JSTO in the News

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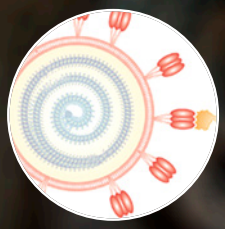
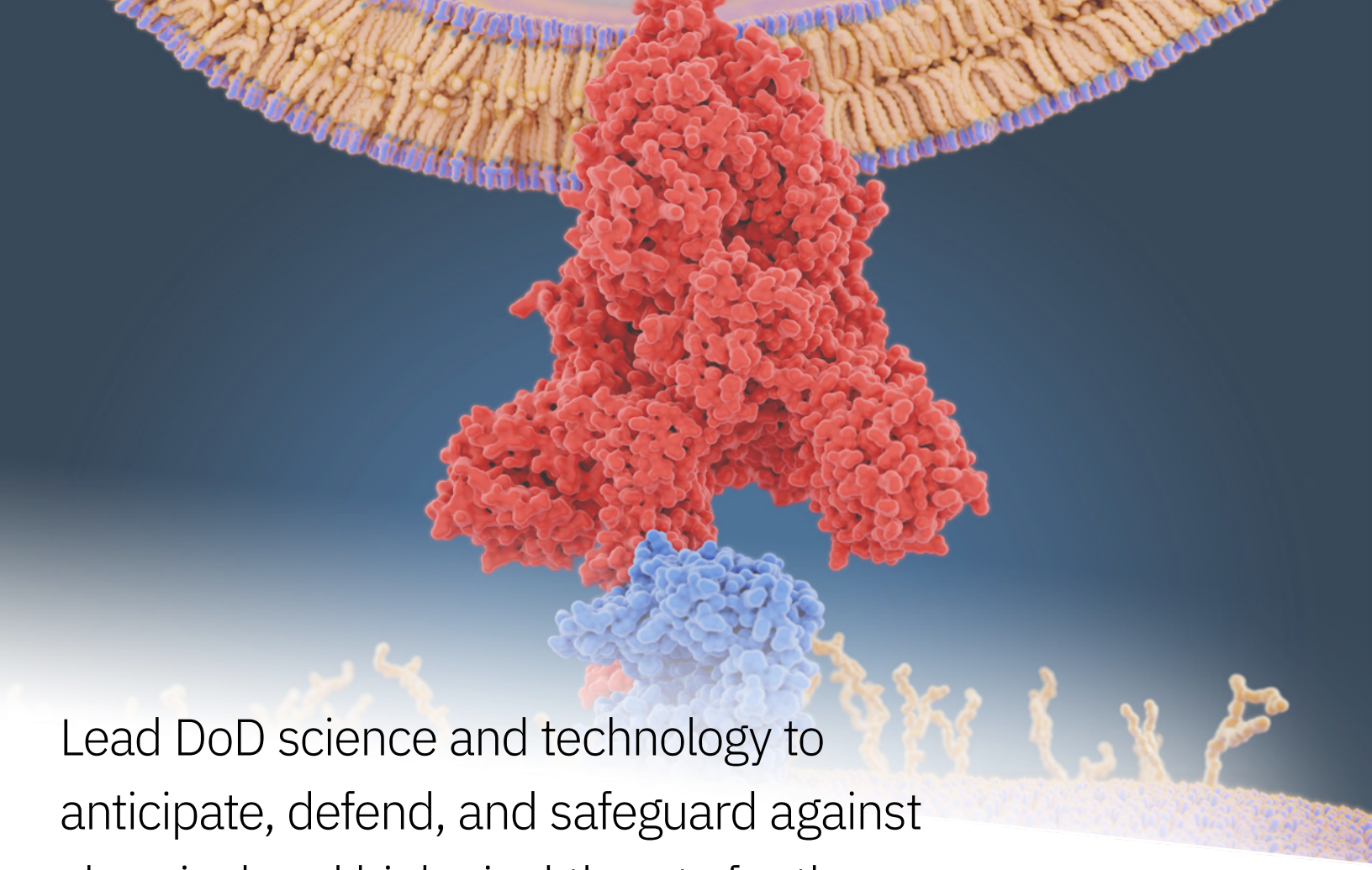


Putting SARS-CoV-2 in a Bind

Out For Less Blood



Lead DoD science and technology to anticipate, defend, and safeguard against chemical and biological threats for the warfighter and the nation.

MISSION

DTRA enables Department of Defense, the U.S. Government, and International Partners to counter and deter Weapons of Mass Destruction and Emerging Threats.

