Science & Technology

Scientists Discover 'Gate' that Opens To Allow COVID-19 Infection

Since the early days of the COVID-19 pandemic, scientists have aggressively pursued the secrets of the mechanisms that allow severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)—the virus that causes COVID 19 disease—to enter and infect healthy human cells.

Published in *Nature Chemistry* Aug. 19, a new study by a team led by Rommie Amaro, a computational biophysical chemist at the University of California, San Diego, describes the discovery of glycan "gates" that open to allow SARS-CoV-2 to enter a human cell. Glycans are molecules that make up a sugary residue around the edges of the spike protein on the virus to act as infection gateways.

"We've essentially unlocked an important secret of the spike, in how it infects cells. Without this gate the virus basically is rendered incapable of infection."

Amaro believes this discovery opens potential avenues for new therapeutics to counter SARS-CoV-2 infection. If glycan gates could be pharmacologically locked in the closed position, then the virus is effectively prevented from opening to entry and infection.

New Sensor Detects Whether Virus Is Present, and Whether It's Infectious

Researchers have developed a sensor that integrates specially designed DNA fragments and nanopore sensing, to target and detect infectious viruses in minutes without the need to pre-treat samples. They demonstrated the sensor's power with two key viruses that cause infections worldwide: the human adenovirus; and SARS-CoV-2, the virus that causes COVID-19 disease.

"The infectivity status is very important information that can tell us if patients are contagious or if an environmental disinfection method works," said Ana Peinetti at the University of Illinois, Urbana-Champaign, the lead author of the study. "Our sensor combines two key components: highly specific DNA molecules and highly sensitive nanopore technology. A nanopore is a pore of nanometer size. We developed specific DNA molecules, named aptamers, that not only recognize viruses but can differentiate the infectivity status of the virus."

The "gold standard" of viral detection, the PCR (polymerase chain reaction) test, detects viral genetic material but cannot distinguish whether a sample is infectious or determine whether a person is contagious. This can make it more difficult to track and contain viral outbreaks, the researchers said.

The findings are reported in the journal *Science Advances*, Sept. 22.

Launch of Lucy Is Successful: Onward to Jupiter!

NASA's *Lucy* space vehicle was launched Oct. 16 from Cape Canaveral, Florida, atop a United Launch Alliance (ULA) Atlas V rocket.

Lucy's 12-year mission: Fly by one main-belt asteroid and seven Trojan asteroids, becoming the first single spacecraft mission to explore so many different asteroids. The so-called Trojan asteroids are a clump of tiny asteroids concentrated into "swarms" in two Lagrange points (L4 and L5) of Jupiter. They may be remnants of the material that formed giant planets. Studying them will reveal information about their formation and our solar system's evolution.

Lucy, named after a fossilized human ancestor found in Ethiopia's Great Rift Valley, is expected to arrive at her first target in 2027, and then continue, after two gravity-assists from Earth, to visit other asteroids in 2027 and 2033.

NASA Schedules Two More Important Launches

On Oct. 22, NASA announced the launch schedules for the James Webb Space Telescope and Artemis 1.

The Webb telescope is scheduled for launch Dec. 18. For the sweeping scientific importance of this telescope, see Janet West's article in the Oct. 29 issue of *EIR*.

Space.com reported Oct. 22 that Artemis 1, the first of four planned Moon-Mars missions leading to a permanent settlement on the Moon, is tentatively scheduled to launch Feb. 12, 2022. The mission, consisting of an uncrewed space capsule atop a Space Launch System (SLS) rocket, will travel around the Moon and return. The huge SLS is being developed by NASA to take astronauts to the Moon, Mars, and beyond.

Near-Earth Asteroid Activity Update

Several asteroids—from school-bus size to larger than the Pyramid of Giza—will be whizzing by Earth in the

coming days and weeks, according to the Jet Propulsion Laboratory (JPL), which manages NASA's Center for Near-Earth Object Studies.

