NSF-FUNDED RESEARCH HELPS IN THE FIGHT AGAINST COVID-19

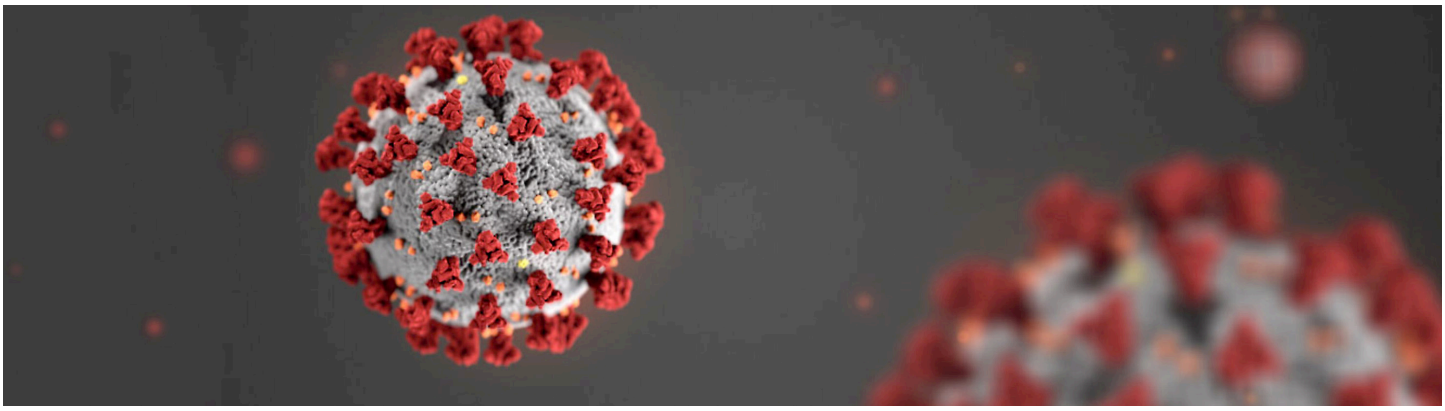

Image credit: CDC

For 70 years, NSF has supported basic research that enhances our economy and national defense, and advances the health, prosperity and well-being of the nation. As the nation responds to the COVID-19 pandemic, NSF-funded research is playing a crucial role. From the science and engineering behind critical diagnostic tools and medical devices to novel solutions that help communities, businesses and individuals navigate the challenges of this difficult time, NSF's investments in science and technology are making a difference.

NSF'S RAPID RESPONSE TO THE CRISIS

As the severity of the COVID-19 crisis loomed in March, NSF responded by calling for Rapid Response Research (RAPID) and Small Business Innovation Research (SBIR) proposals. As of November 2020, 661 RAPID awards totaling more than $122.5 million have been made to researchers around the country to support research related to the pandemic. On March 27, Congress passed the Coronavirus Aid, Relief, and Economic Security Act (CARES Act), which provided $76 million to NSF, including $75 million to support its ongoing grant response to COVID-19 and $1 million to assist in the administration of those grants. As of November 2020, NSF has awarded 534 CARES Act awards totaling more than $75.7 million.

Recent select research awards:

- Researchers at Northwestern University are developing a self-sanitizing medical facemask insert to protect front line workers from infection.
- Membrion, Inc. has developed a spray coating that boosts the performance of cloth masks using minute electrical charges to capture viral particles and prevent them from passing through the fibers.
- Syracuse University is conducting research into a possible treatment to combat coronavirus. The university is testing the connections between pritumumab, a naturally occurring antibody, and COVID-19 to see whether the antibody blocks SARS-CoV-2, the virus responsible for COVID-19, from entering cells.
- Northeastern University has developed and is currently testing a new device that can probe the chemistry of airborne pathogens, including the SARS-CoV-2 virus, which causes COVID-19. And, like a breathalyzer that can give results in real time, the device works within seconds.

DID YOU KNOW?

NSF funding for social, behavioral and economic sciences helps us understand and respond to societal dimensions of the pandemic. One example is a project from Stanford University that studied how flu-like diseases spread within schools. The researchers equipped students and school staff with small wireless transmitters that provided real-time data as students and staff encountered each other. The researchers then used that information to simulate strategies to manage the spread of infectious diseases.

NSF has supported small businesses for more than 40 years. Now, in response to the pandemic, several companies are mobilizing their NSF-funded technologies to respond to the COVID-19 crisis.

