Science & Technology Briefs

Antibodies Just Identified May Make Coronavirus Vaccines Unnecessary

In what may be a major scientific advance, a team of scientists at Tel Aviv University in Israel has isolated two antibodies that they say neutralize all known strains of COVID-19—including Delta and Omicron—with up to 95% efficiency. If so, treatments using these antibodies may make repeated booster shots for new variants unnecessary. This would be good news, especially for at-risk populations such as those with weakened immune systems.

Dr. Natalia Freund of the Department of Clinical Microbiology and Immunology at the Sackler Faculty of Medicine led the research, whose study results are presented here in the Aug. 5 issue of the *Nature* journal *Communications Biology*.

Science Daily reports that, according to Dr. Freund:

"In the previous study, we showed that the various antibodies that are formed in response to infection with the original virus are directed against different sites of the virus. The most effective antibodies were those that bound to the virus' 'spike' protein, in the same place where the spike binds the cellular receptor ACE2. The global health system made extensive use of them until the arrival of the different variants of the coronavirus, which rendered most of those antibodies useless.

"In the current study, we proved that two other antibodies, TAU-1109 and TAU-2310, which bind the viral spike protein in a different area from the region where most of the antibodies were concentrated until now (and were therefore less effective in neutralizing the original strain) are actually very effective in neutralizing the Delta and Omicron variants. According to our findings, the effectiveness of TAU-1109 in neutralizing the Omicron strain is 92%, and in neutralizing the Delta strain, 90%. TAU-2310 neutralizes the Omicron variant with an efficacy of 84%, and the Delta variant with an efficacy of 97%."

The surprising effectiveness of these antibodies might be related to the evolution of the virus. Again, Dr. Freund:

"We need to look at the COVID-19 pandemic in the context of previous disease outbreaks that humankind has witnessed. People who were vaccinated against smallpox at birth and who today are 50 years old still have antibodies, so they are probably protected, at least partially, from the monkeypox virus that we have recently been hearing about.

"Unfortunately, this is not the case with the coronavirus. For reasons we still don't yet fully understand, the level of antibodies against COVID-19 declines significantly after three months, which is why we see people getting infected again and again, even after being vaccinated three times. In our view, targeted treatment with antibodies and their delivery to the body in high concentrations can serve as an effective substitute for repeated boosters, especially for at-risk populations and those with weakened immune systems."

China Announces Green Light for Lunar Missions Chang'e 6, 7, and 8

On Sept. 10, Liu Jizhong, director of the China Lunar Exploration and Space Program Center, told CCTV that China's National Space Administration was now authorized by the State Council to proceed with Phase 4 of China's lunar program, consisting of Chang'e-6 (sample return), Chang'e-7 (orbiter, lander, rover, probe), and Chang'e-8 (technology tests and surveys) over the next 10 years.

The overall mission is to explore the South Pole of the Moon for an appropriate spot for a lunar base. The Chang'e-6 module, with a sample retrieval capability, is basically completed and will travel to the far side of the Moon. The Chang'e-7 is under development; it will pursue a broad range of investigations, including the surface environment of the South Pole.

Wu Weiren, chief designer of the Chinese lunar exploration program, explained to *Global Times* why China has chosen the South Pole for a lunar base: The near side of the Moon reaches temperatures of +200° Centigrade and the far side reaches temperatures of −200°C, neither of which is suitable for long-term human activity, he said, adding that—

"The South Pole region is also subject to the polar day night phenomenon, [but] during the polar day, there would be more than 180 days of continuous daylight, which would support long-term work on the Moon surface, and which explains why we intend to build the station there."

Parts of the south polar region have temperature maxima up to –23°C.

A New Mineral Among the Finds in Lunar Soil

Liu Jizhong's announced Phase 4 of China's lunar program came only one day after China became the third country (after the United States and

the former Soviet Union) to discover a new lunar mineral, which was named Chang'esite-(Y), according to a Sept. 9 *Global Times* article.

