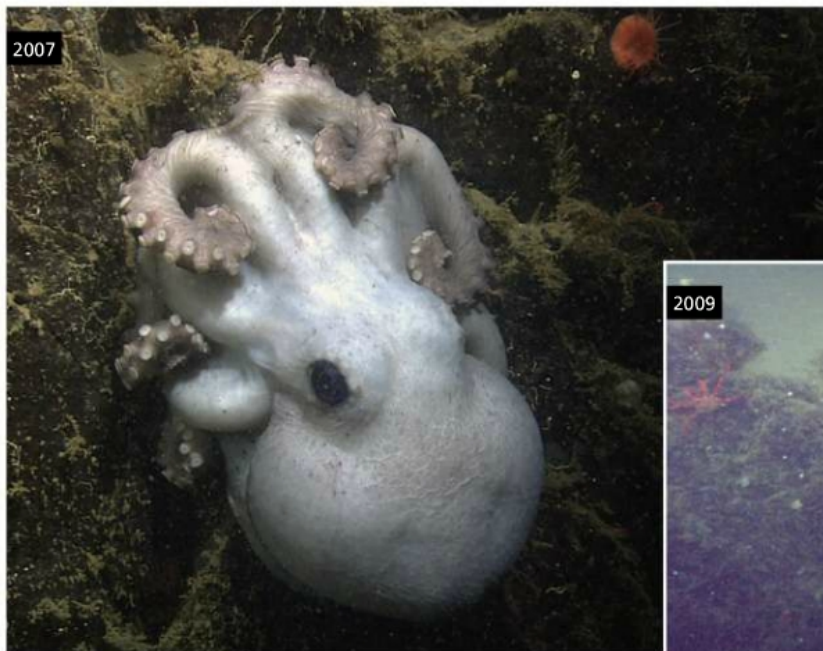
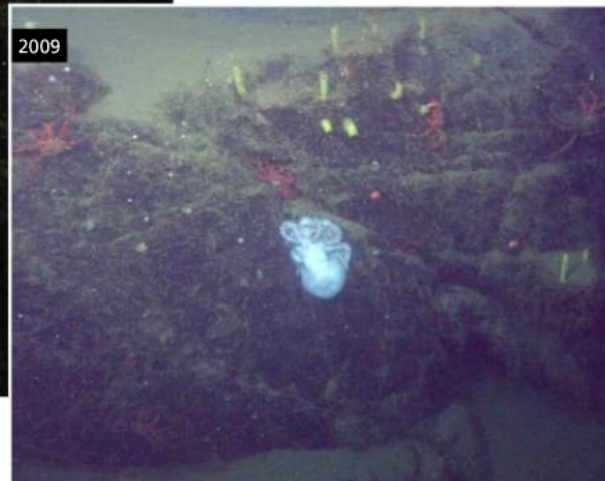


Nature's Most Patient Mother

→ Nine months feels like an eternity to welcome a bundle of joy, but could you imagine 4 ½ years? That was the reality for one female octopus, *Graneledone boreopacifica*, and it's the longest known brooding period of any animal, reported biologists from the Monterey Bay Aquarium Research Institute in July. In 2007, researchers spotted the octo-mom in deep, frigid waters off California's coast. They returned 18 times, only to find the pale, famished mother right where they left her. Researchers believe that when the brood finally hatched, the mother died — a typical fate for new octopus mothers. —CARL ENGELKING



For 4 ½ years, an octopus kept her brood free of silt and fended off predators. Her perseverance gave her offspring, which hatched in 2011 (leaving behind egg cases, top right), an increased chance of survival: They were so well developed, they could already swim and hunt.



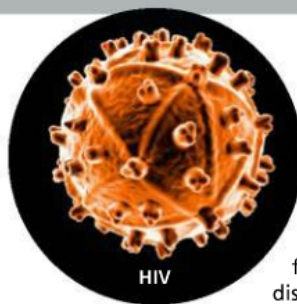
Hunting Down HIV Holdouts

→ HIV/AIDS is no longer a death sentence, thanks to now-standard treatments — particularly highly active anti-retroviral therapy (HAART). But even with HAART, HIV can linger in brain and immune cells, reactivating years later to cause heart, kidney and neurological problems. Now, a new method that hunts down these HIV holdouts could lead to the first true cure for HIV/AIDS.

