CIENCIA Y TECNOLOGÍA

New Pills Offer Hope in Fight Against Covid

By CARL ZIMMER

As the world worries that the Omicron coronavirus variant may cause a surge of cases and weaken vaccines, drug developers have some encouraging news: Two new Covid-19 pills are coming soon, and are expected to work against all variants of the virus.

Merck and Ridgeback Biotherapeutics made a pill called molnupiravir that reduces the risk of hospitalization and death from Covid-19 by 30 percent if taken within five days of the onset of symptoms.

An antiviral pill developed by Pfizer may perform even better. An interim analysis showed that the drug, called Paxlovid, was 85 percent effective when taken within five days of the start of symptoms.

Since the start of the pandemic, scientists have hoped for convenient options like pills that could be prescribed by any doctor and picked up at a local drugstore.

The scramble for Covid-19 pills started last year. At pharmaceutical companies and academic labs, researchers screened thousands of existing drugs to see if any worked against SARS-CoV-2, the virus that causes Covid-19. What followed was a wave of failures.

Merck's new drug, molnupiravir, was studied in 2019 as a treatment for Venezuelan equine encephalitis virus. When molnupiravir encounters a virus's genes, it wreaks havoc, leading to new mutations. New viruses are often left unable to replicate.

An advisory committee of the U.S. Food and Drug Administraiton discussed the potential for the drug to cause mutations in people's DNA. The committee voted to recommend authorizing molnupiravir, but only by a slim majority. And even those who voted in favor expressed reservations, given the potential side effects.

Pfizer's drug is next to enter the spotlight. Its origins reach back nearly two decades, when researchers were searching for a drug that could fight the coronavirus that caused SARS. They built a molecule that could block an essential viral protein, known as a protease. Proteases cut long molecules into pieces that help build new viruses. The drug lodged in the protease and proved effective against SARS when given intravenously to rats.

The SARS epidemic ended before Pfizer could launch a clinical trial. But after the pandemic hit last year, the company modified the drug to work against the protease of the new coronavirus and tinkered with the molecule so it would work as a pill.

MERCK & CO., VIA ASSOCIATED PRESS

Unlike molnupiravir, Paxlovid does not introduce mutations, so it probably will not raise the same concerns.

While many protease-inhibitors have proved safe, however, some of them can also lock onto the proteases made by our own cells. Still, the short course of pills needed to stop Covid-19 may reduce any such risk from a drug like Paxlovid.

Sara Cherry, a virologist at the Perelman School of Medicine at the University of Pennsylvania, and her colleagues are mixing antiviral drugs to see how well they work against the coronavirus.

In tests on infected human cells, they have found that combining molnupiravir and Paxlovid creates a more powerful impact than either drug has on its own.

Through the newly formed Antiviral Program for Pandemics, the U.S. National Institutes of Health will have $3 billion to fund academic research centers developing new drugs.

Coronaviruses produce a host of proteins essential for their replication, and each could be a target of a new drug. Other researchers are aiming to attack the genetic material of the viruses themselves. If any of these experimental drugs prove effective, they could open the way for even more potent combinations.

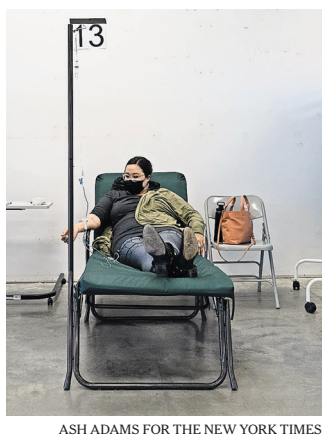
"You want to hit the virus from every single side," said Dr. Mark Denison, a virologist at Vanderbilt University Medical Center in Tennessee. "You want to slash the tires and foul up the engine and screw up the brakes."

At the Walter Reed Army Institute of Research in Maryland, researchers are trying to build a pill that will work against all coronaviruses by looking for targets common to all coronavirus proteases. They screened 41 million compounds with the help of a computer trained to recognize potential drugs.

They ran experiments on the 800 best candidates and ended up with just a few top contenders, which they are now testing in mice. But because the team is making a drug from scratch, they will not be able to move as fast as Merck or Pfizer toward an authorized pill. "It could be a matter of a few years, if resources permit," said Lieutenant Colonel Brandon Pybus, one of the researchers.

