

# Science & Technology Briefs

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## Toward a Vaccine Efficacious Against All COVID-19 Variants

A major step has been reported toward developing a COVID-19 vaccine for any present or future variants of the coronavirus. *RT* [reported](#) Dec. 1 on a study published Nov. 30 by Chinese scientists, showing that monoclonal antibody 35B5 was able to neutralize all variants, both in test-tube experiments and with “humanized” mice.

The [study](#) says that “35B5 neutralizes SARS-CoV-2 [COVID-19] by targeting a unique epitope [part of the antigen molecule to which the antibody attaches itself] that avoids the prevailing mutation sites.” *RT* explains: “In other words, 35B5 targets a unique part of the virus that does not change during the mutation process. By targeting part of the virus which is not impacted by the mutations identified in circulating VOCs, antibody 35B5 demonstrated capacity for ‘pan-neutralizing efficacy’ across multiple strains. These findings, the scientists argue, could be ‘exploited for the rational design of a universal SARS-CoV-2 vaccine.’ The part of the antigen targeted by antibody 35B5 is also present in the Omicron variant, the researchers note.”

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## An Oral COVID-19 Pill by Christmas?

Azvudine, a reverse transcriptase inhibitor already approved for use against HIV, is now undergoing Phase III clinical trials in China, Russia, and Brazil as an oral anti-COVID drug. A reverse transcriptase inhibitor prevents the replication of the virus in the body. A research team at Henan Normal Uni-

versity in China is hoping for approval to release it to the domestic market as early as this month. The *Global Times* Nov. 24 [described](#) this and two other anti-COVID projects, and reported that “China has deployed three technical routes in developing COVID-specific drugs: blocking virus entry into cells, inhibiting virus replication, and adjusting the human immune system.”

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## New Study Challenges Climate Models

Recent research in a region of the North Atlantic reveals it has experienced a warming trend since 1900, decades before the so-called “anthropogenic global warming,” underscoring the flaw of current climate models. However, caution must be exercised in drawing conclusions from such research.

As [reported](#) by *SciTechDaily* on Nov. 25, “an international group of researchers reconstructed the recent history of ocean warming at the gateway to the Arctic Ocean in the Fram Strait between Greenland and the Svalbard archipelago north of Norway.

“Using the chemical signatures found in marine microorganisms, the scientists found that the Arctic Ocean began warming rapidly at the beginning of the last century as warmer and saltier waters flowed in from the Atlantic—a phenomenon called Atlantification—and that this change likely preceded the warming documented by modern instrumental measurements. Since 1900, the ocean temperature has risen by approximately 2° C, while sea ice has retreated and salinity has increased.

“The results, [reported](#) in the journal *Science Advances*, provide the first historical perspective on Atlantification of

the Arctic Ocean and reveal a connection with the North Atlantic that is much stronger than previously thought.”

Water circulation in the Arctic is extremely complicated, because although the Fram Strait is a major artery from the Atlantic (it’s about 450 km/280 miles wide) there is also water circulating from the Pacific on the other side of the Arctic. In addition, the ice caps and related sea-ice have a modulating effect on wind and other factors. And, the circulation is not only within the Pacific, Atlantic, and Arctic oceans themselves, but it also occurs in three dimensions, and is affected by the other ocean currents, which are themselves dynamic and unpredictable in many ways.

An example of how such large currents affect local weather can be seen in the effects of La Niña. NOAA monitors such events to help predict weather patterns in the U.S.

“Consistent with typical La Niña conditions during winter months, we anticipate below-normal temperatures along portions of the northern tier of the U.S. while much of the South experiences above-normal temperatures,” says Jon Gottschalck, Chief, Operational Prediction Branch, NOAA’s Climate Prediction Center.

This research is a reminder that global climate change—unlike a temporary change in the weather—can only be identified on a timescale of more than a century, and cannot be inferred from local events alone. A famous actor once claimed (when filming on location) that the seasonal Chinook Winds of western North America were an “indication of global warming.” For further reading, see the Nature Education [article](#), “Arctic Ocean Circulation,” and NASA’s Sci-

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entific Visualization Studio [production](#) from Feb. 15, 2012, “Gulf Stream Sea Surface Currents and Temperatures.”