HIV, which infects about 35 million people worldwide, infiltrates cells, slips

its genome into chromosomes and turns the cells into HIV factories. HAART keeps HIV from replicating, preserving the patient's immune function.

But to rid infected cells of HIV, Temple University researchers Kamel Khalili and Wenhui Hu customized a new gene-editing method called CRISPR to snip out the entire HIV genome without harming any human genes. The technique, announced in July, works in brain and immune cells where the virus hides, and it could one



HIV

day protect people from future HIV infection and from other viral diseases, such as HPV and hepatitis B.

Researchers still need to test the treatment in animals, which could take several years. "We want to eradicate every single copy of [HIV] from the patient," Khalili says. "That will cure AIDS. I think this technology is the way we can do it." —KATIE BO WILLIAMS

Rare Good News for Endangered Pandas



Captive giant pandas like Ju Xiao, shown here with one of the triplets she gave birth to in July, are genetically healthy, but it's tough for her wild cousins to find a bamboo patch to call their own.

→ The giant panda's star turn in animated movies and nature shows has done little to bolster its protection. Decades of logging, as well as road and railroad construction, have shrunk the bear's habitat; just 1,596 wild pandas remain, according to the latest count. But in July, Chinese researchers reported some good news: By analyzing 240 of the iconic bears from four Chinese breeding centers — accounting for 64 percent of captive giant pandas — they found high levels of genetic diversity and little evidence of inbreeding at all but one of the facilities. “The captive population is genetically healthy,” the team wrote. But there's a catch to releasing more pandas into the wild: There's little room left for them. Where's *Kung Fu Panda's* Po when you need him? —APRIL REESE

2014 World Debut: New Species Series



Mite-y Singer

2014 World Debut: New Species Series

Litarachna lopezae

Type of animal: Deep-sea mite

Description: Microscopic member of widespread but relatively unstudied Pontarachnidae family

Home: The Bajo de Sico coral reef system off Puerto Rico

Fun fact: *L. lopezae's* namesake is none other than pop icon Jennifer Lopez. According to Vladimir Pešić, the study's lead author, J.Lo's music kept the team upbeat while writing the manuscript for their paper.

While it is the deepest-living marine mite, found nearly 230 feet below the ocean's surface, its claim to fame is mainly in the name. —BRENDA POPPY



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Nearby galaxy M82 was home to one of the closest type Ia supernovas in decades.

Stellar Explosion Illuminates Cosmos

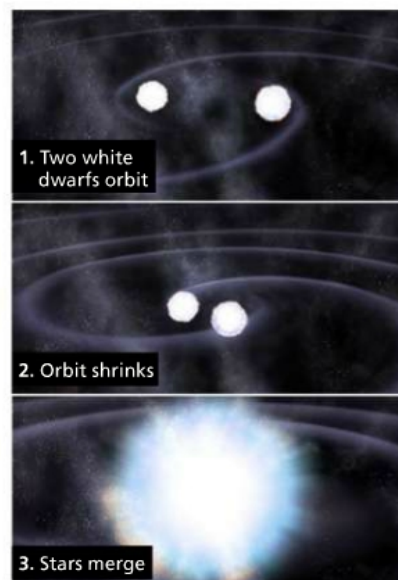
→ In January 2014, astronomers watched a rare supernova light up and began filling in one of the most embarrassing gaps in their understanding of the universe.

The explosion, dubbed SN2014J, belongs to a class of supernovas called type Ia. These objects all apparently blow up the same way, allowing astronomers to use them as standard beacons for reckoning the size and structure of the cosmos. But nobody knows exactly how type Ia supernovas work, leaving the queasy possibility that those inferences are full of errors.

SN2014J is changing that. The star exploded in the neighboring galaxy M82, about 12 million light-

years away, making it the nearest type Ia supernova in decades. It's close enough that researchers could confirm current theories indicating the supernova started out as a white dwarf — a small, collapsed stellar cinder. Details about the explosion specifically suggest that it occurred when one white dwarf collided with another.