Dr. Anthony Fauci, the U.S. government's top infectious disease expert, and his colleagues intend to use the same strategy to search for pills that work on other viral families.

"I have a great deal of confidence," Dr. Fauci said, "in the creative ability of the investigators that are out there, some with crazy ideas, and some with ideas that look crazy that turn out to be really, really good."



ASH ADAMS FOR THE NEW YORK TIMES

Pills to treat Covid-19 would be more convient than antibody treatments given intravenously.

Hubble Checks Out Our Distant Planets

By DENNIS OVERBYE

You don't need a weatherman to know which way the wind blows on Jupiter. All you need is the keen eyesight of the Hubble Space Telescope for a close-up look at the candy-colored ribbons of clouds and storms on the face of the solar system's largest planet.

Every year the Hubble is deployed to make a visual "grand tour" of Jupiter, Saturn, Uranus and Neptune. NASA calls this the Outer Planets Atmospheres Legacy program, and it lets planetary scientists and astronomers on Earth see what has changed and what hasn't in something like a cosmic weather report.

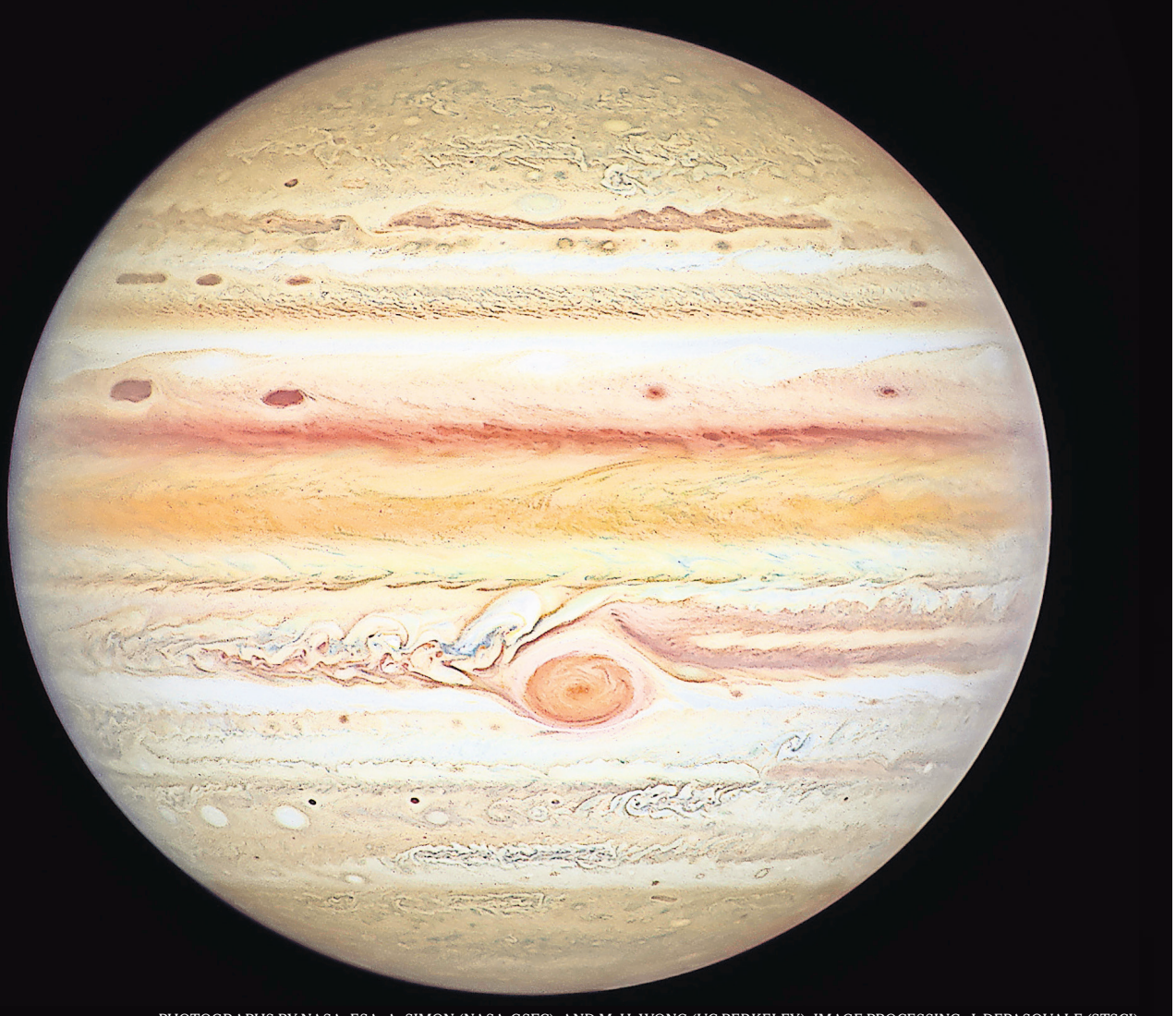
Last month, NASA released photos from this year's grand tour. The gallery of portraits of the planets with all their brisk stripes, ethereal rings, giant storms and raging winds bears witness to the endless ability of nature to surprise and charm us. The results, NASA says, will help scientists understand the dynamics of huge gas giant planets both in our own solar system and around other stars, as well as provide insights into how Earth's atmosphere works.