DEFENSE THREAT REDUCTION AGENCY

Research and Development Directorate
Chemical and Biological Technologies Department
Joint Science and Technology Office for the
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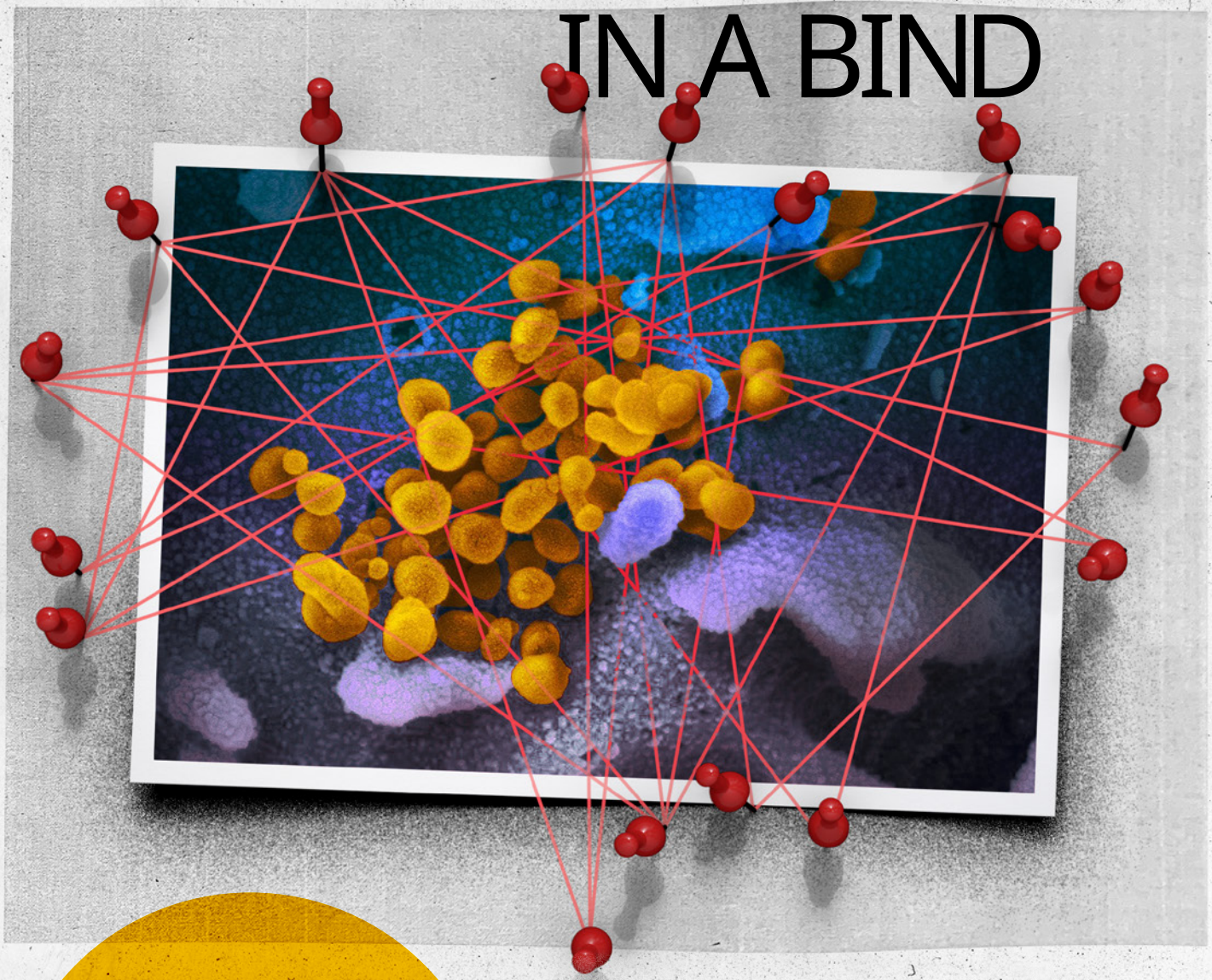
Front cover: A U.S. Navy Hospital Corpsman inspects a blood bag for a simulated casualty during an en-route care training exercise. (U.S. Marine Corps photo by Nicholas Guevara)

Inside cover: The coronavirus spike protein (red) mediates the virus entry into host cells. It binds to the angiotensin converting enzyme 2 (blue) and fuses viral and host membranes. (elvanegra/ Getty Image)

