How we find solutions to stop the spread of COVID-19

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The global effort to fight COVID-19 has led to research being conducted at an unprecedented volume and speed. That's why the Human Vaccines Project is launching the HVP COVID Report as an expert resource for research on vaccines and other advances related to harnessing the human immune system and ending the COVID pandemic.

Time and again, we are playing catch-up with epidemics like COVID-19. With each new outbreak, the race begins anew to find a diagnostic, vaccine and treatment, and to stop it from spreading. Each time, the same mysteries remain: Where are the vulnerabilities on the virus? What is needed for prevention? What are the rules of infection and immunity?

Many people infected with COVID-19 only showed mild symptoms – and we do not know why. It seems like younger people are less likely to get the disease – but we do not know yet for sure. With more than 824.000 cases and 40.000 deaths in just a few months since its emergence, the COVID-19 pandemic has highlighted the vulnerabilities of aging populations to emerging infectious diseases, and more broadly, the current gaps in global pandemic preparedness. Scientists, clinicians and public health specialists worldwide are now racing to develop vaccines, rapid diagnostics and therapeutics, in trying to end a pandemic that threatens to infect a large percentage of the global population, and potentially kill millions of older adults.

All of us at the Human Vaccines Project (HVP) are working closely with our network of partners from leading academic centers, industry, government and non-governmental organizations to lend our capabilities towards prevention and control of the COVID-19 pandemic. With our immunology-based clinical research network and mission to decode the human immune system to accelerate development of vaccines and therapies for major global diseases, HVP is now focusing on immediate-term solutions to mitigating the spread of COVID-19, and long-term solutions to preventing subsequent pandemics.

In order to better understand the immense complexity of the human immune system, the Human Vaccines Project was launched in 2016. As a global consortium, HVP is bringing together leading scientists from academia, industry, government and philanthropic organizations on a common mission. The objective is to decode the human immune system and to create the basis for the development of new and effective vaccines, diagnostics and treatments for the most prevalent diseases, ushering in a new era of human health.

The race for a SARS-CoV-2 vaccine

In this inaugural issue of the HVP COVID Report, we provide a graphic of the current status of the pandemic, and highlight the efforts of two of our partners in accelerating development of vaccines and therapeutic monoclonal antibodies for prevention and control of SARS-CoV-2, the viral cause of the pandemic. Future editions will include a review of the world's efforts to develop vaccines and immune-based therapies, a synthesis of recent basic and translational science publications impacting vaccine development, a primer on vaccines and human immunity, and other related topics.

In addition to the HVP COVID Report serving as an educational resource, the Human Vaccines Project is actively working with our broad network of collaborators, in identifying research gaps and prioritizing proposals to accelerate the development of vaccines and immune-based therapies for SARS-CoV-2. We welcome thoughts and suggestions from the scientific community of where our resources could have the greatest impact.

The COVID-19 pandemic also highlights the urgent need to decipher effective immunity in aging populations. Numerous studies have demonstrated that as we age our immune systems decline which limits the effectiveness of vaccines and immune-based therapies. Current limitations in understanding the mechanisms for protective immunity against SARS-CoV-2 and mechanisms for enhancing immunity in aging populations may present challenges to vaccine developers.

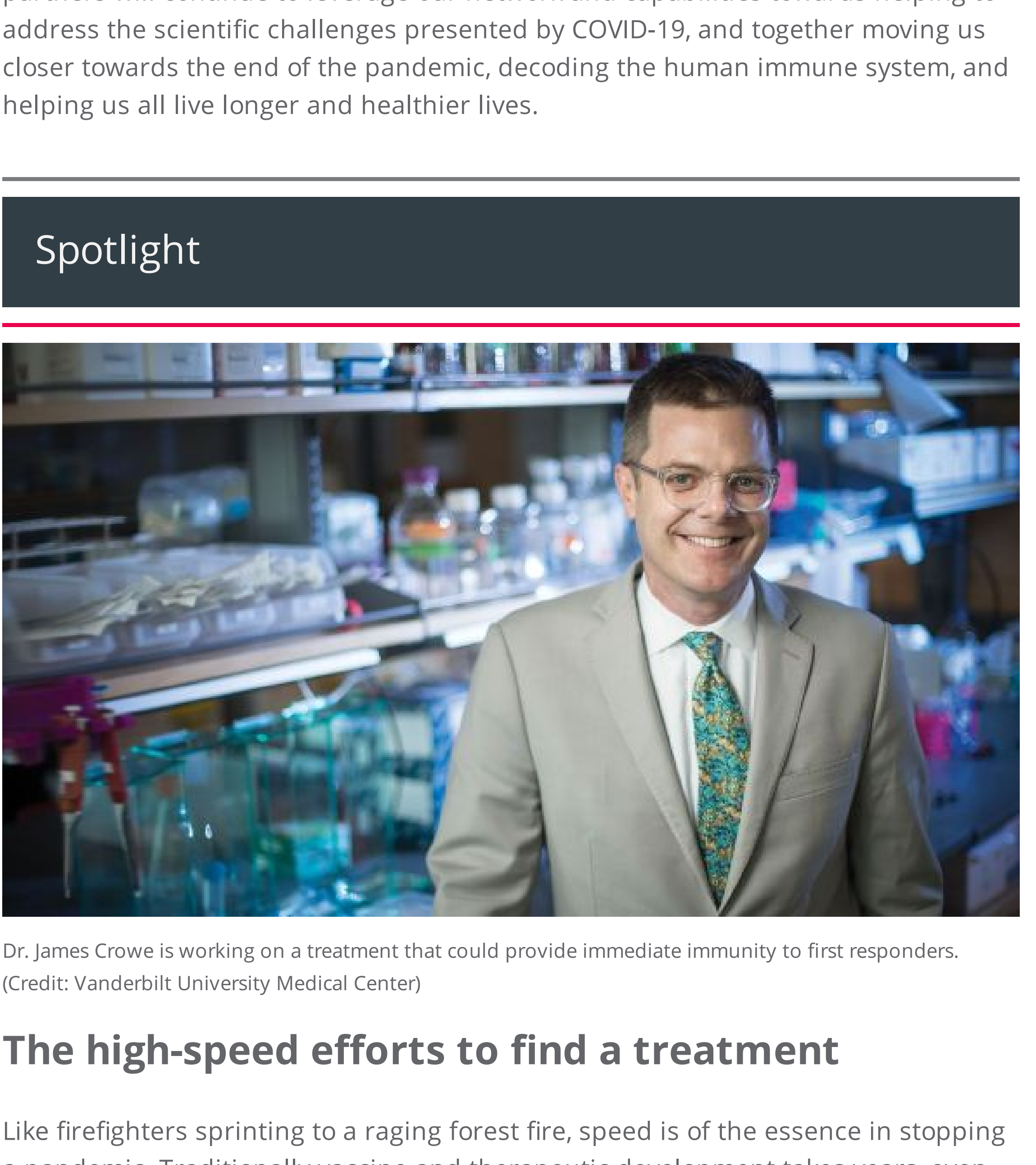
Protecting humanity against future diseases

