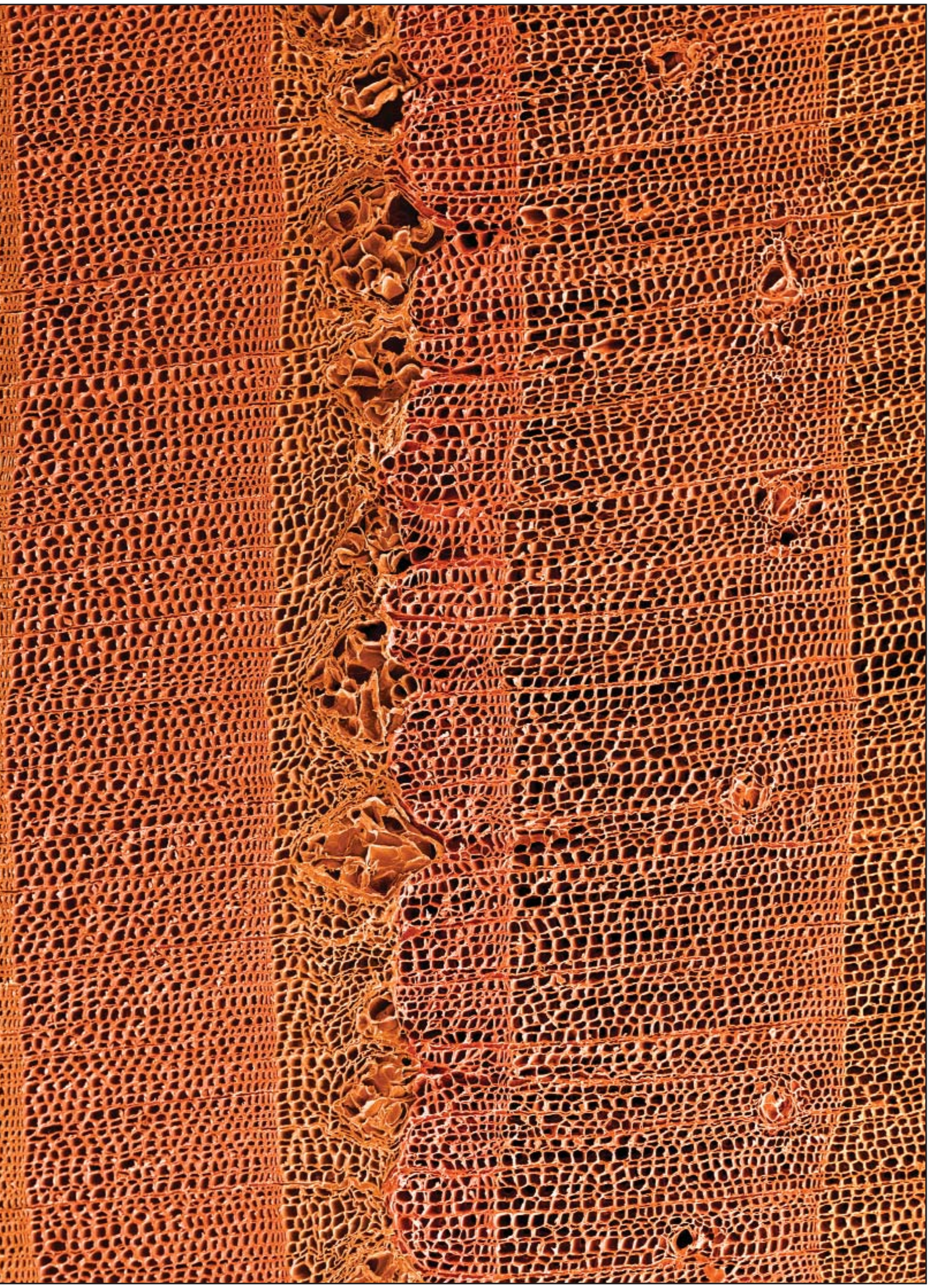
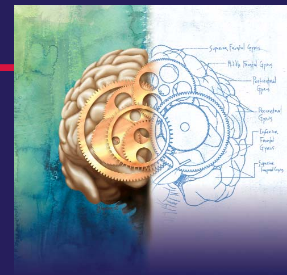
Science and Engineering Visualization Challenge





it takes both sides of the brain

National Science Foundation · Science

Panel of Judges

Donna J. Cox
Professor, School of Art and Design, University of Illinois, Urbana-Champaign
Specialist in three-dimensional computer animation

Felice Frankel
Research Scientist, Massachusetts Institute of Technology, Cambridge
Science photographer and director, Envisioning Science Project

Jon Franklin
Professor of Journalism, University of Maryland, College Park
Pulitzer Prize–winning science journalist formerly at The Baltimore Sun

Gary Lees
Chair and Director, Department of Art as Applied to Medicine, Johns Hopkins University, Baltimore, Maryland
Specialist in medical illustration

Thomas Lucas
Thomas Lucas Productions, New York City
Producer of science documentaries

Boyce Rensberger
Director, Knight Science Journalism Fellowships, MIT
Science journalist formerly at The Washington Post *and* The New York Times

Photography

FIRST PLACE

Mongolian Frost Rings

DEE BREGER

Magnification: 35×
Sample courtesy of G. Jacoby

A core sample from a Siberian pine tree in Mongolia tells a cold, dark tale. Dee Breger used a scanning electron microscope (SEM) to create this image of the tree's rings spanning the years A.D. 535 to 539. The narrow, deformed rings at the center of the image correspond to the years 536 and 537. The ruptured cells graphically record a catastrophic summer cooling that froze the tree's sap—a climate blip that has been linked to a massive eruption of a young volcano, the precursor to Krakatoa, or possibly an impact event.