Collectively, the findings support the notion that type Ia supernovas suffer from “stellar amnesia,” meaning that they “forget” the specifics of their earlier selves and become largely identical once they go off — just as astronomers hoped. Only in the counterintuitive world of cosmology can amnesia lead to greater awareness. — COREY S. POWELL



Two white dwarfs merge into an unstable star that explodes as a type Ia supernova.



Aedes aegypti is one of the two mosquito species responsible for spreading the chikungunya virus across the U.S.

Chikungunya Virus Arrives in the U.S.

→ In July, the Centers for Disease Control and Prevention confirmed that chikungunya, a mosquito-borne virus recently introduced to the Western Hemisphere, had arrived in the United States.

Chikungunya has no specific treatment and causes fever and severe joint pain. First found in Africa and Asia, the disease spread to Europe, then the Caribbean islands, where the first locally transmitted case in the Western Hemisphere was reported in late 2013. In 2014, the disease traveled rapidly, reaching the United States and about 30 other countries.

As of Oct. 27, the CDC reported nearly 760,000 suspected and more than 14,000 confirmed cases in the Americas and the Caribbean, with almost 1,500 in the United States. Although most of the U.S. citizens caught the virus abroad, on July 17, a Florida man became first chikungunya victim to contract the virus at home. Eleven more local cases have followed as of late October. So far, all are isolated to the Sunshine State.

The two mosquito species spreading chikungunya in the Western Hemisphere, *Aedes aegypti* and *Aedes albopictus*, are also responsible for dengue fever's spread.

There's no known cure for chikungunya, but it usually isn't fatal and clears up in about a week in most people. — CARL ENGELKING

Lithium's Power Unleashed

→ If you're sick of your cell phone's pathetic battery life, Stanford University researchers announced in July that they may soon have a solution: a pure lithium battery.

Lithium batteries have three main parts: the anode that discharges the electrons, the cathode that absorbs them and an electrolyte that carries ions between the two. Today's batteries use graphite anodes, but lithium anodes are ideal because the metal is lightweight and stores high energy levels in a small space. Past lithium anode attempts failed because lithium is highly reactive, forming fingerlike structures that build up on the anode and short-circuit the battery. Lithium anodes also react with liquid electrolytes to heat up and wear out the battery.

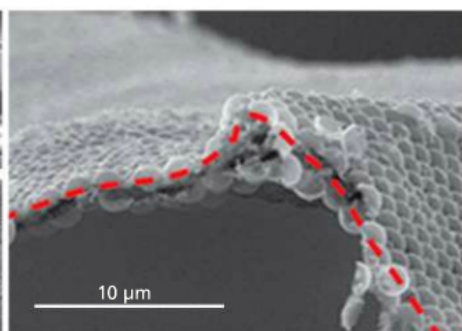
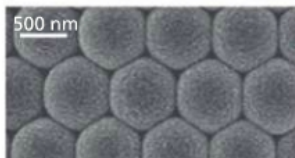
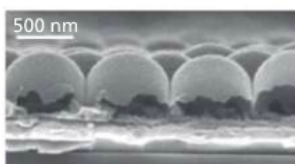
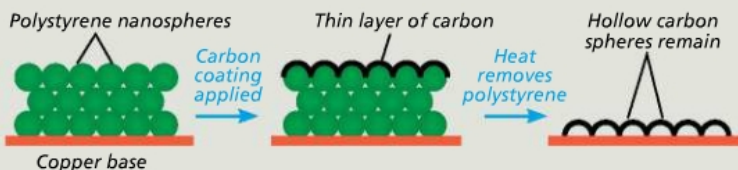
To overcome this problem, engineer Yi Cui and his team built a minuscule, hollow carbon sphere on top of the anode. The honeycomb-like structure, roughly 1,000 times smaller than the radius of human hair, acts like a hat for the lithium anode, protecting it from buildup.

Despite the exciting potential, Cui said it will take three to five years before this product could be ready to store energy for the electric grid, solar cells and wind farms. — AMY KRAFT



This carbon nanosphere film guards the lithium battery's anode from harmful chemical reactions that would render the high-energy battery useless.

HOW IT'S MADE: CARBON NANOSPHERES



Lithium is highly reactive and, in batteries, creates buildup that short-circuits the system. As a solution to this problem, Yi Cui and his team built hollow, carbon nanospheres to act as a protective barrier between the liquid electrolytes and the lithium anode.