However, recent advances in biomedical, computer and engineering sciences now present opportunities unimaginable just a decade ago. Innovations in systems biology applied to vaccine studies now enable unprecedented scale and depth of measurements of human immunity. Together with advances in bioinformatics and AI, the field is on the cusp of determining the mechanisms which differentiate responders from non-responders to vaccines and why some people such as the elderly progress to greater disease and mortality from pathogens such as SARS-CoV-2.

The COVID-19 pandemic has also served as catalyst for a global approach to research, bringing together all sectors in a collective attempt to defeat SARS-CoV-2. The lessons we learn from the COVID-19 pandemic, in accelerating development of vaccines, diagnostics and therapeutics, and understanding the principles of effective immunity, particularly in our most vulnerable populations, will help to provide the foundation for pandemic preparedness and protect against emergence of future diseases.

Over the coming weeks, we at the Human Vaccines Project, together with our partners will continue to leverage our network and capabilities towards helping to address the scientific challenges presented by COVID-19, and together moving us closer towards the end of the pandemic, decoding the human immune system, and helping us all live longer and healthier lives.

Spotlight



Dr. James Crowe is working on a treatment that could provide immediate immunity to first responders. (Credit: Vanderbilt University Medical Center)

The high-speed efforts to find a treatment

Like firefighters sprinting to a raging forest fire, speed is of the essence in stopping a pandemic. Traditionally vaccine and therapeutic development takes years, even decades. With SARS CoV-2 now spread to nearly 200 countries since December, researchers are trying to radically accelerate product development armed with a host of new technologies. Here, we highlight two exiting efforts by our research partners under collaborations with other funders:

- HVP partner Dr. James E. Crowe Jr., MD, at the Vanderbilt University Medical Center is racing to identify potent antibodies against SARS-CoV-2 and begin human testing of a therapy this summer. Such antibodies isolated from infected individuals are increasingly seen as powerful tools underlying rapid therapeutic and vaccine development efforts, and are the basis for DARPA's ambitious Firebreak program. The Crowe lab, which set a record of 78 days designing a novel Zika antibody therapy, is now seeking to top that for SARS-CoV-2.

- The vaccine company Moderna, working with the Vaccine Research Center of the National Institute of Allergy and Infectious Diseases (NIH) and the Coalition for Epidemic Preparedness (CEPI), has rapidly moved from the genetic sequence of the virus to a vaccine ready for human testing in just 42 days. Using a platform approach, Moderna was able to rapidly swap the SARS-CoV-2 viral sequence into its existing mRNA vaccine platform. The company estimates that a vaccine will not be ready for wider-spread use for at least 12 to 18 months.

Despite this speed and creativity, challenges lay ahead particularly with new technologies. While new treatments are essential, a vaccine remains the best hope for ending the pandemic. Even if we are fortunate enough to find a vaccine that is safe, effective, and works across populations, mass production and roll out at a global scale remain major hurdles. We will look into these challenges — and possible solutions — in future discussions.

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Must Read

The following pre-print articles cover important new research around coronavirus immunity of the week. This research has potential implications for vaccine design, therapeutic development as well as new ways to diagnose infection.

- Wang et al. report on a human monoclonal antibody that neutralizes SARS-CoV-2 (and SARS-CoV). This cross-neutralizing antibody targets a communal epitope on these viruses and offers potential for prevention and treatment of COVID-19.
- Ju et al. describe a series of human monoclonals that neutralize SARS-COV-2 but not SARS-COV.
- Munster et al. show that SARS-CoV-2 causes respiratory disease and viral shedding in infected rhesus macaques, and may suggest a useful animal model to advance our understanding of human pathogenesis and vaccine development.
- Long et al. focus on acute antibody responses to SARS-CoV-2 in COVID-19 patients. They demonstrate that seroconversion or fourfold rise in IgG antibodies identifies acute SARS-CoV-2 infection, suggesting a potential serological approach for diagnosing SARS-CoV-2 infection.
- Okba et al. developed serological assays for the detection of various SARS-CoV-2 antibodies for both mild and severe COVID cases. Validated SARS-CoV-2 serological assays are currently lacking, and such work could aid in patient contact tracing, diagnostics as well as epidemiological and vaccine evaluation studies.

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COVID in Numbers

The COVID-19 Trajectory: Deaths by Select Country.
Data Source: John Hopkins University / CSS / Worldometers / Financial Times