



HUMAN GENETICS RESEARCH IS ESSENTIAL FOR SAVING LIVES FROM COVID-19 PANDEMIC

The international biomedical research community is working at an unprecedented pace, with unparalleled progress, to understand and defeat the SARS-COV-2 pathogen. In early 2020, researchers pivoted quickly to COVID-19 and today are generating and sharing data, treatment options, and prevention strategies with record speed and transparency. This rapid response and our ability to understand and respond to this specific virus are possible thanks to decades of basic and translational research, as well as sustained federal investment in technology and a research community that spans disciplines and sectors.

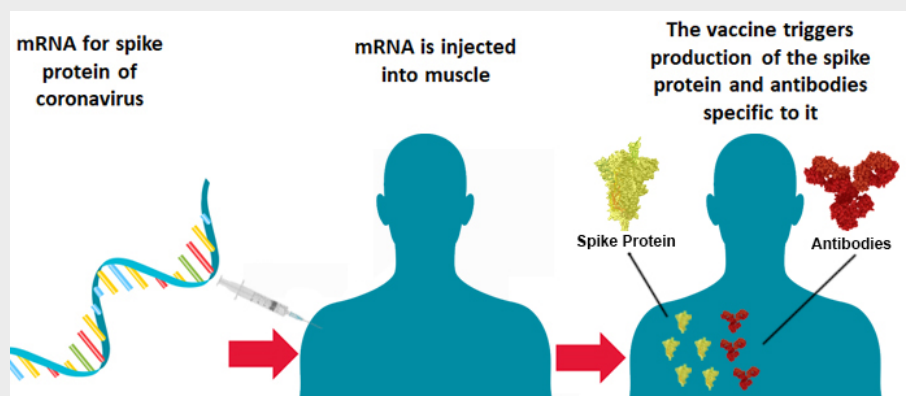
The human genetics community is contributing to solutions in three foundational ways and, even as headlines report changes in the virus, researchers are tracking those changes relentlessly and working to get a step ahead and stop its tragic impact.

Longstanding public investments in NIH-funded basic research and private investments have led to tools for analyzing DNA that allowed researchers to quickly respond to the pandemic.¹ Our ability to quickly and inexpensively analyze the genome of the SARS-CoV-2 virus has been crucial for many aspects of the COVID-19 response.

1. Developing Therapeutics and Vaccines

The ability to rapidly sequence the SARS-COV-2 genome enabled researchers to identify the target sequence and generate those sequences used in the vaccines.² In addition, researchers were able to develop antibody therapies using human genome sequencing.

Researchers at Vanderbilt University used next-generation sequencing to identify antibodies to COVID-19 in a blood sample from the first U.S. COVID-19 case.³ As part of the body's response to SARS-CoV-2, white blood cells called B cells rearrange their DNA to produce different antibodies. To find the sequences of all the potential COVID-19 antibodies in the sample, the team rapidly sequenced the genomes of individual immune cells.⁴ Using this information, industry partners were able to quickly produce antibodies that are now in development as therapies to treat COVID-19.



The genetic sequence of the virus's spike protein is used to synthesize the mRNA sequence used in vaccines. Source: NIH

2. Infrastructure for testing and tracing

Researchers at public universities and institutions, and genetic testing companies across the country have shifted gears to focus their expertise, time, and equipment on developing sample collection infrastructure, developing and running COVID-19 testing, and analyzing the course of the pandemic. For example, the Broad Institute transformed their genomics facility to process COVID-19 tests.⁴ Baylor College of Medicine's Human Genome Sequencing Center turned its focus to COVID-19 testing for the community.⁶ Color Genomics has increased testing capacity for California and other areas.⁷



3. Understanding how COVID-19 affects the body

It is unclear why some people who have COVID-19 need to be hospitalized while others experience no symptoms at all. Systemic health inequities and social determinants of health are a major factor in the increased burden of disease on communities of color, who face greatly increased risks of infection, hospitalization, and death.⁸ Genetic differences between individuals may also play a part in determining susceptibility to the disease.

Scientists are investigating how variation in the human genome and biological processes are related to COVID-19 susceptibility and symptom severity. This research will help us understand the connection between human genetics and disease and reveal potential drug targets. Diversity among research participants in these studies is important: it not only ensures that potential treatments are effective for those who are most vulnerable to the disease but is crucial for finding all relevant genes and biological pathways.

International human genetics consortia dedicated to COVID-19

Human geneticists across the world have mobilized quickly in response to the COVID-19 pandemic. Two collaborations in particular, the COVID-19 Host Genetics Initiative and the COVID-19 Human Genetics Effort, have brought together researchers from dozens of countries to share resources, experimental protocols and data.^{9,10} Combining data from around the world allows us to more quickly understand how human genetics affects COVID-19 susceptibility, severity, and outcomes – one recent study, for example, has highlighted how dysfunction in certain components of the immune system may worsen outcomes.¹¹

The need for Congressional Support

The utility of genome sequencing technologies and human genetic insights into COVID-19 disease onset, severity, and treatment illustrate how human genetics and genomics research powers virtually all areas of biomedical research, human health, and the research across NIH. Researchers' ability to rapidly understand the SARS-CoV-2 virus and develop ways to address the pandemic at this unprecedented pace offers a success story that validates sustained public investment in technology, expertise, infrastructure, and knowledge built through decades of publicly funded biomedical research with a strong basis in genetics. To create and maintain a solid foundation for responding to COVID-19 and future national health crises, Congress should continue to support genetics and genomics research at NIH.

Additional Resources

References:

ashg.org/advocacy/fact-sheets/