Science & Technology Briefs

An Oral COVID Antiviral For Global Distribution

Merck Canada announced Dec. 6, according to a CTV News report, that it is "partnering with Thermo Fisher Scientific to manufacture its COVID-19 antiviral drug in Canada for global distribution." Ottawa hopes this deal "will help jump-start the country's position as a bio-manufacturing center and better secure its supply chain for future public health emergencies."

The Thermo Fisher facility in Whitby, Ontario "will produce doses of molnupiravir, an investigational drug developed in collaboration with Ridgeback Biotherapeutics, for distribution in Canada, the UK, the European Union, the Asia Pacific, and Latin America, pending approvals in those respective regions. The drug is awaiting approval by Health Canada."

The company says its oral pill reduces the risk of hospitalization or death by about 30% for at-risk, non-hospitalized adult patients with mild or moderate infection—sharply less, unfortunately, than the 50% reported in the initial data.

In a narrow vote, a panel of expert advisers to the U.S. Food and Drug Administration (FDA) recommended the drug be authorized for treatment of COVID-19, but expressed concerns over whether it could cause the virus to mutate, and over its potential to cause birth defects. Studies in rats showed the drug, when given at very high doses, caused toxicity and birth defects.

According to the CTV report, "While Merck has yet to conduct specific research on the medication's effectiveness against the Omicron variant, the company appeared confident that it should have some potency based on its effectiveness against other variants. Final authorization for emergency use by the FDA and the Centers for Disease Control and Prevention (CDC) is pending."

A Gene for Severe COVID-19

"The Polish Health Ministry is planning to introduce a new type of screening for coronavirus after a gene was discovered that determines the likelihood of a patient suffering from severe or fatal COVID-19," according to a Jan. 13 press release from the Medical University of Bialystok.

Researchers from the university studied over 1,500 patients with COVID-19. Using genetic testing, they identified a gene in chromosome 3 that significantly influences how badly the virus will affect an individual. From the beginning of the pandemic, researchers have sought to understand why, even among people of similar age, some cases are asymptomatic while others fight for their lives. Thanks to this study, an understanding of this phenomenon is becoming clearer.

The gene is the fourth factor in indicating susceptibility to severe forms of COVID-19, coming after age, obesity and gender (men are more susceptible than women). "If at least one version of the gene is present in the chromosome, a patient is more than twice as likely to suffer the worst effects of COVID-19 or die," concludes the study, led by Prof. Marcin Moniuszko, (Medical University of Bialystok) and Associate Prof. Mirosław Kwaśniewski (Medical University of Bialystok, IMAGENE.Me).

"The findings will now be applied to help identify patients at increased risk from the virus when or even before they contract the infection. The Health Ministry plans to develop and launch a 'relatively simple' and quick genetic test that can be performed alongside PCR [polymerase chain reaction] screening within a few months," the Health Ministry reported at a Jan. 13 press conference called by Moniuszko and Kwaśniewski.

The study was conducted with a technology partner, IMAGENE.Me, and the Institute of Tuberculosis and Lung Diseases in Warsaw, and funded by the Medical Research Agency, a state agency, which works in cooperation with the University of Texas MD Anderson Cancer Center and numerous pharmaceutical companies including AstraZeneca, Pfizer Poland, Eli Lilly Poland, Takeda Pharma.

A New International Hospital in Bali

On Dec. 27, Indonesian President Joko Widodo, in cooperation with the Mayo Clinic, broke ground for the Bali International Hospital, reported the Straits Times. The intention is to make it a "health special economic zone" (SEZ), a research center, collaborating with several international universities and hospitals. Widodo called on domestic companies to produce many of the medical devices and medicines now imported. Construction is expected to be complete by May 2023.

A New Fusion Energy Record

Scientists at the Joint European Torus (JET) near Oxford, England, have nearly tripled their previous record of 21.7 megajoules of heat

energy from a fusion plasma in 1997, by producing 59 megajoules over a 5-second period. The peak temperature was 150 million degrees Celsius (270 million degrees Fahrenheit).

