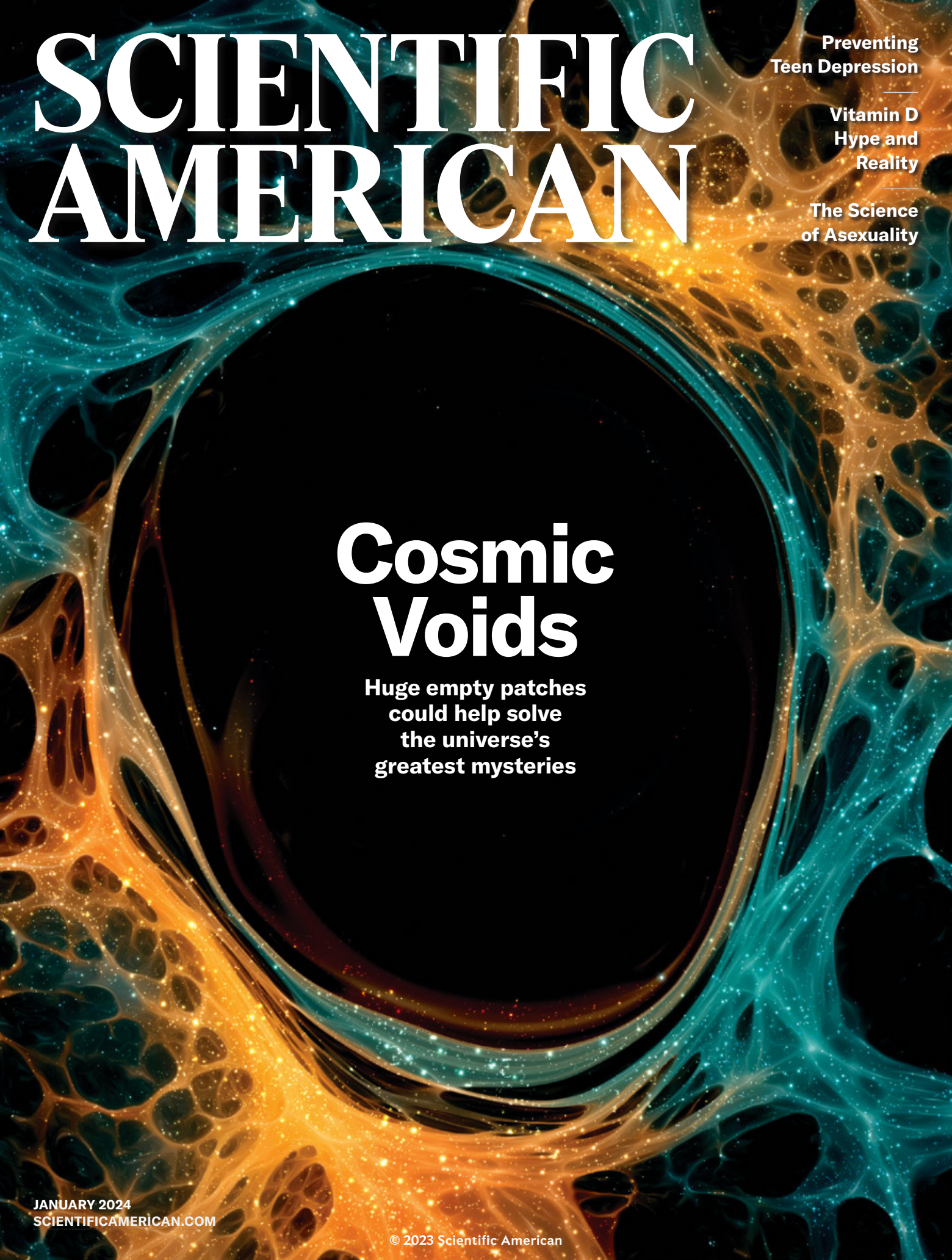
SCIENTIFIC AMERICAN

Preventing Teen Depression

Vitamin D Hype and Reality

The Science of Asexuality



Cosmic Voids

Huge empty patches could help solve the universe's greatest mysteries

JANUARY 2024
SCIENTIFICAMERICAN.COM

Sophia Agrobiotech Institute, who was not involved with the research. "But I think they need to confirm this claim," he says, because the researchers haven't yet located these potentially stolen genes in the worm's genome. The new study confirmed only that they were present in the parasite's tissue samples, and it is still possible that some of these genes were just contamination from the mantid, Danchin says.