A Jolt for Dull Thoughts

→ Humans are unique among the animals in our ability to mentally detach from our surroundings and purposely look inward. But sitting in quiet contemplation turns out to be much tougher than it seems, University of Virginia and Harvard researchers reported in *Science* in July.

The researchers instructed 146 college students to sit in an austere laboratory for up to 15 minutes without cell phones, books or other distractions, entertaining themselves with only their thoughts. Most of them couldn't do it, and reported being bored. Even in the presumably cozier environs of their home, volunteers in another experiment found their own musings painfully dull.

Then, when researchers left people alone in a room with a device that let them jolt themselves with mild electric shocks, they discovered that most men are so desperate for distractions that they would rather zap themselves. Two-thirds of men in the study, compared with 25 percent of women, chose to shock themselves rather than sit quietly. One man even pressed the button 190 times.

Lead author Tim Wilson, a University of Virginia psychologist, doesn't yet know why we get sidetracked so easily, but he doesn't think our social media addictions or even testosterone-addled male brains are entirely to blame. The ability to gaze inward may be an integral part of the human condition, but so is our inability to be alone, he says: "Because we're so attuned to be alert to danger, there is something about the human mind that finds it hard to turn in on itself." —LINDA MARSA



Top-to-Bottom Sex Bias in Labs Skews Results

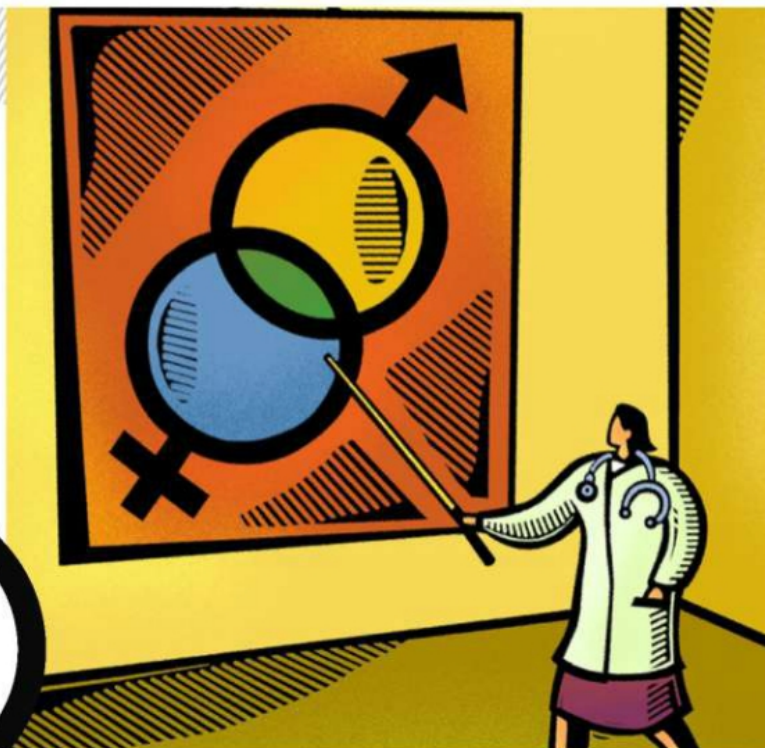
→ Gender and sex imbalance infects science at every level, from the demographics of lab personnel right down to the tissue samples used in experiments. This bias is skewing research results in ways that threaten public health, warn top officials at the National Institutes of Health (NIH).

"It's a real blind spot that's resulted in huge gaps in our knowledge," says Janine Clayton, associate director of Research on Women's Health at NIH. "Too often we rely on male animals, even when studying diseases that are more prevalent in women."

Traditionally, researchers avoided using female animals because they worried hormonal fluctuations and reproductive cycles would skew results. But because women respond to medications and develop some diseases differently than men, researchers need to include female lab animals, tissues and cells in their experiments, according to a *Nature* commentary Clayton co-wrote in May.

Even a scientist's gender can compromise research, according to a Canadian study published in April. The paper found that the mere presence of men in the lab induced such intense stress in rodents that it altered how the animals reacted to pain.