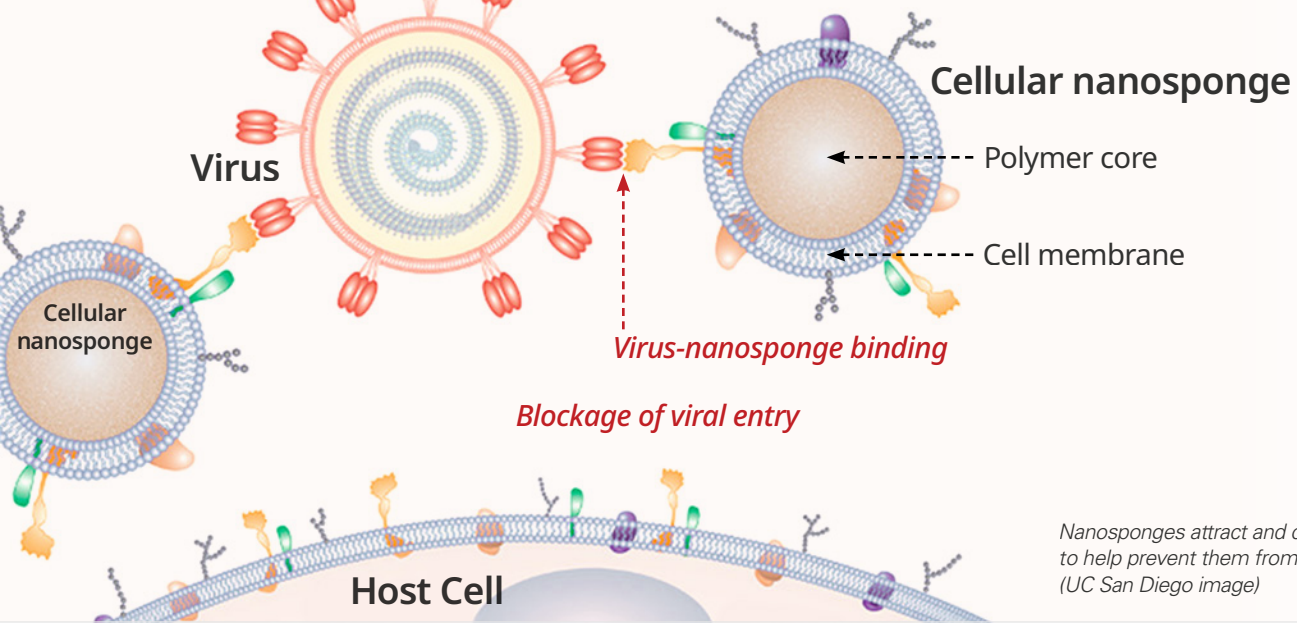
Back cover: U.S. Navy Hospital Corpsman extracts saliva from a receptacle during a research study conducted by a U.S. Naval Medical Research Unit. (U.S. Marine Corps photo by Hailey D. Clay)

PUTTING SARS-CoV-2 IN A BIND



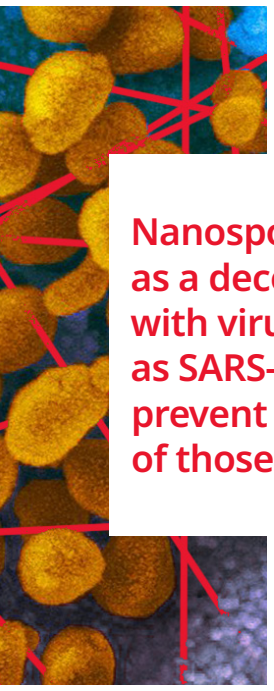
Nanosponge platform technology shows promise to effectively treat emerging infectious diseases such as COVID-19.

Early testing indicates "nanosponges" may provide an innovative solution for treating COVID-19 and other emerging infectious diseases. The Defense Threat Reduction Agency's (DTRA) Chemical and Biological Technologies Department in its role as the Joint Science and Technology Office (JSTO) for the Chemical and Biological Defense Program is investing in medical countermeasure research at the University of California San Diego's (UCSD) Department of NanoEngineering to determine if nanosponges can provide an effective treatment against infectious diseases.



Nanosponges attract and capture virus cells to help prevent them from causing infection. (UC San Diego image)

Nanosponges are tiny biodegradable polymers wrapped by the membrane of target cells, such as lung epithelial cells.



Some "good" news about SARS-CoV-2 is that it shares most of its gene content with SARS-CoV that affected humans several years ago. In both coronaviruses, there are common viral antigens—toxins or other foreign substances that induce an immune response in the body—and common proteases—enzymes that break down proteins and peptides. A recent study confirmed that, like SARS-CoV, the angiotensin-converting enzyme-2 (ACE-2) processed or "expressed" in the lining of the human respiratory tract is the entry receptor for SARS-CoV-2.