Breger, who manages the SEM and X-ray Microanalysis Facility at Lamont-Doherty Earth Observatory in Palisades, New York, framed the cold season with normal tree rings for context. She colorized the image, using Adobe Photoshop, "to enhance its appeal," she says. The hues are slightly more vibrant than pine but still look like wood.

"It's the tiniest fragment of an ancient tree, and yet it tells a story of global proportions," says panel of judges member Thomas Lucas. "That's why it won: because it was an astonishing story encapsulated in a teeny, teeny little thing."

Visualization and the Communication of Science

Data may be the gold standard of science, but they don't exactly glitter. A neat table of values cannot convey the significance, context, or excitement of research results to anyone besides other scientists in the same subfield. No one else quite gets the picture—including the larger community that supports the global research enterprise.

So it's not surprising that more and more scientists are striving to illustrate and explain their work with digitized images, color diagrams, and even multimedia. This effort, visible weekly on the cover and pages of *Science* and other journals, must increase. It is especially important because investigators at the outermost frontiers of science and engineering frequently study phenomena that are extremely difficult for most scientists to visualize, and downright formidable for the general public.

To recognize and encourage visualization in the communication of science, and to showcase the exceptional talents of those who work in this area, the National Science Foundation (NSF) and *Science* cosponsored the first annual Science and Engineering Visualization Challenge. Earlier this year, we invited entries in three categories: photography, multimedia, and illustration. Those judged best in each category would be featured in *Science*. We received 297 entries, which were screened by an internal NSF and *Science* committee. A panel of experts in scientific visualization then reviewed the 30 finalists and selected the winners, whose work appears in these pages. We congratulate the winners and all the other entrants, whose combined work attests to the vitality of scientific visualization.

Susan Mason of NSF organized this year's challenge; Naomi Lubick of *Science*'s News staff wrote the text that accompanies the winning images. Stewart Wills and Tara Marathe of *Science* have put together a special Web presentation, including audiovisual clips, at www.sciencemag.org/feature/data/vis2003.

We intend to make the challenge an annual event. Entries for 2004 will be solicited early next year through announcements in *Science* and elsewhere.

Curt Suplee
Director, Office of Legislative and Public Affairs, NSF

Monica Bradford
Executive Editor, *Science*

HONORABLE MENTION

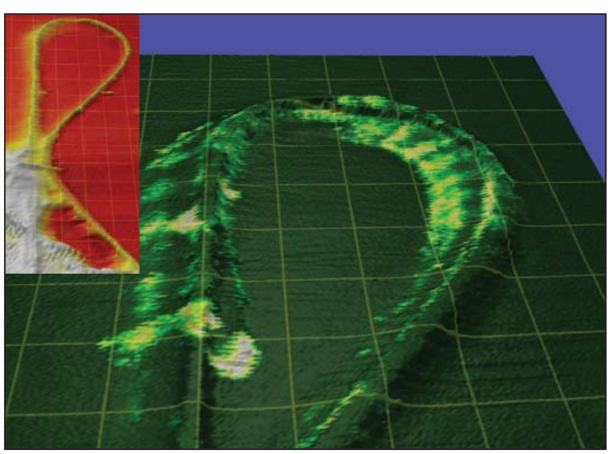
Buckling Nanotube
With Conductivity Map

MICHAEL STADERMANN

At first glance, the image could be a three-dimensional map of a pier jutting off a coastline, or some strange earthwork. But it is on an entirely different scale: a carbon nanotube, resting on a silicon dioxide surface, next to a smattering of gold atoms.

Michael Stadermann, a physicist at the University of North Carolina, Chapel Hill, made this image with an emerging technique called conductance-imaging atomic force microscopy that measures a sample's topography and conductivity simultaneously. The conductivity appears as color—the brighter the color, the higher the conductance—superimposed on the topography.

Merging the different properties of the object into one image provides clues to how they interact. Stadermann thinks the brighter spots indicate where the tube is buckling, which changes the tube's contact area with the probing tip.



Panel of judges member Donna J. Cox said that the judges gave the piece honorable mention because of Stadermann's "effort at pioneering a visualization technique in a very challenging area," in addition to communicating two very different kinds of data sets on the same page.

SECOND PLACE

Black Sea Pyrite

DEE BREGER

Magnification: 6400×
Sample courtesy of W. Pitman, W. Ryan, and C. Major

Lamont-Doherty's Dee Breger also took the second spot with another scanning electron micrograph that has connections to ancient history. The image shows a tiny cluster of pyrite crystals forming inside a microplankton called a coccolithophorid, taken from sediments in the Black Sea. The pyrite has replaced one cell nestled among the original armoring plates that composed the plant's calcareous shell.

The chemical reaction that creates pyrite occurs when marine sediments lack oxygen. This indicates that the bottom of the Black Sea was lifeless and stagnant when the coccolithophorid was deposited thousands of years ago. The unbroken plates surrounding the pyrite also suggest that there was no life present to break them down. Such anoxic conditions may have arisen from a rush of salty Mediterranean water flooding the original freshwater "Black Sea Lake," an event that could have been the biblical Noah's flood. The salt water would have sunk to the bottom, creating a layer of oxygen-free water.

Breger colorized a scanned darkroom print using Photoshop. "I chose to portray the realistic gold of pyrite while enhancing the shell with blue-green shadows for greater aesthetic appeal," she says.

Breger's image is "very fine," says panel of judges member Felice Frankel, "especially because of the story behind it."