with a vengeance. You see what no one had seen before.”

You don't have to be a nanoscientist or neuroscientist to appreciate this impressionistic art, any more than you have to be a gardener to appreciate the beauty and wonder of a botanical garden. That appreciation naturally grows as viewers seek-and-see the concepts explored in these artworks, and emerging from them.

One emergent concept adventured here is the invention of a new Periodic Table of Nanomaterials, in which a potentially infinite number of nanomaterials can be built from the bottom up (atom-atom clusters-nanomaterials -materials) and top down. By uniquely combining the four basic building blocks of nanomaterials (nanocrystals, nanowires, nanosheets, nanotubes), nanoscientists can make a II kinds of materials for practical innovations serving our world's most urgent challenges and the creation of a sustainable future. For more information, visit www.ArtNanoInnovations.com

In 2011, Geoffrey Ozin co-founded **ArtNano Innovations** with Todd Siler. Using multimedia artworks and aesthetic experiences, they aim to explore the possibilities of nature-inspired innovations in nanoscience and nantechnology that can benefit humankind by meeting our global challenges. This project considers new ways of synthesizing and responsibly applying nanomaterials. It also critiques the significant impact these developments are having on the built and natural environment—and on humanity—taking into account the “materials to nanomaterials” paradigm shift that's underway today.

About Todd Siler

By happenstance in November 2011, Todd Siler met Geoffrey Ozin for the first time at the World Cultural Council's Awards Ceremony at the University of Tartu in Estonia. <http://www.consejoculturalmundial.org/winners-arts-toddsiler.php> Dr. Ozin received the Albert Einstein World Award for Science at the same time Siler received the 2011 Leonardo da Vinci World Award of Arts. They quickly discovered a union akin to “two prongs of a tuning fork in resonance as ‘ScienceArt and ArtScience’.” This meeting inspired them to embark on an adventure exploring the fusion of their expertises in Art (‘Metaphorming’; www.artofscience-learning.org/metaphorming.html) and Science (‘Nanochemistry, Synthesis in Diminishing Dimensions’; <http://nanowizardry.info/>). Most recently, Siler presented his work at the Aspen BrainLab Forum at The Aspen Institute <http://www.aspenbrainlab.com/speaker-bios.php>, highlighting his large-scale (9ft. x 127ft.) artwork, “Thought Assemblies” (1979-82), which explores the nature of human creativity. This artwork will be exhibited late November 2014 in the Picower Institute for Learning and Memory at M.I.T., where it will be installed in various sections as part of their permanent art collection.

About Geoffrey Ozin

Widely regarded as a founding father of the field of Nanochemistry, Geoffrey Ozin <http://nanowizardry.info/> was nominated for the 2014 Kavli Nanoscience Prize for the originality and significance of his visionary work. He continues to catalyze collaborations leading to innovations in his field that can benefit humankind in outstanding ways, helping us meet our global environmental and health challenges, among other urgent concerns. As the Chairman of University of Toronto relates: “In the early seventies, working in his laboratory in the Chemistry Department at the University of Toronto, Geoff pioneered an ‘atom-by-atom’ chemical approach to the synthesis of nanomaterials...Throughout Geoff's long career he has made seminal fundamental and important applied research contributions, and provided innovative educational tools that served to enhance and enrich the science, technology and teaching of nanochemistry, and he is still going strong...Geoff's work over the past four decades offers a wealth of contributions to the field of nanoscience through nanochemistry. They encompass creative ways of synthesizing a remarkably wide range of novel nanomaterials created combinatorially in a practical Periodic Table of Nanomaterials he's currently designing.”