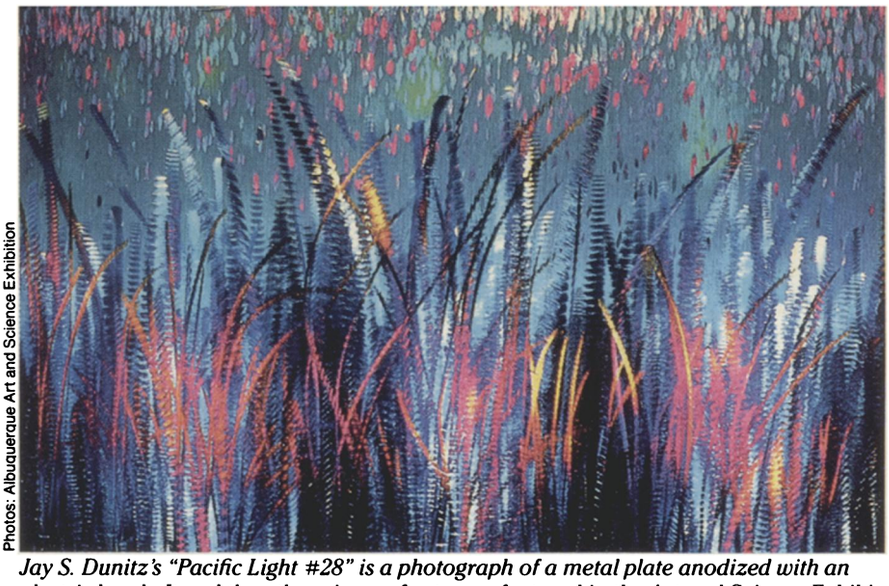
The Spark

Personal testimonies of creativity

By STEFI WEISBURD



Photos: Albuquerque Art and Science Exhibition

Jay S. Dunitz's "Pacific Light #28" is a photograph of a metal plate anodized with an electric brush. It and the other pieces of art were featured in the Art and Science Exhibition held in October in Albuquerque, N.M.

Shortly before her 17th birthday, Rosalyn Tureck was playing the Bach fugue in A minor from Book 1 of the Well-Tempered Clavier when she lost all awareness of her own existence. As she came to, she recalls, she saw Bach's music revealed in a completely new light, with a new structure that required the development of a novel piano technique. Over the next two days she worked out this technique on four lines of the fugue and then played it at her lesson. Her teacher told her it was marvelous, but impossible, that it couldn't be done.

"All I knew," says Tureck, "was that I had gone through a small door into an immense living, green universe, and the impossibility for me lay in returning through that door to the world I had known."

Tureck went on to become a renowned concert artist, the first woman invited to conduct the New York Philharmonic Orchestra and author of several books, including one in the works that links the structure of Bach's music to two physical theories.

Why some people are wellsprings of fresh ideas, while for others the creative juices flow at a mere trickle, has been the subject of decades of research: What are the psychological and cultural forces that mold creative work and play? Is creativity contagious? Can it be taught? Do artists and scientists share the same creative processes?

These questions formed the tapestry of a recent Smithsonian Institution symposium honoring the opening of the Smithsonian's new museum of Asian art and its benefactor, Arthur M. Sackler. Sackler, who died in May, was a pioneering biopsychiatric researcher (he was the first to link schizophrenia to a neuroendocrine imbalance), a medical publisher, a collector of fine art and a great believer in interdisciplinary thinking. His friends and colleagues, artists and scientists alike, gathered on Sept. 11 in the National Academy of Sciences' geodesic auditorium in Washington, D.C., to remember him and to celebrate that uniquely human spark of insight and invention called creativity.

The symposium didn't promise to break any new theoretical ground on the creative process. But it did provide some delightful and inspiring illustrations of creativity in action. And it offered an all-too-rare opportunity to share the personal landscapes of the lives of some very creative people, including the regal Tureck, the indefatigably cheerful chemist Linus Pauling and the somewhat crusty sculptor George Segal.

This is the third panel of Evelyn Rosenberg's "Evolutionary Geoscape II" mural created at the New Mexico Institute of Mining and Technology with plastic explosives and metal forming. It hangs over the door of the New Mexico Museum of Natural History.

Creativity is at once both an intensely individual act of expression and a bridge that links us to the rest of the universe. It can be a personal joy, a chance at immortality or a tool for humanity's survival. Yet, in spite of its importance to individuals and societies, creativity is not something that is freely and intensely exuded by everyone.

What makes a creative mind? According to David N. Perkins, co-director of Harvard University's Project Zero study of cognitive skills in the sciences and humanities, scientists know that creativity has little to do with intelligence, talent or expertise. These may provide the raw horsepower for creative endeavors, but not the steering.

