Science & Technology Briefs

Human SARS-CoV-2 Virus in White-Tailed Deer and Other Animal Species

New studies in Iowa and four other states have discovered human SARS-CoV-2 virus in hundreds of white-tailed deer. Although the scientists have not proven that humans were the transmitters, they think it very likely. SARS-CoV-2 has also been found in cats, mice, skunks, gorillas, snow leopards, and mink on mink farms, in the U.S. and Denmark.

A research team from Penn State University working with the Iowa Department of Natural Resources—which performs disease surveillance of white-tailed deer—conducted the survey, testing deer lymph node samples for infection. One study, conducted April 2020 through December 2020, found 33% of 283 lymph node samples, collected from deer from across Iowa, SARS-CoV-2 positive.

A second test, conducted Nov. 23, 2020 to Jan. 10, 2021, found that 82.5% of the white-tailed deers' lymph nodes tested positive, indicating a rapid spread of coronavirus in the deer population.

Human-animal transmission of coronavirus—if it indeed is happening—is potentially a very threatening development, as the deer and other animals would become a reservoir for the deadly SARS-CoV-2, in which new variants could be incubated and possibly be transmitted back to humans.

Hon Ip, a scientist at the U.S. Geological Survey in Wisconsin, told CNN.com Nov. 17: "[W]e don't know what's going on in our very own country and we need to find out." Ip and his colleagues tested animals they had found around a mink farm that was the site of an outbreak of SARS-CoV-2 in Utah.

The Nov. 2 *New York Times* reported:

"In the case of mink, the coronavirus has already demonstrated an ability to sicken animals infected by humans, and last year, Denmark slaughtered its entire population of 17 million farmed mink after scientists discovered they could pass the virus back to people."

"Recombination is one of the major mechanisms for coronavirus evolution," says Ip. If animals are already carrying their own varieties of coronavirus, and people then infect them with strains that cause pandemics among humans, "the potential exists for these viruses to infect animals at the same time, [to] trade genetic material, and give rise to new pandemic viral species."

In the United States today are about 35 million white-tailed deer, an estimated 100 million cats, and countless skunks and mice. Mink farms in 23 states produce about 1 million pelts per year.

The findings were verified by federal scientists at the National Veterinary Services Laboratories.

Japanese Study: Delta Out-Mutated Itself

While the percentage of Japanese who are vaccinated against COVID-19 is high, and they cooperate well in social distancing and masking, the *Japan Times* of Nov. 18 reported a possible fascinating development. Ituro Inoue, a geneticist at Japan's National Institute of Genetics, reported that it seems the Delta variant, after clearing out the other variants, eradicated itself!

Examining viral specimens from June to October, 2021, the study found a lack of genetic diversity, yet many genetic changes in a particular site (A394V). That site is thought to be linked to a specific protein, nsp14, which is key for the virus' reproduction. While high mutation rates helped the virus, making it very adaptable, mutations unfavorable to the virus also piled up. Supposedly, nsp14 helps keep that pileup from happening. It is thought that the malfunctioning of the nsp14 allowed for mutations that ended the virus's career. Inoue declared:

"We were literally shocked to see the findings. The Delta variant in Japan was highly transmissible and [was] keeping other variants out. But as the mutations piled up, we believe it eventually became a faulty virus and it was unable to make copies of itself."

Japan is not off the hook, however, from exposure to COVID-19. As of Dec. 22, Osaka had become the first community transmission location for the Omicron variant.

Europe's First New EPR Nuclear Reactor Reaches Criticality

On Dec. 21, Finland's fifth nuclear reactor, Olkiluoto 3 (OL3), achieved first criticality, that is, initiated a sustaining fission chain reaction. When the unit is connected to the national grid in February, it will produce about 14% of the country's electricity.

Owned and operated by Teollisuuden Voima (TVO), this European Pressurized Water Reactor (EPR) is the first new nuclear unit to be commissioned in Finland in 40 years.

