Photography

FIRST PLACE WINNER AND PEOPLE'S CHOICE

Biomineral Single Crystals

Pupa U. P. A. Gilbert and Christopher E. Killian; University of Wisconsin, Madison

These fantastical structures could be a creation of Antoni Gaudí, the surrealist architect. In reality, they are the microscopic crystals that make up a sea urchin's tooth. Each shade of blue, aqua, green, and purple—superimposed with Photoshop on a scanning electron micrograph (SEM)—highlights an individual crystal of calcite, the abundant carbonate mineral found in limestone, marble, and shells.

The curved surfaces of the crystals look nothing like normal calcite crystal faces, however, says biophysicist Pupa U. P. A. Gilbert of the University of Wisconsin, Madison. Gilbert studies biomineralization: the process by which living organisms produce mineral structures such as bones and teeth. Sea urchin teeth in particular are "fantastic," she says, because they defy our expectations of what a crystal should look like in nature. Instead of flat sides and sharp edges, the sea urchin produces "incredibly complex, intertwined" curved plates and fibers that interlock and fill space in the tooth as they grow. Though made of a substance normally as soft as chalk, the teeth are hard enough to grind rock, gnawing holes where the sea urchins take shelter from rough seas and predators. Layers of continuously regenerating crystals slough off and reveal new crystals as the teeth wear down, self-sharpening with use.

On first seeing the SEM image of the tooth in black and white, Gilbert and staff scientist Christopher E. Killian were dumbstruck: "I had never seen anything that beautiful," she says. However, the black-and-white image made it difficult to distinguish the individual crystals, so she applied the colors to highlight how the crystals intertwine and connect. The resulting image is a "virtuosic combination of chemistry, biology, and art," says judge Michael Reddy. The fact that sea urchins have evolved to produce self-sharpening teeth is "just wild," he says.

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HONORABLE MENTION

X-ray micro-radiography and microscopy of seeds

Viktor Sykora, Charles University; Jan Zemlicka, Frantisek Krejci, and Jan Jakubek, Czech Technical University

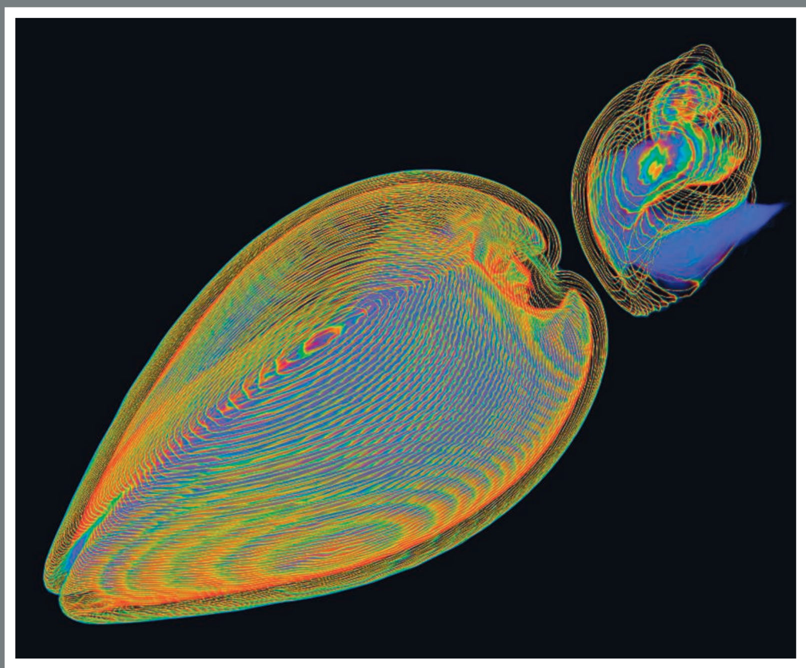
Furred, fringed, and barbed, these fruits with tiny seeds—each seed no bigger than 3 mm across—look almost guaranteed to get stuck in your socks. However, biologist Viktor Sykora of Charles University and his colleagues at Czech Technical University in Prague saw the seeds not as common stickers but as works of art. To image the seeds' fine details, the team used high-resolution, high-contrast x-rays (left) along with traditional microscopy (right). The most challenging part of the 20-hour process, Sykora says, was to find a way to fix the seeds in place using a material that would be invisible in the final image. Although high-resolution x-rays are commonly used to visualize the internal structures of small objects without destroying them, according to the authors it has never before been applied to the visualization of seeds. "The number of details that could be seen in the final image delighted us," Sykora says. He hopes that the images will motivate more scientists to use the technique in plant biology, as well as inspire painters, designers, and architects. "We should realize how much beauty, elegance, and wit can be found in nature and in seemingly ordinary things," he says.

HONORABLE MENTION

Self Defense

Kai-hung Fung, Pamela Youde Nethersole Eastern Hospital in Hong Kong

This is no shell game, but a matter of life or death. The clam (left) can snap its bivalve shell shut at the first sign of a threat. The whelk (right) has evolved another strategy: The spiral shell provides a series of barricades to potential invaders. It also has a trick up its shell to foil the clam's defense. After softening the clam's single-layered shell with secretions, it can drill a hole right through and eat the clam for lunch. This dramatic example of two different evolutionary strategies for self-defense caught the eye of radiologist Kai-hung Fung at Pamela Youde Nethersole Eastern Hospital in Hong Kong, who has won numerous awards for his creative use of CT scanning to make art. To create this image—which he says was commissioned as a backdrop for a marine-themed musical—Fung used a CT scanner to image thin slices of the whelk and clam, then rendered their contours in rainbow colors to highlight their complex structures. Creating such images involves balancing "two sides of a coin," he says. "One side is factual information, while the other side is artistic."



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