Perkins and others have identified several psychological traits they believe are shared by creative people. One is a drive to uncover the aesthetic, or, as cellist Janos Starker told the symposium, the obsessive desire for reducing chaos and for finding beauty. In science, says National Academy of Sciences President Frank Press, the aesthetic solution is often the correct solution; thus, the aesthetic drive for order and simplicity created the periodic table, replacing "a potpourri of tortured arrangements of elements, which were almost uniformly

useless for predicting properties or missing elements." And in high-energy physics, he adds, the zoo of particles discovered by the 1960s was nicely caged by the elegance of the quark model.

Creative people also appear to have as strong an interest in finding and framing unusual problems as in solving them, says Perkins. And their discovery of innovative answers often stems from a tremendous capacity for metaphor, for making unexpected connections, and from a need to challenge traditional assumptions. "The main obstacle to progress is not ignorance, but the illusion of knowledge," reflects panelist and Librarian of Congress Emeritus Daniel J. Boorstin, who is working on a history of art called *The Creators* to follow his history of science, *The Discoverers* (Random House, 1985).

Another creative trait, says Perkins, is a measure of objectivity, the ability to temper the energy of creation with testing and judgment. This is a key ingredient to the problem-solving recipe of two-time Nobel laureate Pauling, who once told a student that the trick in coming up with good ideas is to think up a great many ideas and then simply get rid of the bad ones.

According to Perkins, creative people also tend to function on the edge of their competence. They are risk-takers, he says, either because they enjoy risk or because their aesthetic sense pushes them toward that uncomfortable frontier. From his own studies, University of Wisconsin-Madison psychologist Frank Farley labels creative individuals with a Type T (as in Thrills) personality. These are people who live on the edge of uncertainty, who thrive on novelty and who are tolerant of ambiguity, he says.

Finally, Perkins notes that creative individuals are stirred by intrinsic motivations — money, grades, recognition and awards are relatively unimportant. "At an early age," reflects Pauling, "I had a strong curiosity about the nature of the world. I don't think I was ambitious."

Because these six traits are not thought to be genetic, Perkins believes that creativity can be taught or at least moderately encouraged in young people. Unfortunately, he says, conventional schooling doesn't foster these traits very well. For example, students are rarely given the freedom to find and define their own problems to be solved. According to Perkins, there are instructional programs aimed at nurturing creative and analytic thinking, and experimental results show some short-term success, but no one knows whether the students in these programs lead more creative lives 15 years down the road.

While psychologists may love to dissect the motivations and drives of creative people, the artists and scientists at the Sackler symposium were much more taken with the whole of their creative experiences. And many found that they share remarkably similar impressions of the creative process.

For instance, most stress that it is not an easy process. "We work terribly hard," says Tureck. The simple discoveries are difficult to make, says Pauling; only in retrospect do they look easy.

To demonstrate the "total goulash" that provokes creative situations in his life, Segal delivered to the symposium a sampling of the chaos at work during his struggles to become an artist: pressures from his father to pursue a more conventional career, his attraction to the heady atmosphere among American abstract expressionists who were deliberately challenging European preeminence in art, the utopian dream of communism and then the brutality of Stalin unearthed, teachers asking for connections between James Joyce, Picasso and Italian realist cinema, images of intense young men in white-washed, decaying studios talking in unintelligible phrases, Jackson Pollock's muscles as he splattered paint on a canvas.

"River" is an electroformed copper topographic landscape by geologist and artist Doug Czor.

"My history is trying to punch my way out of this dilemma," he says, to make sense out of what seems to be utter confusion.

Many of the symposium panelists found that they have taken the same steps to discovery that the physicist Hermann von Helmholtz described last century: immersion, incubation and illumination. Tureck, for example, says she spent two years of concentrated study prior to her first insight about Bach's music. "It's only with this background that such a revelation was possible," she says. "You don't get such intuitive experiences out of nothing."

Sometimes, after months or years of immersion, illuminations arise rather unceremoniously. Nobel-prize-winning particle physicist Murray Gell-Mann remembers making a discovery about strange particles through a slip of the tongue during a lecture. Gell-Mann dubbed these particles strange because they are produced copiously by strong forces but have a long lifetime, decaying slowly through weak interactions. He was attempting to understand the rule that forbids the strong forces from inducing the decay of strange particles by looking at a quantity called isotopic spin (I). However, his progress was blocked by conventional wisdom, which assumed that neutron- and proton-like particles called baryons had to have half-integer values of isotopic spin, e.g. I = 5/2, rather than integer values. This meant that electromagnetic interactions, which change I values by one unit, could result in particles having the I values of 3/2 or 1/2, which would allow for strong decay.