This achievement, reported Feb. 9 in *World Nuclear News*, comes as part of a dedicated experimental campaign designed by EUROfusion to test over two decades' worth of advances in fusion and optimally prepare for the start of the International Thermonuclear Experimental Reactor (ITER), the giant tokamak in southern France now being constructed with the support of the EU, China, India, Japan, South Korea, Russia and the U.S., whose purpose is to demonstrate the scientific and technological feasibility of fusion energy.

To achieve this new record, the carbon in JET's inner walls was replaced by beryllium and tungsten, which absorb much less tritium than carbon, making its configuration closer to that of ITER, but with a volume 10 times smaller.

Tony Donné, EUROfusion Program Manager, said: "This achievement [by JET] … fully confirms our predictions that we are on the right path to a future world of fusion energy. If we can maintain fusion for five seconds, we can do it for five minutes, and then five hours as we scale up our operations in future machines. The operational experience we've gained under realistic conditions gives us great confidence for the next stage of experiments at ITER, and Europe's demonstration power plant EU DEMO (ITER's planned successor), which is being designed to put electricity on the grid."

Dr. Bernard Bigot, Director General of ITER, commented: "A sustained pulse of deuterium-tritium fusion at this power level—nearly industrial scale—delivers a resounding confirmation to all of those involved in the global fusion quest. For the ITER project, the JET results are a strong confidence builder that we are on the right track as we move forward toward demonstrating full fusion power."

New Evidence of a Possible Global Cooling to Come

A study conducted at the University of Massachusetts Amherst and published Jan. 4, 2017 in Science Advances, suggests that the "Little Ice Age" (1300-1860) was preceded by a warming trend, driven by the Atlantic Meridional Overturning Circulation (AMOC), which in turn was influenced by increased solar activity.

The AMOC is a well-known process that functions like a huge conveyor belt, transferring warm waters from the tropics up along the coast of Europe, where it meets the cold waters of the Arctic; the current then sinks to the bottom of the ocean, and continues southward along the coast of North America. The sunken portion of the current also pulls carbon from the atmosphere, and stores it at deep levels for long durations. Variations of the AMOC have also been known to change sea levels.

Lead author François Lapointe, a postdoctoral researcher and lecturer in geosciences at UMass Amherst, and Raymond Bradley, distinguished professor in geosciences there, re-examined a previously published study of their 3,000-year reconstruction of North Atlantic sea surface temperatures, results of which were published in the Oct. 2020 Proceedings of the National Academy of Sciences. They realized that there was "an abnormally strong northward transfer of warm water in the late 1300s which peaked around 1380. As a result, the waters south of Greenland and the Nordic Seas became much warmer than usual. 'No one has recognized this before,' notes Lapointe."

This meant there was rapid loss of Arctic ice, and large amounts of sea ice flushed into the North Atlantic, cooling it and decreasing its salinity, eventually collapsing the AMOC, and leading to the overall cooling of the North Atlantic, bringing on the Little Ice Age.

"The answer, Lapointe discovered, is to be found in trees. Once the researchers compared their findings to a new record of solar activity revealed by radiocarbon isotopes preserved in tree rings, they discovered that unusually high solar activity was recorded in the late 1300s. Such solar activity tends to lead to high atmospheric pressure over Greenland."

A lull in volcanic activity at the time also resulted in less ash in the atmosphere, allowing more sunlight to hit the surface of the Earth.

One study noted that the southerly currents of the AMOC "are deep, isolated from atmospheric ventilation, and thus store energy and chemical compounds for hundreds of years. This property of the ocean—storing anomalies at depth—gives the ocean a longer memory than the atmosphere, with the potential to influence climate variability on long timescales."

LaPointe concluded that we could see another cooling period. He admitted that "climate models do not capture these events reliably and so we may be underestimating future ice loss from the ice sheet, with more freshwater entering the North Atlantic, potentially leading to a weakening or collapse of the AMOC."

An article posted Dec. 15, 2021 on the UMass website, titled "Winter Is Coming: Researchers Uncover the Surprising Cause of the Little Ice Age," updates the findings of Lapointe and Bradley.

More on this subject is available from a June 7, 2019 review article in *Frontiers in Marine Science*.