An asteroid or comet is considered to be a Near-Earth Object (NEO) when it approaches our planet at less than 1.3 times the distance from Earth to the Sun, on average ~150 million km. Most NEOs pose no peril. The potentially hazardous asteroids are those that approach Earth at less than 5% of the Earth-Sun distance, ~7.5 million km. One such object, Asteroid 2021 SM3, discovered just in September, passed Earth on Oct. 15. Its diameter was ~160 meters, just a little bigger than the Great Pyramid of Giza, 147 meters in height.

One of the closest approaches occurred Oct. 16, when Asteroid 2021 TJ15 passed Earth at about one lunar distance (~385,000 km). That asteroid has a diameter of ~5.5-13 meters.

Asteroid 2004 UE, one of the largest, will make its closest approach Nov. 13 at a range of ~4.8 million km from Earth. At a diameter of around ~380 meters, it is nearly the size of the Empire State Building.

JPL's Asteroid Watch site explains: "Potentially hazardous asteroids are ~150 meters or larger, roughly twice as big as the Statue of Liberty is tall. They approach Earth's orbit to within 7.5 million km. By comparison, when Mars and Earth are at their closest, they are ~53 million km apart…. Knowing the size, shape, mass, composition and structure of these objects helps determine the best way to divert one, should it have an Earth-threatening path."

Award-Winning Corn Yields Refute Malthusian Lie that People Deplete the Earth

The current USDA-projected national average corn yield is 176 bushels per acre, a jump from 33.1 bushels in 1945, 86.4 in 1975, 113.5 in 1995 and 168.4 in 2015. This one fact alone refutes the green lies that population growth will outrun food growth. In early December, the national award-winner for the highest yield per acre will be announced, a competition which has been run for years by the National Corn Growers Association.

In 2019, Charles City, Virginia farmer David Hula produced 616.16 bushels of corn per acre (18.48 tons of shelled corn), the highest ever recorded in the national corn-yield contest and a world record. How did he do that?

All the corn is no-tilled, which means the soil is not plowed between fall harvest and spring planting, thus dramatically reducing soil erosion potential as the modern harvesters can shred all the corn stalks into 1-2 inch pieces and completely cover the soil with a blanket of organic matter, further protecting the soil from erosion by rain and wind. The shredded corn stalks also provide more surface area to microorganisms that eat and decompose the organic matter and burrow back into the soil to increase and incorporate the organic matter of the soil, increasing the availability of nutrients to corn plant roots. As yields go up, the biological fertility of the soil increases.

"No-tillers" have control over soil, fertility, and pest management, says Hula. This system, along with state-of-the-art mechanical, chemical, biological, and genetic technology, gives great yields.

Modern crops keep nitrogen in leaves longer, helping keep leaves green for continued photosynthesis. Corn yields benefited from several decades of genetic improvements before hybrids were widely used, and the increased yields required increases in nitrogen application. Purdue University research has found that, in the past 70 years, genetic enhancements have led to an 89% increase in grain yields and a 73% increase in nitrogen use efficiency from early hybrids to the modern day. They found that plants are capturing more fertilizer and nitrogen, helping create more grain. By retaining more nitrogen, less damage to groundwater and air quality occurs.

A chart showing the innovations that went into corn yield increases over the past 100 years is presented on page 37 in the new report, *The Coming U.S. Economic Miracle on the New Silk Road,* published by The LaRouche Organization.

Electric Current in Soil Measures Microbial Metabolism for Soil Health

Measuring soil health is not straightforward. Farmers and researchers use soil chemistry, nutrient analysis, texture and acidity measurements to gain understanding of soil's physical and chemical properties. While valuable, it doesn't always reflect how productive the soil actually is.

An essential feature of soil that makes it beneficial for a plant is that it is alive and contains bacteria and fungi. Billions of bacteria, fungi and other organisms play critical roles in nutrient mobilization and provisioning, defense against pathogens and plant growth. But until now, there has been no simple, real-time way to measure the microbial activity.

Scientists at Washington State University have now developed a way to assess soil health by measuring the electric current produced by its microbes. The team used a probe originally developed to measure the electrochemical signal of microbes in aquatic environments and tested it on healthy and unhealthy soil samples to measure microbial metabolism and other indicators of soil health.

The proof-of-concept research, published in the *Journal of The Electrochemical Society* Aug. 17, could lead to a simple, real-time test for farmers to determine this aspect of the productivity of soil.