"Males can be perceived as dangerous, and stress can muffle pain responses," says Jeffrey Mogil, the study's lead author and a pain researcher at McGill University in Montreal. "This can affect a very large set of experiments. What's amazing is that this is 2014, and we didn't know about this until now." —LINDA MARSA



Safety Lapses Lead to CDC Lockdown

→ In July, nearly two dozen government laboratories were locked down after more than 80 employees at the Centers for Disease Control and Prevention in Atlanta were potentially exposed to live anthrax bacteria. A subsequent internal investigation revealed a systemic pattern of safety lapses at the nation's top health agency. Investigators found four other incidents in the past decade when deadly pathogens were mishandled, including an event in March when a sample of the avian flu strain H5N1 was contaminated with a more lethal strain and accidentally shipped to a USDA lab without proper protections.

The agency moved swiftly, imposing a moratorium on the 23 labs transferring certain dangerous materials until they passed stringent safety inspections. The CDC also set up a panel of 11 independent experts to address lax procedures.

Although no one was sickened in the anthrax incident, the probe found numerous missteps, including that the bacteria were stored in unlocked refrigerators in unrestricted hallways. In the case of the H5N1 flu virus, shortcuts in the lab led to cross-contamination with the other virus.

A dozen labs had reopened by August, the same month the new safety panel started hammering out ways to improve oversight. "Safety protocols were in place, but they weren't followed," says Benjamin Haynes, a CDC spokesman. "We take it very seriously." —LINDA MARSA



July's anthrax scare at the CDC's headquarters closed 23 labs for weeks.

2014 World Debut: New Species Series

Waiomys mamasae

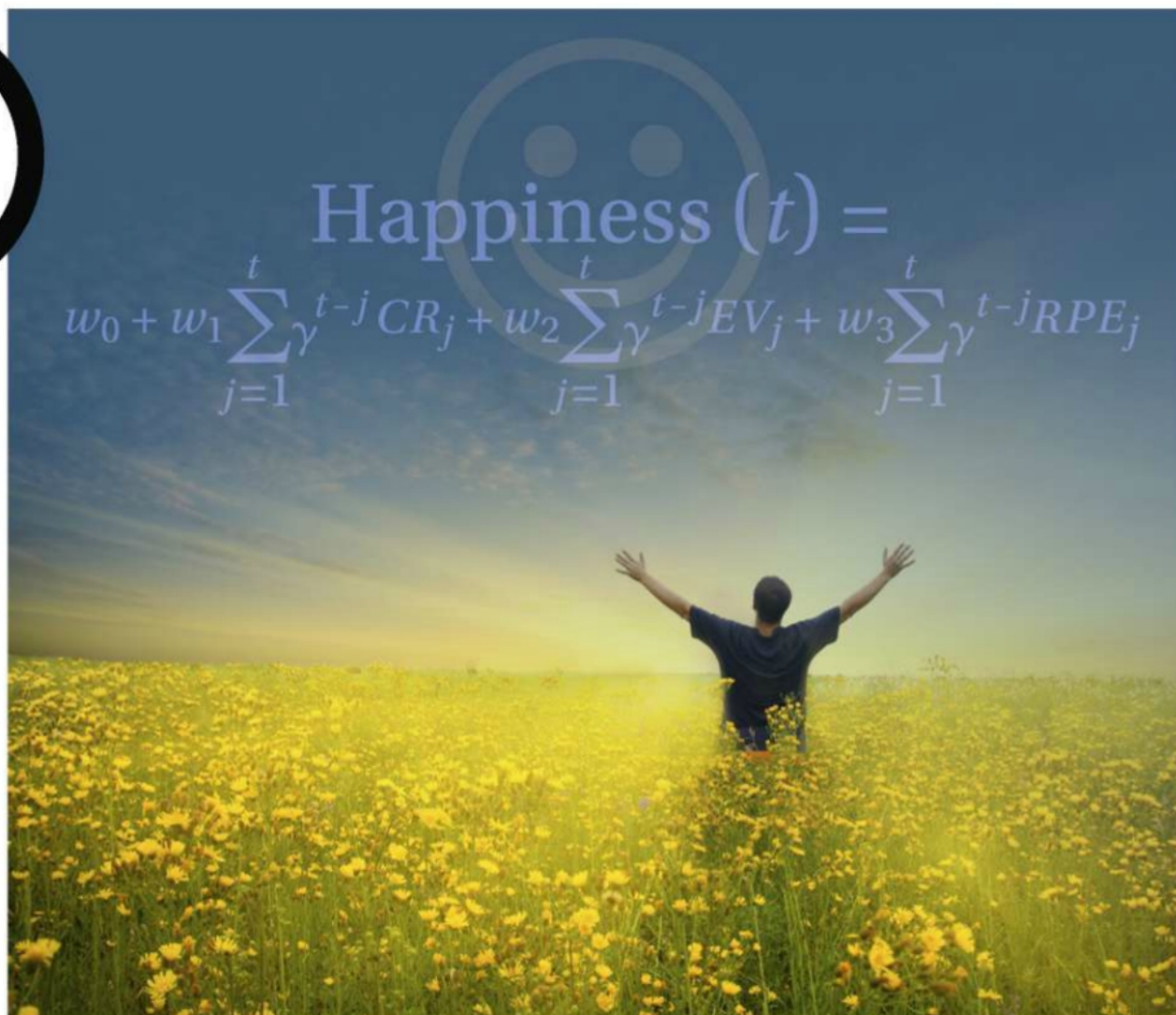
Type of animal: Semi-aquatic, insectivorous rat
Description: Dense gray-brown fur; small eyes and ears; long tail equipped with whiskers to aid in swimming
Home: Sulawesi Island, Indonesia
Fun fact: Although physically similar to water rats from nearby countries, *W. mamasae* is genetically more similar to the land rats of Sulawesi — meaning it evolved the same traits as other water rats without descending from the same line, via convergent evolution. It represents not only a new species, but an entirely new genus. Yet it's not new to everyone: The people of Mamasa (the species's namesake) have long used the rat as a talisman to ward their homes against fire. —BRENDA POPPY



