COLLIDING WORLDS

HOW CUTTING-EDGE SCIENCE IS REDEFINING CONTEMPORARY ART

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Seeking a visual language for scientific art: Steve Miller

Steve Miller's work ranges from x-ray portraits and Rorschach tests to DNA art. We meet outside his spacious studio on Manhattan's Lower East Side. He has a second studio in Sagaponack, in the Hamptons, in a converted potato barn once owned by the artist Frank Stella. A lot of Miller's savvy comes from jobs he took early on to support his art—bartender, ski instructor, studio assistant, construction worker, and commodities trader, all jobs that require personality, confidence, and verve, which he has in abundance. Nowadays, as well as being a practicing artist, Miller teaches at the School of Visual Arts in New York. His interests include biology art and physics art.

Born in Buffalo, New York, he was taken to museums by his parents so often as a child that eventually he came to appreciate them, especially the Albright-Knox Art Gallery, where he encountered Jackson Pollock's spectacular *Convergence*, a massive work nearly eight by thirteen feet. It was a major event for a twelve-year-old. "It, like, knocked me out," he says. Miller's family offered no direct support for his artistic aspirations but "artistic encouragement was in the genes." Miller's grandfather was the glass designer who created the iconic Coca-Cola bottle, while his great-grandfather was a portrait painter of some renown as well as an agent for Tsar Nicholas II charged with acquiring paintings, particularly Impressionists.

Miller did some painting in high school and went on to Middlebury College, a small liberal arts college in Vermont, where he majored in fine arts, specializing in sculpture. He then spent two years as a fellow at the Fine Arts Work Center in Provincetown, Massachusetts, then by degrees relocated to New York and the Hamptons.

In New York in the early 1970s, Miller continued to sculpt, then turned to Abstract Expressionist painting. Soon disenchantment set in: "The habitual gestures of making paintings had become frustrating and were feeling meaningless." He started making movies and working in commercial film. But this still wasn't immediate enough for him. He longed to put brush to canvas, pencil to paper once again.

Looking into Cubism he became "totally enchanted with that epoch" and its new visual language, developed in response to innovations in technology. This was the sort of art he wanted to do.

Perhaps, like Picasso at the turn of the twentieth century, he was in at the beginning of a new avant-garde. He took in the dramatic changes happening in computers, technology, and science. This was how it happened in Cubism, he reasoned. After all, "changes in technology and changes in science allow for changes in consciousness." "Man, I wanted to be in on the next epistemological break," he says, "epistemological break" being a term from the French philosopher Michel Foucault meaning a rupture from accepted knowledge that is felt immediately. Miller was sure that the new technologies could be used "to reinvent new genres, to literally get inside, to reinvent portraiture."

Miller has always believed that the job of the artist should be to reveal truths. The 1980s was an era fraught with corruption, greed, and the dominance of the military-industrial complex, with AIDS running rampant. There seemed to be "a breakdown in culture, society, and the human body." Why not "use science to look at pathology as a metaphor" for this breakdown?

He was looking for a way to do this when he came across Rorschach tests, in which subjects interpret ink blots. Psychologists claimed to be able to deduce a person's personality and emotional state from their interpretations. If a prisoner up for parole gives a sinister interpretation of a Rorschach blot, he would be less likely to be freed than if he gave a more benign one. This social aspect fascinated Miller; he also liked the fact that the blots were "somebody else's piece of paint." He liked the randomness of the process, the fact that he was not responsible for whatever shapes emerged. So he took the blots and made them into art. He scanned them, photographed them from the computer screen, then printed them onto silk screens and touched up the result with acrylics. Now, "a blob of paint had a scientific meaning." And each person still saw them in a different way.

"Technology allows you to penetrate, to get inside," he says,

referring to x-rays, MRI and CAT scans that make the invisible visible. To him, the "beauty of these images is that they are the biological, technological, scientific equivalents of the Rorschach blots." They tell us about pathology, about the state of the body. To the untrained eye, an x-ray or an MRI scan looks like a surreal jumble, but a scientist looking at the same scan can make out a virus or a cancer cell. In the same way that the Rorschach test can be a litmus test of a culture—instead of seeing a butterfly, people might see "Hiroshima or bloody fetuses on the pavement"—scans are used to reveal diseases of the body.