And the planets are pretty to look at, too. The most prominent feature among Jupiter's cloud tops is the Great Red Spot, an anticyclone bigger than Earth that has been swirling for more than 150 years at speeds of some 640 kilometers per hour. The new observations show that the winds at the center of the storm are continuing to slow, while the winds on the outer edges are speeding up. The spot is slowly changing its shape into a circle from an oval, and a series of new storms have formed to its south.

In the northern hemisphere of Saturn, it was early autumn when Hubble took this year's look at the ringed planet. A mysterious six-sided hurricane has reappeared around the planet's north pole. The storm, big enough to swallow four Earths, was first spotted by the Voyager spacecraft in the early 1980s.

Farther out, it is springtime on Uranus, which goes around the sun tilted on its side relative to the other planets. This means that its north polar region is aimed right at the sun.

As a result, the planet's northern latitudes are being bathed in ultraviolet light from the sun and are glowing like a light bulb. The researchers suspect that the brightening results from changes in the concentration of methane gas, a major component of Uranus's atmosphere, and smog, as well as wind patterns around the pole.


PHOTOGRAPHS BY NASA, ESA, A. SIMON (NASA-GSFC), AND M. H. WONG (UC BERKELEY); IMAGE PROCESSING: J. DEPASQUALE (STSCI)

The winds are changing in the Great Red Spot, Jupiter's prominent anticyclone. Left, Uranus's northern latitudes are being bathed in ultraviolet light. A mysterious hurricane has reappeared on Saturn, below.

Neptune beckons with the seductive deep blue of the ocean. But its color comes from methane, not water. The solar system's eighth planet is also prone to storms, high-pressure regions that resemble dark blurs or bruises on its surface. They were discovered in 1989 when Voyager 2 went past Neptune.

Typically these storms appear in the mid-latitudes and drift to the planet's equator, where they weaken and then disintegrate.

In 2018, Hubble spotted a massive dark spot drifting southward toward the equatorial "killing zone," in Neptune's northern hemisphere.

Two years later, however, to the astonishment of astronomers and computer simulations, the storm had reversed course and was heading back north. Moreover, the reversal had coincided with the appearance of a new, slightly smaller storm called "Dark Spot Jr." to the south — perhaps a piece of the larger vortex that had split off, taking away energy and momentum.

"It was really exciting to see this one act like it's supposed to act and then all of a sudden it just stops and swings back," said Michael Wong, a research scientist at the University of California, Berkeley, in a news release from NASA last year. "That was surprising."

In the most recent Neptune portrait, the large dark spot is still there in the north. But Junior has vanished, and the entire north pole region is dark. The Neptune weather forecasters still don't know why.

Savor these cosmic postcards while you can. The Hubble Space Telescope has been up there for more than 30 years, long past its planned service life, and it has been having more frequent troubles lately. Three times this year, the telescope endured extended shutdowns because of software problems.

But there is potentially good news coming with the launch of the James Webb Space Telescope this month. It is almost three times bigger than Hubble. It is designed to see infrared or "heat" radiation rather than visible wavelengths, and thus can see through the clouds and hazes of these planets and map the heat below, shedding light on how these planets work.