"One day I was giving a talk at Princeton on why conservation of isotopic spin failed to work as an explanation of the long lifetime and, mentioning the [baryons], I was going to say, 'Suppose they have I = 5/2,' but . . . said, 'I = 1,' instead," recalls Gell-Mann. "I stopped dead because I realized that I = 1 would do the job. . . . I saw immediately that the requirement that [baryons] have these 1/2 integral values of I was just a superstition."

Pauling, champion of the medicinal properties of vitamin C, owes one of his earlier insights to, of all things, a cold. For 11 years he had been trying to unravel the problem of how polypeptide chains coil up into hemoglobin molecules. One day he took to bed with a cold and was reading science fiction and detective stories when the idea came to him. Within a few hours, he says, he worked out the answer to the problem: the alpha-helix structure. Pauling says he had been taught in 1929 the basic symmetry operation that helped him discover this structure, but for some reason, he says, it wasn't until that day in 1948 that it entered his mind.

From his previous discussions with "poets, painters, biologists and chefs," Gell-Mann says he's convinced that artists experience the same creative processes as scientists. This view is supported by Perkins's studies. It also resonates with Einstein's observation that science and art, along with religion, are all branches of the same tree, says Press.

At times, however, the Smithsonian symposium seemed less like a celebration of the common roots of the two disciplines and more like a forced wedding between the blushing bride of sci-

ence and the reluctant bridegroom of art. Panelist and concert pianist Byron Janis asserts that there are big differences between art and science. A scientist does something 20 times to prove it works the same way each time, he says, while each artistic performance has to be unique.

Segal echoes that science has a verifiable reality, while in art the territory is more amorphous. To his mind, scientists have evolved from the "lonely misogynist Leonardos of yesteryear" to teams of workers who "hold faith in the community brain." If one great mind doesn't make a discovery, he says, another will.

To the extent that this is true in science, counters Tureck, it is also true in art. She says the composer Arnold Schönberg once told her that if he had not developed 12-tone music, someone else would have, and that his work was a natural and historical extension of Mahler's. Certainly science is often more of a communal effort, she says, but scientists as individuals go through the same process of illumination as do artists. And artists and scientists alike need to employ both rational and intuitive approaches, adds Gell-Mann. "Many problems transcend disciplines and demand a fusion of the two ways of perceiving."

There are many examples in the world today of how this belief is being embraced with vigor. Much of the artwork illustrating this article, for instance, was created by people who are both scientists and artists. "There is a tremendous synergy when you overlap the two disciplines," says geologist and sculptor Doug Czor, who organized the Art and Science Exhibition held in Albuquerque, N.M., last month.

"I think we're seeing greater similarities between some of the major divisions like art and science," says psychologist Farley, who, though not present at the symposium, chaired one of two art and science sessions at last February's meeting of the American Association for the Advancement of Science. "It's enormously important in the long run to show how everything works together in some relation, because that is the basis of ultimate understanding. Knowledge can't be so neatly compartmentalized."

Farley argues that art should play a more central role in education, because it stimulates the kind of "transmutational" thinking between concrete and abstract ideas that is essential to the sciences. He also stresses the growing importance of computers in bringing artists and scientists together to produce new works of art and science. At the University of Illinois in Urbana-Champaign, for example, such "renaissance teams" are using supercomputers to visualize previously hidden patterns in nature (SN: 10/24/87, p. 264).

Retired physicist Craig Hudson, who created this oil painting called "Shocks," says he enjoys visualizing what scientists measure or record.

The merging of art and science and their common creative link is hardly a new event in human history, however. As mathematician and essayist Jacob Bronowski, who died in 1974, once observed, it is no coincidence that the arts and sciences have thrived simultaneously during the same eras and in the same cultures. And, he would have argued, Einstein's branches of art and science have been growing together from their common trunk since the dawn of humanity.

In "The Ascent of Man" film series, Bronowski takes his viewers to see the traces of that prehistory: the Altamira cave paintings of bison, running deer and other hunted animals as well as painted outlines of the human hand. At that time, the men who made the flints, knives and other scientific inventions for the hunt, he says, "and the men who made the paintings were doing the same thing — anticipating the future as only man can do, inferring what is to come from what is here.

"There are many gifts that are unique in man; but at the center of them all, the root from which all knowledge grows, lies the ability to draw conclusions from what we see to what we do not see." This is the essence of the creative act.

"All over these caves," he concludes, "the print of the hand says: "This is my mark. This is man." □