Reasoning in this way, Miller turned to medical pathology as a metaphor for cultural diseases. First he took images from medical texts. Then he tried using medical imaging as a new way of making a portrait. "It was a new way to take on a historically dead genre, to reinvent a genre that had been marginalized by photography." Miller's aim was to use "new technologies to reinvent new genres, literally to get inside, to reinvent portraiture"—to produce an internal portraiture. "All of a sudden, I realized there was this whole other world that couldn't be seen by the eye but could be visualized through the new technology." Imaging enabled him to move away from traditional portraiture, in which the eyes communicate the subject's inner being, to a new view of the subject, a new way to understand what a human being is. "We really have windows into the human body."

Through friends in medical research, Miller was able to use x-ray machines, sonogram apparatus, MRI and CAT instruments, as well as electron microscopes. He was like a child in a toy store. In 1993, as a gift for two patrons, Jacques and Véronique Mauguin, Miller combined sonograms of two fetuses in their mother's womb which he silk-screened and sandwiched beneath a radiograph of the father's hip. The finished work is entitled *Portrait of Jacques and Véronique Mauguin.*

In *Portrait of Pierre Restany,* also produced in 1993, in Paris, he depicts the French art critic and philosopher Pierre Restany as an x-ray profile, complete with glasses and cigar, with another x-ray

image of his hands (see Insert). The entire canvas is silk-screened and bleached by acrylic, with a graduated scale like those used in word-processing software along the side.

Since the 1980s, computers had been part and parcel of his art. But as late as 1993 the art world still considered computers a gimmick, not part of serious art, "whereas today all artists use computers." In Paris, the mood was different; France had embraced the new technology. Everyone had a Minitel, like a small computer, which you could use with your telephone line to make purchases or reserve seats at a restaurant, or—famously—to flirt. Handheld devices for paying with a credit card also started in France. The graduated markings in the portrait of Pierre Restany emphasize Miller's respect for computers as well as his interest in cognitive science, a quantitative study of the mind based on seeing it as an information processing system, somewhat like a computer. Indeed, Miller considers his portraiture a new way of looking into the mind.

Another 1993 work, *Portrait of Dr. William Frosch*, his psychiatrist, superimposes slices of MRI scans of the doctor's head with a Rorschach image, once again a silk screen on canvas, bleached with acrylic to produce a surreal juxtaposition. Besides being a portrait of Dr. Frosch, it is also a view into the mind of the person looking at it. One of Miller's self-portraits, *Self Portrait Yellow*, completed earlier, in 1992, is an MRI of his own spine superimposed with EKG signals together with an MRI of his scrotum. Another self-portrait consists of a CAT scan of his head and spine, with EKG signals superimposed to evoke his bodily rhythms.

He has also made forays into DNA art, producing a portrait by mixing the nuclei of some of the subject's blood cells into a bean culture. Using an electron microscope, he photographed the nuclei after they had undergone differentiation (mitosis). He then photographed the chromosomes under an electron microscope as they divided. Then he scanned the images into a computer to produce a genetic portrait, an extraordinary and beautiful image that looks like a cloud of bubbles.

Miller began x-raying and scanning anything he could lay his

hands on—women's high-heeled shoes, his mother's handbag. In 2007 he made a powerful x-ray image of a Glock pistol being loaded by a skeletal hand and called it *Glock*. Scientists were amazed and envious of what he got away with. He "brought into radiological labs all sorts of things, like snakes, guitars, violins. Scientists never get to play like that." This, in his view, is what an artist can bring to a medical laboratory.

Back in 2000, the director of the Brookhaven National Lab (BNL) in Upton, Long Island, had invited a group of artists to meet the scientists who work there. For Miller the big attraction was the BNL's Relativistic Heavy Ion Collider (RHIC), 2.5 miles across, which was used to study the debris from collisions of protons hitting protons, and of heavy nuclei such as gold and lead smashing into each other at speeds close to that of light. At the time it was the only accelerator studying heavy nuclei. Now the Large Hadron Collider at CERN devotes a month each year to this research.

The aim of smashing heavy nuclei together was to re-create conditions at the moment of the Big Bang, the creation of the universe, when temperatures were about a million trillion degrees Centigrade. At Brookhaven, they actually did it. For a few billionths of a second, the protons and neutrons that made up the heavy nuclei melted. Then their fundamental constituents, quarks—the building blocks of matter—and gluons—the particles that glue them together—burst free to form the quark–gluon plasma. It was as if they had moved back in time. The existence of the quark–gluon plasma was first shown at Brookhaven.