"We should reserve judgment on the role and extent of horizontal gene transfer until a whole genome sequence is available that confirms that the transcripts are correctly attributed to the mantid and the worm," says Julie Dunning Hotopp, a microbiologist at the University of Maryland Baltimore, who was not involved with the study.

Sato plans to check the parasites' genome next. "The mechanism of horizontal gene transfer in *C. fukuii* is still a huge mystery," he says. "By investigating genomes of *C. fukuii* and its mantid host," he hopes to get closer to unraveling it.

—Darren Incorvaia

prevent the mtDNA from degrading.

If mtDNA sticks around in sperm's mitochondria, it could become a source of infertility. Previous studies showed that people with decreased sperm counts and motility have elevated amounts of mtDNA in those cells.

Mouse studies have indicated that TFAM is absent in sperm's mitochondria, says Xinnan Wang, a mitochondrial cell biologist at the Stanford University School of Medicine. The new study, along with prior research in other animals that found paternal mtDNA can be eliminated after egg fertilization, "shows multiple mechanisms that may contribute to maternal mitochondrial inheritance in different organisms," she says.

Temiakov says there are probably other, yet unidentified mechanisms that regulate mtDNA in different cells and that might contribute to mitochondrial diseases if disrupted. "We need to uncover these mechanisms," he says, "to better understand mitochondrial diseases and how to treat them." *—Sneha Khedkar*

Pablo Carlos Budassi (*composite*); ESO/Serge Brunier (*background*)

Hot and Heavy A very dense exoplanet found in the "hot Neptune desert"

ASTROPHYSICS A bizarrely dense exoplanet located more than 500 light-years from Earth is challenging scientists' understanding of how planets form. This astronomical body, recently described in *Nature*, is the size of the ice giant Neptune but nearly 10 times heavier—meaning it is denser than steel.

"It's impossible for a planet like this to have formed by classical planetary formation models," says lead study author Luca Naponiello, a Ph.D. candidate at the University of Rome Tor Vergata. Named TOI-1853 b, the planet is also oddly close to its sun; it rockets around the star once every 1.24 days. Neptune-size worlds are so rarely found in such tight orbits that astronomers have labeled these planet-sparse zones "hot Neptune deserts."

The bigger mystery, though, is how TOI-1853 b got so dense. Astronomers think planets usually form "bottom-up," with grains of rock and dust in a whirling protoplanetary disk glomming on to one another in ever larger clumps, eventually assembling a hefty core. But when that core reaches a certain critical mass, a buildup of pressure in the protoplanetary disk begins pushing additional planet-building material away, stifling further growth. TOI-1853 b seems to have somehow shot right past this limit—it has twice the amount of solid material that researchers believed could accumulate into a single object.

If conventional models can't explain TOI-1853 b, what can? Naponiello and his co-authors propose two possibilities. First, the planet may have emerged from the collision of two preexisting protoplanets. Such collisions are expected in a planetary system's early epochs, but they are more likely to leave behind multiple planets than to result in a single, larger world, Naponiello says.

The second possibility is that TOI-1853 b began as a gas giant about the mass of Jupiter before losing most of its atmosphere to intense stellar radiation, ending up as a stripped-down solid core. Indeed, if this planet once had a sizable atmosphere, very little remains. That makes it unique even among Neptune-size planets, says astronomer Chelsea Huang of Australia's University of Southern Queensland. Huang finds the gas-giant theory particularly intriguing, as such planets' thick atmospheres typically obscure what's happening deeper inside. If TOI-1853 b once was a gas giant, then "this is the only way we can actually observe [a gas giant's] interior," Huang says.

Future analysis of the planet's remaining atmosphere could reveal whether either of these hypotheses is correct. If TOI-1853 b was formed by collisions, researchers would expect its atmosphere to include water and other volatile compounds. If instead it was once a gas giant, they would expect to see a relatively thin, hydrogen-dominated atmosphere.

—Allison Gasparini