2014 World Debut: New Species Series



Holy Water Rat, Man



There's a Happy App for That

→ If you want to be happy, it's time to lower your expectations.

Researchers from the University College London in August created a mathematical formula that accurately predicted the rise and fall of people's happiness. We become happy, the equation indicates, when events exceed our expectations.

"If you have lower expectations, and you get a reward, you'll be happier about it," says study co-author Robb Rutledge.

To build the formula, Rutledge's team asked 26 people to undergo a functional MRI while playing a gambling game that required them to place bets, spin a wheel of chance and collect as many points as possible. Subjects rated their happiness every few rounds as they won or lost points. Then, to ensure their results in the lab weren't a fluke, researchers released a smartphone app that simulated the lab experiment cheaply and on a larger scale.

"Our expectations were pretty

low for the app because we were worried that no one would play it," Rutledge says. However, more than 18,000 people participated in the app experiment, and the algorithm's predictive powers were confirmed. The app's expectation-shattering performance, not surprisingly, made researchers quite happy.

The algorithm could help diagnose mental disorders, such as depression, by comparing people's happiness levels to what the algorithm predicts, Rutledge says.

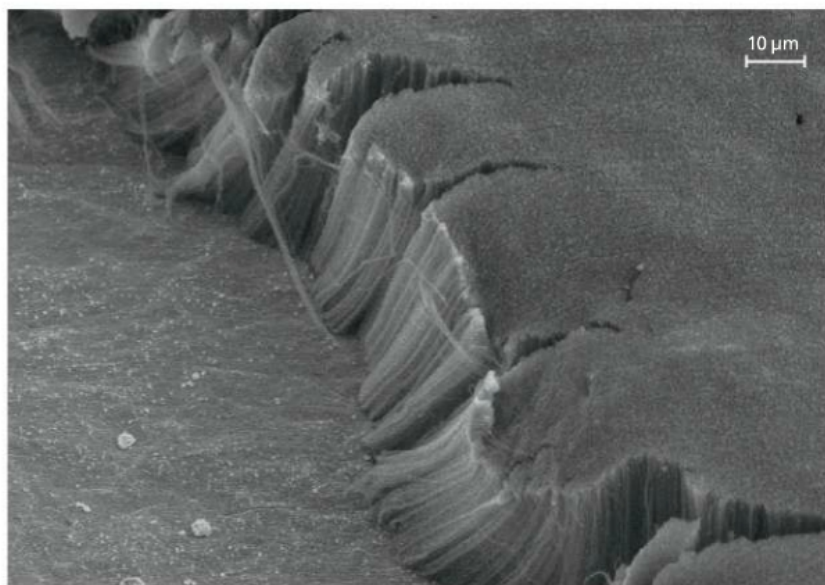
—CARL ENGELKING

Vantablack Is the New Black

→ Imagine the darkness of a black hole right here on Earth. In July, British company Surrey Nanosystems publicly released a material so black that it absorbs 99.96 percent of light, making it the most absorbent thing on Earth.