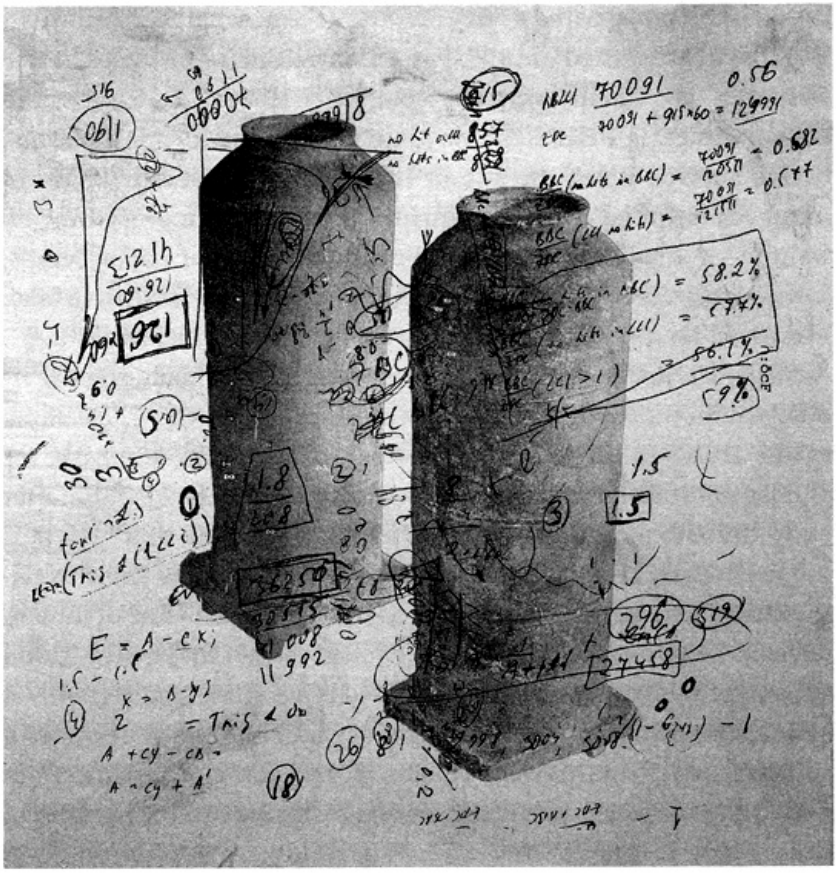
The quark–gluon plasma is like a sort of hot primordial soup. Studying it could give us further information about what conditions were like in the very early universe, before quarks bound together to form protons and neutrons and stopped existing as free particles. To Miller the RHIC was like an imaging machine that looked into the body, except that it looked into nature instead.

In the course of that visit, Miller met Steve Adler, who worked on one of the giant detectors, PHENIX (Pioneering High Energy Nuclear Interaction eXperiment), whose task was to actually detect

the quark–gluon plasma. "They invited me to do whatever I wanted," he tells me. It turned out to be an embarrassment of riches. Adler was an engineer in information technology. His job was to write the code instructing PHENIX how to detect the quark–gluon plasma. "Steve showed up at the site of the experiment in Brookhaven," Adler recalls, "and I showed him around, giving him everything he wanted—items like physics doodles on the back of paper scraps, software source code printouts, and all the photos he wished to take. From that he started creating his art which I found inspiring."

Miller's starting point was a discovery he had made the previous year in Singapore, when he was teaching art there. He came across stores selling Neolithic pottery, dating from 5000 BC, for almost nothing. The pots struck him as not only beautiful but an early "investigation of matter, taking dirt and doing this." His studio is now full of ancient pottery. His realization was "how to tell the story." The RHIC enabled him to tell it as a "time line of human development, from mud pies to the [discovery of the] quark–gluon plasma." Among the works he produced is *Neolithic Quark* (2001), a series of paintings overlaying images of Chinese Neolithic pots with software codes and physics equations, providing a timeline from one of the earliest experiments in transforming matter right up to the present. *Untitled 91101* is from that series (see next page).

Miller also spent time at the National Synchrotron Light Source (NSLS), also at Brookhaven. This massive machine accelerates electrons so that they emit light and is used to study the structure of crystals. One of the scientists there introduced Miller to Roderick MacKinnon, based at Rockefeller University, who was using the light emitted from electrons to study the structure of proteins. MacKinnon was interested in how certain proteins—ion channels—permit ions such as calcium, sodium, potassium, and chloride to enter cells. These ions cross cell membranes at up to a million ions per second. This is an electrical process. Our bodies, of course, are electrochemical engines. MacKinnon took snapshots of ion channels using the NSLS which helped him discover their spatial structure and how they can pass through cellular walls, for which he won the Nobel Prize in 2003.