For a while anyway, if all goes well, astronomers could have two complementary ways of understanding what is going on out there.

This Ink Is Alive, Made Entirely of Microbes

By SABRINA IMBLER

The thought of combining a printer (the bane of office workers) with the bacterium E. coli (the scourge of romaine lettuce) may seem an odd, if not unpleasant, collaboration.

But scientists have melded the virtues of the infuriating tool and of the toxic microbe to produce an ink that is alive, made entirely from microbes. The microbial ink flows like toothpaste under pressure and can be 3D-printed into tiny shapes — a circle, a square and a cone — all of which hold their form and glisten like Jell-O.

The researchers described their recipe for their ink last month in the journal Nature Communications.

Scientists have previously created printable gels that were cocktails of bacteria and polymers that helped provide structure when printed. But the new substance contains no additional polymers; it is produced entirely from genetically engineered E. coli bacteria. The researchers induce bacterial cultures to grow the ink, which is also made of living bacteria cells. When the ink is harvested from the liquid culture, it becomes firm like gelatin and can be plugged into 3D-printers and printed into living structures, which do not grow further and remain in their printed forms.

"They developed this really nice engineered platform where the microbes secrete their own ink," said Sujit Datta, an engineer at Princeton University in New Jersey not part of the team. "The microbes are creating the material themselves — you just have to feed them and keep them happy."

Bacteria may seem an unconventional building block.

A new technology with potentially grand ambitions.

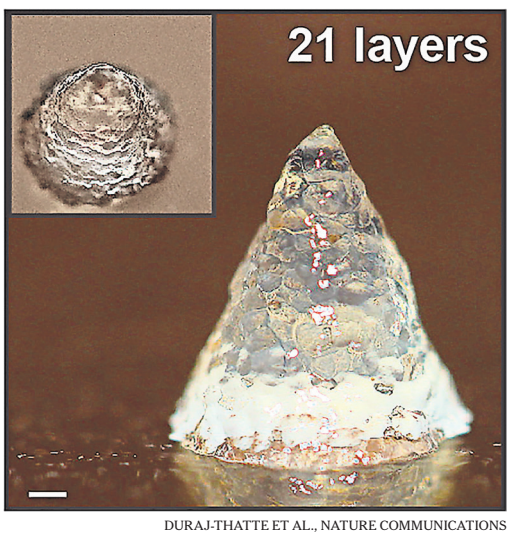
But microbes are a crucial component of products such as perfumes and vitamins, and scientists have already engineered microbes to produce biodegradable plastics.

A material like a microbial ink has more grandiose ambitions, according to Neel Joshi, a synthetic biologist at Northeastern University in Boston and an author on the paper. Such inks are a new focus of the field of engineered living materials. Unlike structures cast from concrete or plastic, living systems would be autonomous, adaptive to environmental cues and able to regenerate — at least, that is the aspirational goal, Dr. Joshi said.

"Imagine creating buildings that heal themselves," Dr. Datta said.

To Dr. Joshi, the best analogy may be a seed's transformation into a tree. A seed has all the information it needs to harvest the energy of the sun and organize its growth into a tree. In an engineered living system, a single engineered cell could function like a seed.

Many engineered living materials take the form of hydrogels, structures that can absorb large quantities of water, like gelatin. In 2018, Dr. Joshi and Anna Duraj-Thatte, an engineer at Virginia Tech and an author on the new paper, successfully created a hydrogel entirely from E. coli that could grow and regenerate. Although the hydrogel could be squeezed through a syringe, it was not stiff enough to stand on its own.



DURAJ-THATTE ET AL., NATURE COMMUNICATIONS

When printed into discrete shapes, such as a cone, microbial ink remained stiff and did not sag or ooze.

Researchers firmed up the substance with fibrin, a polymer used in blood-clotting, and printed it into shapes and patterns to test its ability to hold its shape: a lattice grid, a box, a ring and a cone. The ink was squeezed like toothpaste from the printer but did not ooze or melt once printed.

Dr. Duraj-Thatte hopes to see the ink combined with tissue engineering, as it can be customized for medical applications. Dr. Joshi suggested the ink could eventually offer a greener, renewable way to construct buildings.