This outrageously obsidian material, called Vantablack, owes its darkness to a set of vertically aligned carbon nanotubes — each about 10,000 times thinner than a human hair — that are suspended in plasma and coated directly onto materials like aluminum foil. The nanotubes are packed so tightly that incoming light particles bounce around between them until the nanotubes absorb them.

Vantablack also has other useful qualities: It withstands the stress from launching a rocket into space, long-term vibrations and extreme



Vantablack consists of a dense forest of carbon nanotubes suspended in plasma that's coated on materials like aluminum (magnified above) for easy application.

temperature fluctuations. Defense contractors are especially eager to get their hands on the material, no doubt due to its ruggedness and potential for stealth weaponry. More peacefully, astronomers hope it can improve telescope accuracy by reducing stray light within their instruments. — AMY KRAFT



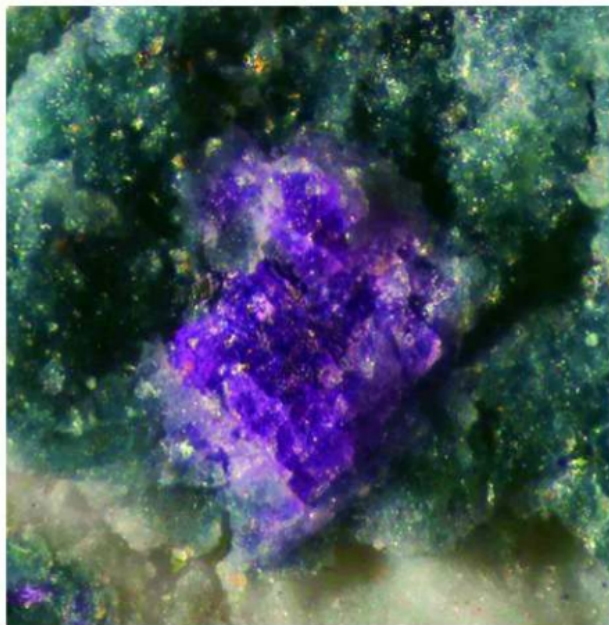
Via its system of carbon nanotubes, Vantablack absorbs 99.96 percent of light.