5.11: Steve Miller, *Untitled 91101*, 2001.

The two men hit it off, and MacKinnon invited Miller to Rockefeller and gave him access to his notebooks. In 2003, Miller produced a series of works, among them *Protein #330*. In this rather magical work he uses a photograph of a potassium ion channel, identified using light from the NSLS, silk-screened onto a canvas, with a photograph of equations which MacKinnon had written on his blackboard superimposed on top of it. The equations also describe the process by which ions diffuse through cell walls.

Miller's work is sometimes misunderstood. In November 2007, in a publication called *Big Red & Shiny*, the art critic Katie Hargrave wrote a review of his exhibition Spiralling Inward at the Rose Art

Museum at Brandeis University in Waltham, Massachusetts. This is what she wrote of *Protein #330*: "Silk-screened on canvas, Dr. MacKinnon's notebook page is obstructed by this confusing protein image, with only the title words and a mess of partial equations showing through. What qualities do we need, Mr. Miller? The work creates a conversation between the neurobiologists who understand these equations, but in their obstruction, he denies the usability of the science. Instead, viewers are left with undeniably beautiful and poetic images. If Miller is disallowing the scientists to be able to understand this work, then who is it for?"

At least she saw the totality as beautiful and poetic. "If you read this review through the lens of an art critic, I fared pretty well on many fronts," says Miller. Cate McQuaid, a more scientifically literate art critic, described the exhibition as "an affirmation of life."

In avant-garde circles, Miller says, "beauty is, for many, a forbidden word." Beauty is not something he considers before beginning a work, rather "it's the result of a process" which encompasses past experience, thought, and the making of the work itself. As artists often do, he emphasizes the process over the end result. Yet in the end he chooses not to make any definite statement, simply noting that beauty is, like a Rorschach test, in the eye of the beholder. Perhaps more explanation might have helped in the exhibition at Brandeis. These works are not responses to emotional situations or landscapes. Nevertheless, like the works of old masters, works that bring together science and art deserve close study and much thought.

Miller does not collaborate with scientists. Rather, "scientists cooperate with me." What he brings to his relationship with scientists is a thorough knowledge of art and its history, gleaned from years of study. But if he produced a work in very close cooperation with a scientist, he would certainly add their name to it, he says. What is important to Miller is the "cross-pollination that can loosen everybody up. Art gives scientists permission to play."

Too often, he says, scientists "appreciate art but know nothing about it." Once, when he gave a lecture at CERN, a scientist, think-

ing of classical art, asked how Miller could consider his own work to be art. Artists' visits to labs such as Brookhaven and CERN give scientists some idea as to what the present world of art is all about. Certainly art can be useful "to present complicated information to an audience, as for example, in Michael Frayn's play *Copenhagen*, which portrays a drama about the bomb. It's not about science, however. I would like to do that," says Miller.

Steve Adler, who works on PHENIX searching for the quark-gluon plasma, says that Miller's art had no direct effect on his work. But, he adds, "Steve's influence on my work at that time would have been like a breeze blowing cross-bow on an oil tanker. But I did feel the breeze." Keenly aware of the art world, Adler has always appreciated and "been aware of the creative intellect we share with artists." Both seek to understand the "world out there"—artists with canvas, pen, and paper, scientists with mathematics. Adler's contact with Miller reinforced his belief "that both art and science play equal roles in our quest to understand the world we live in."

Adler is also well aware of the schism between art and science that came with the Industrial Revolution, raising the scientist's status to that of "new magicians, with artists relegated to more of an intellectual pastime status—an unfortunate asymmetry." With regard to his work as a scientist, "I see my motivation in a larger context, one which Steve [Miller] helped me to understand."

"Expertise demands discipline and focus," says Miller. "There is so much to learn that it's very difficult to do both [art and science]." Nevertheless, his work with scientists has produced some fascinating, profound, and—dare I say—beautiful works of art.

Beyond space-time and matter: Antony Gormley

Most of Antony Gormley's sculptures are based on the human body, often his own. One of the best known is *Event Horizon*, thirty-one statues of naked men cast from his own body, which appeared dotted around streets and the tops of buildings in London in 2007. Eight years earlier, in 1999, Gormley created *Quantum Cloud* for