Nanosponges act as a decoy and bind with viruses (such as SARS-CoV-2) and prevent the spread of those viruses.

These novel nanosponges could potentially combat a variety of viruses that enter hosts' airways by acting as a decoy and binding to the viruses before they can bind to host cells. Zhang et al. recently published results showing that SARS-CoV-2 binds to these decoy nanosponges that were more than 90% effective in causing the virus to lose its ability to infect cells in vitro. Once the virus is locked into the decoy, it can't invade any real cells, and is then cleared by the body's immune system. UCSD researchers specifically focused on overexpressing ACE-2, the key player mediating the entry of SARS-CoV-2.

This research shows that nanosponges could be used both to prevent disease and as a post-exposure treatment to better protect warfighters and the public from COVID-19 and other emerging infectious diseases. ●

Read the study.

Click here to read the article

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INTRODUCING
THE DTRA-JSTO eBOOK

The official eBook of the Defense Threat Reduction Agency's (DTRA) Chemical and Biological Technologies Department in its role as the Joint Science and Technology Office (JSTO) for the Chemical and Biological Defense Program (CBDP)

This comprehensive eBook outlines the mission, strategy, and capabilities of DTRA-JSTO. By navigating the eBook, scientists, researchers, military personnel, and others will learn about the CBDP and DTRA-JSTO's role in supporting disruptive scientific and technological advancements to protect the warfighter and the nation.

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OUT FOR LESS BLOOD

New studies that find equivalence between venous and finger-stick blood collection could improve diagnostic testing for warfighters in austere environments.

Warfighters are often deployed to locations where they risk exposure to rare tropical diseases, emerging viral pathogens, or biological warfare agents. The ability to quickly diagnose an illness at the point of exposure and administering timely medical countermeasures can aid in protecting the warfighter, stopping the spread of disease, and supporting the mission. While there have been significant advances made in versatile diagnostic capabilities, collecting a blood sample using venipuncture—blood drawn from a vein—requires trained medical personnel, and the warfighter may have to travel a great distance for this procedure. If capillary blood from a simple finger stick could yield the same test results, then the warfighter could be diagnosed and treated closer to the deployment location and in less time.

FilmArray assays being performed by Umaru Bangura and Rashid Ansumana. (Photo by Tomasz Leski)

Victoria Baio extracts DNA from patient samples. (Photo by Chris Taitt)

The Defense Threat Reduction Agency's (DTRA) Chemical and Biological Technologies Department in its role as the Joint Science and Technology Office (JSTO) for the Chemical and Biological Defense Program invested in a study to determine if blood from a finger stick instead of venipuncture could be used for relevant diagnosis of chemical and biological threats. To test the equivalence of the different methods, DTRA-JSTO used the Laboratory Analysis and Clinical Evaluation program at one site in South America and another in West Africa.

The Naval Medical Research Unit #6 monitors a well-studied population of a half million residents in the remote city of Iquitos, Peru, on the Amazon River. Since the mosquito-borne dengue virus is the predominant infection seen at the clinic, researchers compared the precision of laboratory-based polymerase chain reaction (PCR) conducted on both blood from venipuncture and from finger stick. Of the 327 paired samples, 74 were positive for dengue serotype 1, and 10 for dengue serotype 2. Researchers determined the positivity rates were nearly identical, which confirmed that consistent results could be obtained from the venous and capillary blood samples.

Similarly, the Naval Research Laboratory conducted a study in a smaller city in Bo, Sierra Leone, of about 175,000. They performed PCR using the FilmArray Global Fever Panel and a multiplex Q-PCR assay to analyze the paired venous and capillary blood of 141 people exhibiting symptoms of malaria to detect the presence of *Plasmodium* parasites. The researchers found no difference in malaria detection between venous and capillary blood using two different PCR-based detection assays. This data supports the use of capillary blood for PCR-based malaria diagnostics.

While the sample sizes were small, these studies revealed preliminary evidence of the accuracy of using finger-stick capillary blood rather than venous blood for rapid testing with molecular diagnostic assays. This research supports eliminating the need for transporting warfighters from deployed locations to skilled medical technicians in a hospital or point-of-care setting by using simpler but accurate diagnostic methods to identify and treat biological threats and help stop the spread of disease. ●

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Within the Defense Threat Reduction Agency's Research and Development Directorate resides the Chemical and Biological Technologies Department performing the role of Joint Science and Technology Office for the Chemical and Biological Defense Program. This publication highlights the department's advancements in protecting warfighters and citizens from chemical and biological threats through the innovative application of science and technology. DTRA.mil