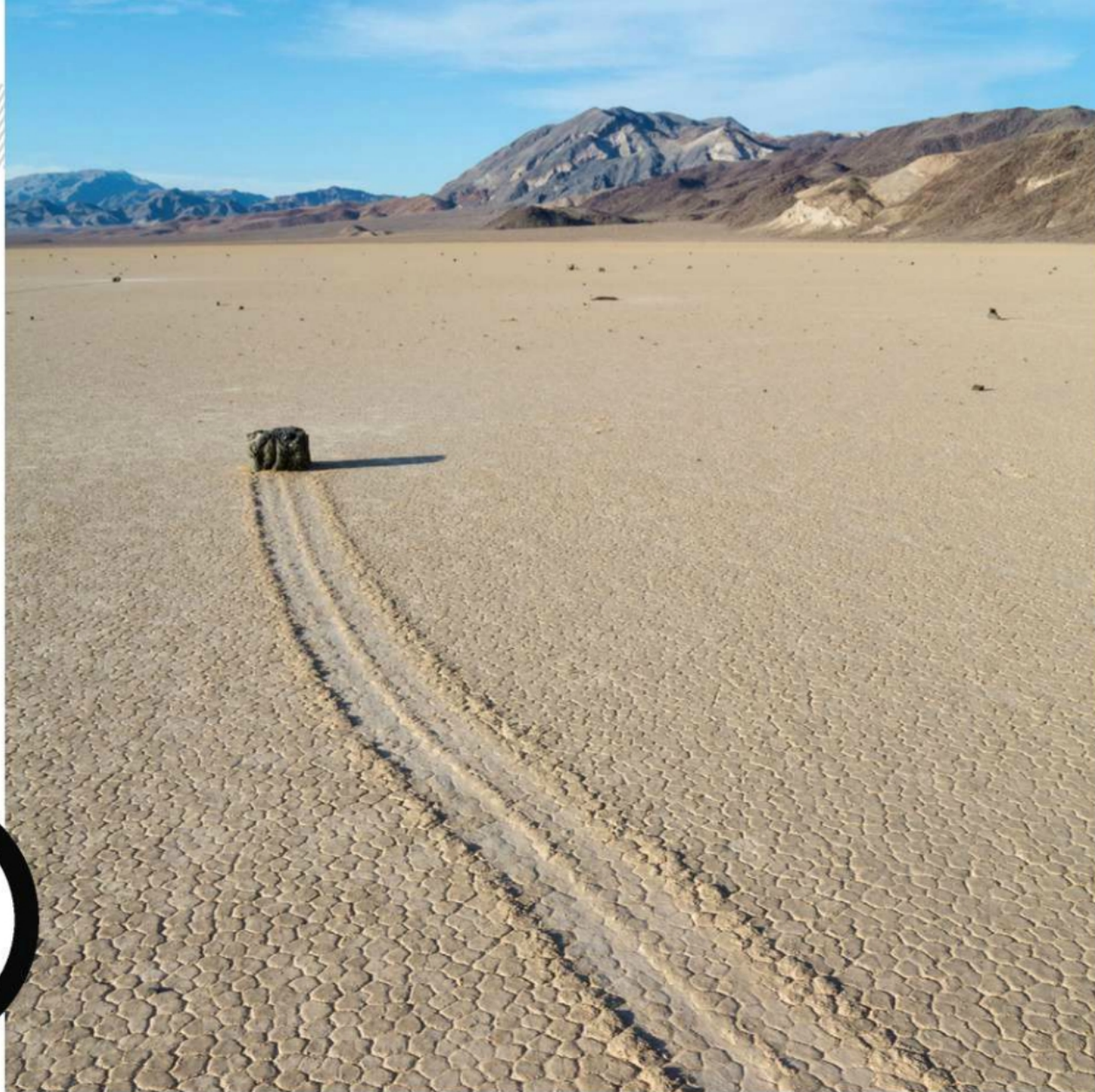
A Rock Like No Other

→ When a Western Australian mining company stumbled across some strange-looking purple-pinkish rocks in 2006, it handed them over to geologist Peter Elliott of the South Australian Museum. Eight years of analysis later, Elliott announced in April that it was a previously unknown mineral, which he dubbed putnisite, after mineralogists Christine and Andrew Putnis.

Putnisite has both style and substance: The shimmering mineral has an otherworldly look, and while most new minerals are chemically or structurally related to other known minerals or synthetic compounds, putnisite is unique on both fronts. — SARAH KOLLMORGEN

Putnisite combines the elements strontium, calcium, chromium, sulfur, carbon, oxygen and hydrogen in a novel way: $\text{SrCa}_2\text{Cr}_8^{3+}(\text{CO}_3)_8\text{SO}_4(\text{OH})_{16} \cdot 25\text{H}_2\text{O}$.





Death Valley's 'Sailing Stones' Riddle Solved

➔ Death Valley National Park is home to a natural wonder that's baffled scientists for decades: large rocks that mysteriously trudge across a barren lakebed, leaving trails in their wake. In August, researchers announced they had caught the "sailing stones" moving on camera, thus solving the riddle.

According to data collected from a weather station,

GPS-embedded rocks and time-lapse photography, a perfect balance of sun, rain, wind and ice sets the rocks in motion. When the sun's heat broke apart ice that had formed atop a pond, the wind pushed the large, yet thin, sheets of ice into the rocks. Ice accumulated behind the stones, providing the push necessary for the rocks to "sail." — CARL ENGELKING



These time-lapse photos from Jan. 9, 2014, capture a "sailing stone" (denoted by the red arrow) moving across the lakebed very quickly — 18 seconds in this case. A combination of ice, sun and wind causes the rocks to move.