China's Chang'e-5 mission retrieved samples from the Moon in 2020. Chang'esite-(Y) has been described as a "phosphate mineral in columnar crystal" found in lunar basalt particles. Scientists from Beijing Research Institute of Uranium Geology isolated a single crystal particle with a radius of about 10 microns by X-ray diffraction from the 140,000 lunar sample particles. The mineral contains the isotope Helium-3, the fuel of choice for an advanced fusion reactor.

In addition to the discovery of Chang'esite-(Y), Chinese researchers at Nanjing University investigating lunar soil samples have found active compounds that can convert CO_2 into oxygen and hydrogen. In particular, they have found samples containing iron-rich and titanium-rich substances which could work as a catalyst to make oxygen using sunlight and CO_2, two of the most abundant resources on the Moon.

The compounds could serve to provide oxygen for astronauts' space suits and living quarters. The Nanjing team proposed a strategy using lunar soil to electrolyze water from the Moon and the astronauts' life support systems into oxygen and hydrogen. The process is powered by sunlight. CO_2 exhaled by Moon inhabitants can be collected and combined with hydrogen to yield the fuel methane, also catalyzed by lunar soil, according to the study.

With this method, no external energy apart from sunlight would be used to produce oxygen and fuel to support life on a Moon base, say the researchers.

At the Institute of Geochemistry of the Chinese Academy of Scientists, researchers have discovered water in samples delivered from the far side of the Moon.

Using infrared spectroscopy and nanoscale secondary ion mass spectrometry, the team found a large amount of solar wind-derived water in the samples' mineral surface, and estimated a minimum of 170 parts per million (ppm) water content attributed to solar wind proton implantation in lunar soils.

The analysis was published in the Sept.10 *Nature Communications*.

Houston House Built with 3-D Printing

Houston, Texas will become the first American city to have a 3-D printed home. A team of innovators, in collaboration with building industry partners, are constructing a 4,000-square-foot two-story, single-family home in Houston, Texas using 3-D (additive) concrete printing combined with wood framing.

This hybrid construction approach allows the two material systems to be used strategically and aims to increase the applicability of 3-D printing in America, where wood framing is one of the most common construction methods.

The project's primary architects are Leslie Lok and Sasa Zivkovic, co-principals of H.A.N.N.A.H., an experimental design practice, and assistant professors at Cornell University's College of Architecture, Art, and Planning. They are working with PERI 3D Construction, an international provider for 3-D construction printing equipment; and CIVE, an engineering and design/build contractor.

"The building system is structurally efficient, easily replicable, and materially responsive," Lok and Zivkovic told *Builderonline*.

"These design efforts aim to increase the impact, applicability, sustainability, and cost efficiency of 3-D printing for future residential and multifamily buildings in the U.S."

Using the COBOD BOD2 gantry printer, the project takes advantage of the printer's modularity for the building's design, conceptualized as a series of printed cores that contain functional spaces and stairs. The spatial cores are connected by wood framing to produce an architectural alternation of concrete and framed interiors.

"We are incredibly proud to not only showcase the possibilities of the BOD2 3D-construction printer but also our extensive know-how in planning, engineering, and printing on this project, which is the seventh and largest one we printed so far," says Fabian Meyer-Brötz, CEO of PERI 3D Construction.

Bolivia Now Has Three Nuclear Medicine Centers

Bolivian President Luis Arce on Sept. 23 inaugurated the country's third nuclear medicine center, this one in the southeastern city of Santa Cruz. The other two are in El Alto and La Paz. A joint project of the Bolivian Nuclear Energy Agency (ABEN) and Argentina's high-tech company INVAP, the new center, a $50 million investment, possesses state-of-the-art technology (PET/CT—Positron Emission Tomography and Spect/CT—simple photon emission) to diagnose and treat cancer, with an array of other specialized radiotherapy and chemotherapy capabilities.

ABEN director Hortensia Jiménez reports the new center can treat 120 patients a day and will open with a multi-disciplinary staff of 40 doctors, physicists, technicians and engineers. All treatment will be free of charge, under Bolivia's Single Health System, established by Evo Morales when he was president, *Prensa Latina* reports. All work on this center was shut down during the one-year coup government (2019-2020), but was restarted after Luis Arce became President in October 2020.