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

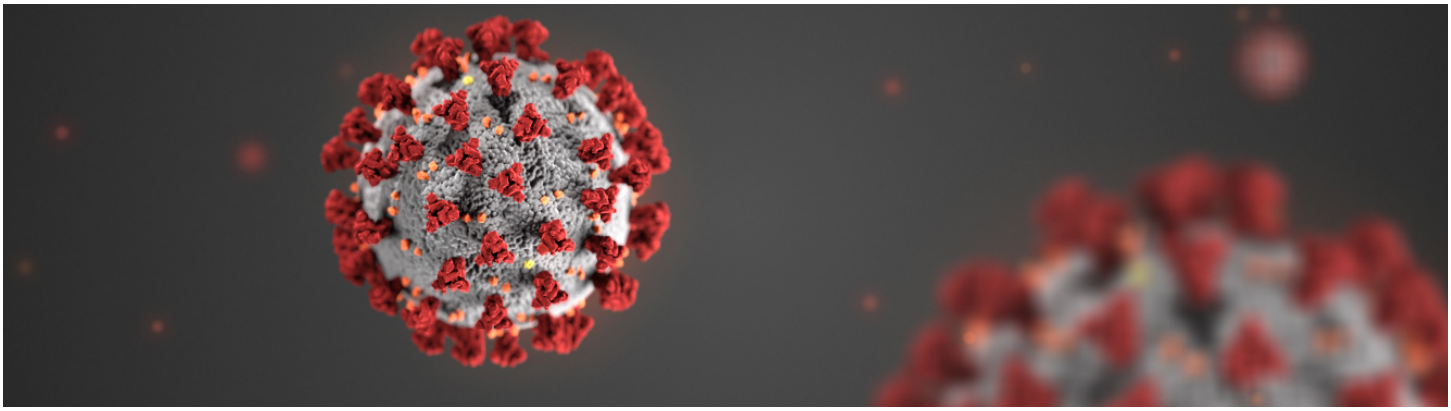

Image credit: CDC

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.

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

3D PRINTED PPE PROTECTS HEALTHCARE 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 (PPE). 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 up 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 2002 SARS coronavirus and begin work on combatting its spread. 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 (EEID) program. EEID funds research to advance the understanding of pathogen transmission, including human, animal, and plant diseases, in effort to control disease and maintain human, animal, and ecosystem health. Multidisciplinary research funded through EEID has laid essential groundwork for addressing the 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 (MolSSI) 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. Viral

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.

simulations provide a molecular-level understanding of the components that make up the virus, e.g. 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 MolSSI, 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.

NSF'S RAPID RESPONSE TO THE CRISIS

In March, as the severity of the COVID-19 crisis loomed, NSF responded by calling for Rapid Response Research (RAPID) and Small Business Innovation Research (SBIR) proposals to address the pandemic. As of April 10, 63 RAPID awards totaling $9,862,000 have been made to researchers around the country to support research related to the pandemic.

Recent RAPID awards include:

- Researchers at Northwestern University are developing a self-sanitizing medical facemask insert to protect front line workers from infection.
- Biophysicists from the University of Delaware are building atomic level simulations of the COVID-19 coronavirus to better understand its makeup and how it infects human cells.
- Researchers at the University of Utah are working to understand how different temperatures, drying, and other conditions affect the virus's ability to survive in mucus-like droplets, like those expelled from a cough. Their findings will help shape best practices that individuals can use to protect against spreading the virus, as well as improving models for tracking the spread of the virus as the seasons change.
- Engineers at Purdue University will study how water quality is affected by building closures over time and assess the origin of contaminations so that communities can ensure their infrastructure is safe when people return after the pandemic.

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

Up-to-date weekly reports on COVID-19 related funding supported by the CARES Act 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 like 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.

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.

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