Here are six NSF-funded startup companies that have joined the fight against COVID-19:

- Aperiomics has established a testing capacity of 2,500 tests per week, using infrastructure, personnel and expertise funded by NSF.
- OmniVis used NSF funding to develop an app-based technology to detect cholera. In response to the COVID-19 pandemic, OmniVis is now adapting its technology to help develop quick and widespread diagnostics.
- MaxQ Research LLC was funded by NSF to develop new, strong, thermal insulation materials that can chill and maintain virus specimens within a critical temperature range, ensuring that blood, plasma and swab samples stay viable for testing. They are now providing their products to hundreds of hospitals, clinics and testing centers to help with the safe transport of SARS-CoV-2 samples, thus improving the accuracy of testing.
- Cognita Labs used NSF funding to improve testing for measuring lung diseases in patients. The resulting PulmoScan test has the potential to identify which COVID-19 patients are at risk of developing pneumonia and eventually respiratory failure. This could potentially help clinicians prioritize their care and allocate additional resources to certain high-risk patients.
- Stabilitas received NSF funding to create machine learning technology to filter, categorize, geoparse, cluster and summarize massive amounts of critical event information. To aid in the COVID-19 response, Stabilitas' technology is mining local news reports and other publicly available data to determine critical information such as the early identification of potential pandemic hot spots/recurrence areas and the availability of hospital beds in a given area in relation to the number of reported COVID-19 cases.
- ZillionInfo was funded by NSF to develop artificial intelligence that optimizes how geographic boundaries, which define various types of service areas, are drawn. ZillionInfo is now developing innovative tools that can help assess and predict pandemic trends, help design social distancing policies, and optimize daily operations to minimize impacts on the economy while maximizing efforts to contain the pandemic's spread.

Up to date weekly reports on COVID-19 supported by the CARES Act can be found here.

DECADES OF NSF INVESTMENTS ARE BEING USED IN THE RESPONSE TO COVID-19

3D PRINTED PPE PROTECTS HEALTH CARE WORKERS

NSF's investments in 3D printing and additive manufacturing—going back to the 1980s—are enabling students and educators at community colleges in Tennessee, Kentucky and Connecticut to produce life-saving personal protective equipment. NSF is continuing to fund research to expand advanced manufacturing capabilities and efficiency, and NSF plays a key role in STEM training that opens these fields to students and workers across the nation.

UNDERSTANDING THE BIOLOGY OF VIRUSES TO MITIGATE TRANSMISSION

Decades of investments in genetics, cyberinfrastructure and fundamental biology enabled the rapid sequencing and identification of the novel coronavirus weeks after its discovery in late 2019. This finding allowed infectious disease experts to quickly realize its similarity to the coronavirus that caused the 2002 outbreak of SARS (severe acute respiratory syndrome) and begin work on combatting the spread of the novel coronavirus. Continued work in comparing genetic variation between infected individuals will provide an understanding of how the virus spreads from person to person and between communities.

Since 2002, NSF has partnered with the National Institutes of Health and the U.S. Department of Agriculture to run the Ecology and Evolution of Infectious Diseases program. EEID funds research to advance the understanding of pathogen transmission, including human, animal and plant diseases in an effort to control disease and maintain human, animal and ecosystem health. Multidisciplinary research funded through EEID has laid essential groundwork for addressing current and future novel disease outbreaks. An example of EEID's impactful work is the 2013 identification of bats as the source of the 2002 SARS coronavirus outbreak.

NSF-SUPPORTED RESEARCH HUBS ADVANCE THE FIGHT AGAINST COVID-19

The Molecular Sciences Software Institute has launched a centralized, open repository for sharing resources and expertise related to the molecular properties of the SARS-CoV-2 virus, to help fight the COVID-19 pandemic.

The simulations provide a molecular-level understanding of the components that make up a virus, for example, spike-proteins or proteases, which may uncover pathways to disrupt the virus's ability to replicate or infect human cells. NSF awarded $17 million to Virginia Tech to develop and run the Molecular Sciences Software Institute, a critical molecular sciences computing hub. This infrastructural investment has allowed MolSSI to swiftly respond to the COVID-19 crisis and help contribute to finding essential therapeutics.

HARNESSING THE POWER OF NSF SUPERCOMPUTERS

Eight NSF-funded computing systems are part of the COVID-19 High Power Computing Consortium, a public-private partnership co-led by NSF that is providing researchers with cutting-edge computing power to answer questions critical to the COVID-19 response. More information on how NSF's computing power is being used during the crisis can be found here.

INVESTING IN A PREPARED FUTURE

NSF is investing in tools and technology that will help us contend with future pandemics. Advances in artificial intelligence and big data offer the potential to spot hidden patterns and raise the alarm about new diseases before they spread. Advanced manufacturing and cutting-edge engineering will be able to put the right tools in the hands of first responders and medical professionals faster than ever. Programs such as the Civic Innovation Challenge are demonstrating how the convergence of technology with local government can give communities and municipalities new tools to help residents and provide services during emergencies. And NSF-supported research will continue to put countless new technologies in people's hands that can enable connectivity, productivity and learning while staying safe at home.

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DID YOU KNOW?

Clinical tests for COVID-19 rely on the genetic identification of the virus, a process made feasible by an NSF-funded discovery of bacteria from thermal pools at Yellowstone National Park. These unique bacteria contained thermostable enzymes that allowed for the rapid copying of genetic material through a process called Polymerase Chain Reaction (PCR). Only a tiny amount of genetic material is retrieved through a nasal swab, far too small an amount to be readily detected, so scientists amplify it to a measurable quantity to confirm whether a patient has been infected with SARS-CoV-2.

Coronavirus.gov | Coronavirus Disease 2019 (COVID-19) | What the U.S. Government is Doing