"I congratulate TVO and all its partners on the completion of Olkiluoto 3," World Nuclear Association Director General Sama Bilbao y Léon said. "This reactor will serve the people of Finland for many decades, providing abundant, round-the-clock, clean, reliable and affordable electricity—the importance of which we are painfully reminded of right now."

For Olkiluoto 3, France's Framatome ANP 1600 MWe EPR was selected as the preferred reactor, based on operating cost, and Germany's Siemens was selected to provide the turbines and generators. TVO signed a €3.2 billion fixed-price, turnkey contract with Areva NP and Siemens for the unit nearly two decades ago, in December 2003, and construction began in 2005. Commercial operation was originally scheduled for 2009, but the project encountered various delays and setbacks due to excessive outsourcing and never-ending changes of security procedures.

The first EPR units to come online in the world were at Taishan in China, where Unit 1 entered commercial operation in 2018, followed by Taishan 2 in September 2019. In Europe, EPRs are currently under construction in France and the UK: Flamanville 3 is currently expected to start up in 2023 with commercial operation in 2024; and two units at Hinkley Point C are currently slated for commercial operation in 2026 (No. 1) and 2027 (No. 2).

Lasers for Space Communications

In a release dated Dec. 7, NASA reported the successful launch of a new mission to develop laser communications in space to improve the efficiency, reliability, and bandwidth of communications, which will be especially important for missions to the Moon, Mars and beyond. Until now, space communications have relied on radiowaves.

The Laser Communications Relay Demonstration (LCRD) launched Dec. 7 went to geosynchronous orbit (35,786 km, 22,236 miles from Earth), where it will conduct tests for at least two years.

In a video posted Dec. 1, by Space.com, Jason Mitchell, Director of SCaN Advanced Communications & Navigation Technology Division at NASA, said: "This will be our first foray into understanding what it means to use lasers to communicate and relay contacts directly to Earth and space users, and look at the effects of that on operational systems, worrying about atmospheric effects—things like turbulence, clouds which can block lasers, site diversity."

Newly announced private space stations will only expand the need for fast information flowing to and from Earth. Meanwhile, astronauts on the Moon and a sample-return mission on Mars could benefit from laser communications that will be 10 to 100 times faster than current radio.

The expanded communications capability will also be critical for near-Earth communications, as current bandwidths available in the radio frequency spectrum are fast filling up.

New Study Solves Mystery of How Cells 'Eat'

A new study, published Nov.12, 2021 in *Developmental Cell* and reported on Dec. 30, 2021, by *Ohio State News*, showed that the intercellular machinery of a cell assembles into a highly curved basket-like structure in order to consume things around it. Scientists had previously believed that structure began as a flat lattice. The membrane curvature is important, because it controls the formation of the pockets that carry substances into and out of a cell; how these pockets formed had been unsolved over the last 40 years of research.

"The pockets capture substances around the cell, forming around the extracellular substances, before turning into vesicles—small sacs one one-millionth the size of a red blood cell. Vesicles carry important things for a cell's health—proteins, for example—into the cell."

The difference in this study was that the researchers took videos of the cells, rather than relying on still photos. Comert Kural, associate professor of physics at Ohio State University, and lead author of the study, commented, "We were able to use super-resolution fluorescence imaging to actually watch these pockets form within live cells, and so we could answer that question of how they are created."

Vesicles are tiny sacs within the cell containing gas, liquid or protein molecules, surrounded by an outer membrane called the lipid bilayer. There are several types, and each type serves a particular function within the cell for different biological functions. The main types are transport (carrying materials from one part of the cell to another), digestive, secretory (moving molecules out of the cell), and extracellular (existing outside of the cell and able to communicate between cells).

These processes break down under conditions of a number of diseases, including cancer. Again, Kural: "Understanding the origin and dynamics of membrane-bound vesicles is important—they can be utilized for delivering drugs for medicinal purposes but, at the same time, [be] hijacked by pathogens such as viruses to enter and infect cells. Our results matter, not only for our understanding of the fundamentals of life, but also for developing better therapeutic strategies."

The scientists were from Ohio State University, UC Berkeley, UC Riverside, Iowa State University, Purdue University, and the Chinese Academy of Sciences.