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## Micro-Robots To Deliver Killer Drugs Directly to Cancer Cells

A proof-of-concept [study](#) conducted by Chinese scientists and researchers, [reported](#) in *Science Daily* on Nov. 17, opens the way for a major breakthrough in the treatment of cancer. Although there have been significant advances in chemotherapy in the treatment of cancer, its side effects can be serious and can sometimes persist for years or be permanent. Delivering drugs directly to the cancer cells, however, could reduce or eliminate such side effects.

Jiawen Li, Li Zhang, Dong Wu, and their colleagues created extremely tiny, shape-shifting robots which are about 100  $\mu\text{m}$  in size (1,000  $\mu\text{m}$  equals 1 mm), which are guided by magnets to specific sites to deliver treatments. Because tumors exist in acidic microenvironments, the team made their micro-robots change shape in response to lowered pH (a measure of acidity).

“So, the researchers ‘4D’ printed microrobots [3D-printed devices that change shape in response to certain stimuli], in the shape of a crab, butterfly or fish using a pH-responsive hydrogel. By adjusting the printing density at certain areas of the shape, such as the edges of the crab’s claws or the butterfly’s wings, the team encoded pH-responsive shape morphing. Then, they made the microrobots magnetic by placing them in a suspension of iron oxide nanoparticles.

“The researchers demonstrated various capabilities of the microrobots in several tests. For example, a fish-shaped microrobot had an adjustable “mouth” that opened and closed. The team showed that they could steer the fish through simulated blood vessels to

reach cancer cells at a specific region of a petri dish. When they lowered the pH of the surrounding solution, the fish opened its mouth to release a chemotherapy drug, which killed nearby cells. Although this study is a promising proof of concept, the microrobots need to be made even smaller to navigate actual blood vessels, and a suitable imaging method needs to be identified to track their movements in the body, the researchers say.”

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## Mars’ Smallness Complicates Habitability

Scientists at Washington University in St. Louis have formed a hypothesis about the absence of liquid water on the surface of Mars. The team’s [findings](#), published Sept. 28 in *Proceedings of the National Academy of Sciences*, suggest that Mars, about half the size of Earth, doesn’t have enough mass, and therefore enough gravitation, to retain large amounts of water.

Images taken by rovers on the Martian surface show flood channels and valleys, geological formations consistent with large amounts of water. But no liquid water remains on the planet’s surface, and researchers have struggled to understand why.

“Mars’ fate was decided from the beginning,” said Kun Wang, senior author of the study. “There is likely a threshold on the size requirements of rocky planets to retain enough water to enable habitability and plate tectonics, with mass exceeding that of Mars.”

This hypothesis may help astronomers understand more about the habitability of exoplanets—planets outside our solar system—and the relationship between a planet’s size and whether it can sustain life.

“This study emphasizes that there is a very limited size range for planets to have just enough, but not too much water to develop a habitable surface environment,” said co-author Klaus

Mezger, a geochemist at the University of Bern.

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## A Website Dedicated to Fusion Energy

The U.S. Fusion Outreach Team, a grassroots organization in the fusion community focused on reducing barriers to outreach efforts, has launched a new centralized [website](#), to engage the workforce, media, educators, and the public in the journey toward a world powered by fusion energy. The website features the latest fusion news and informative articles, events, and resources that will help anyone, anywhere, understand the promise of fusion energy.

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## Launch of International Webb Space Telescope Delayed Due to Incident

An incident on Nov. 9, during normal pre-flight processing at the Ariane 5 launch site in Kourou, French Guiana, has delayed by four days the launch of the James Webb Space Telescope, originally scheduled for Dec. 18.

As technicians were preparing to attach Webb to the launch vehicle adapter, which integrates the observatory with the upper stage of the rocket, a sudden, unplanned release of a clamp band that secures Webb to the adapter caused a vibration throughout the observatory. This clamp band is designed to be released from the telescope after launch, when the upper stage of the rocket separates from the telescope unit.

An anomaly review board concluded that Webb was not damaged, and the launch is now re-scheduled for Dec. 22.

Developed jointly by NASA, the European Space Agency, and the Canadian Space Agency, the Webb Space Telescope will succeed the Hubble Space Telescope as NASA’s flagship astrophysics mission.