# VACCINE WARS:

## When Science and Politics Collide

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# Developing the Vaccines

A lot can be accomplished in one weekend. On January 11, 2020, a Saturday, Chinese researchers published online the genetic sequence of the coronavirus that was spreading in Wuhan. Scientists at the Massachusetts-based biotech company Moderna seized on the release and got to work creating a vaccine. They were well prepared. Days earlier, Moderna's chief executive officer (CEO), Stéphane Bancel, had discussed the virus's deadly potential with Barney Graham, a researcher at the National Institutes of Health (NIH). They agreed that a vaccine could be a lifesaver and that every day mattered. They decided to work together to develop it. Inside the labs at Moderna and the NIH, scientists used cutting-edge technology to evaluate the Chinese map of the coronavirus and tailor a protective drug to its genetic blueprint. On Monday, January 13, two days after the Chinese release, the vaccine's gene sequence was done. The United States had yet to report its first official case of COVID-19, yet a vaccine to prevent its infection was essentially ready to be manufactured. A process that typically took years had been completed in forty-eight hours. When he announced his company's breakthrough, Bancel chose to downplay the challenge. As he explained to reporters, "This is not a complicated virus."[4]

## A Game-Changing Breakthrough

Developing a successful vaccine can be a game changer not only for public health but also for a company's bottom

line. Prior to its breakthrough on the coronavirus, Moderna had not produced or sold a single commercial drug. The company's prospects were all based on an unproven technology. However, its vaccine announcement brought undreamed-of publicity and massive new interest from investors. With each positive report on clinical tests and manufacturing, Moderna's stock jumped higher. By December 2020 its market value had risen ninefold, to $67 billion.

The key to Moderna's rapid development of a COVID-19 vaccine was a technology called messenger RNA (mRNA). This genetic material controls how cells make proteins. Moderna's vaccine injects a tiny piece of mRNA from the coronavirus. This piece codes for the spike protein that enables the virus to latch on to healthy cells and invade them. Once the mRNA is injected, a person's immune system produces antibodies that target the viral spikes and neutralize the virus. Pfizer, a huge American pharmaceutical corporation, also used mRNA technology in its COVID-19 vaccine. Working with the small German company BioNTech, Pfizer began testing twenty vaccine candidates, whittling them down to four by April 2020.

Moderna, Pfizer, AstraZeneca, and other drug firms would have to negotiate a minefield of political and scientific challenges in their quest for a COVID-19 vaccine. The situation—trying to stop a deadly spreading virus in its tracks in real time—was unprecedented. Until now, developing vaccines for infectious diseases had always been a slow process of trial and error, one that took years—and often ended in failure. If an effective vaccine did emerge, it tended to arrive well after the worst of an outbreak had passed and death rates were already plummeting. Health experts note that practical public health measures like washing hands, disinfecting living and work areas, and getting basic medical treatment often do more to defeat infectious disease than vaccines or miracle cures.

Nonetheless, with the coronavirus's ability to spread unchecked, it became obvious that practical measures were not


*Together with scientists from the National Institutes of Health, the biotech company Moderna quickly developed a COVID-19 vaccine. Having the virus's genetic sequence from Chinese researchers sped these efforts along.*

enough. As the death toll in America rose into the hundreds of thousands, most people regarded the rapid testing procedures and lightning rollouts for the vaccines as a necessary risk. Science and politics, not without some holdouts, converged to support the effort. David Wallace-Wells, a medical reporter for *New York* magazine, noted the irony that Moderna had already manufactured its vaccine and delivered it to the NIH for clinical trials when the first American COVID-19 death was made public. "This is—as the country and the world are rightly celebrating—the fastest timeline of development in the history of vaccines," Wallace-Wells wrote in early December 2020. "It also means that for the entire span of the pandemic in this country, which has already killed more than 250,000 Americans, we had the tools we needed to prevent it."[5] And the virus's grim business was far from over. By late March 2021, the total number of COVID-19 deaths in the United States had surpassed 545,000.

## A Postwar Success for the Mumps Vaccine

Prior to the COVID-19 vaccines, the fastest creation of a new vaccine was one for mumps, an illness that usually caused high fever and swollen salivary glands in children. In 1968 Maurice Hilleman, the top research scientist at pharmaceutical firm Merck, brought a mumps vaccine to market after only four years of development. As a less dangerous disease than polio or measles, mumps never produced a widespread panic in the United States. Many health officials downplayed its severity. A New York State Department of Health brochure in 1955 claimed, "Almost always a child is better off having mumps: the case is milder in childhood and gives him life-long immunity."[6] Yet mumps had presented a real threat to American soldiers since World War I. Only in the 1930s did scientists discover that mumps was caused by a virus. It was highly contagious, spreading easily in barracks during World War II, and causing disruptions in training and troop movements. A mumps infection often inflamed the testicles, bringing risk of permanent damage and infertility in teens and adults. Infection could also result in severe loss of hearing. Moreover, in America's post–World War II baby boom, a contagious disease that mainly struck children was bound to be a concern.

> **"This is—as the country and the world are rightly celebrating—the fastest timeline of development in the history of vaccines. It also means that for the entire span of the pandemic in this country . . . we had the tools we needed to prevent it."[5]**
>
> —David Wallace-Wells, a medical reporter for *New York* magazine

Hilleman based his mumps vaccine on an active strain of the virus. He got the strain from a throat swab of his daughter, Jeryl Lynn, whose mumps infection had given her a sore throat and swollen glands. In Merck's labs, Hilleman and his team attenuated the strain, or weakened it, by repeatedly running it through chicken embryos. This technique was pioneered by John Enders, a scientist who won the 1954 Nobel Prize for

cultivating the polio virus. Vaccine with the weakened mumps strain did not cause a full-blown infection, but it was enough to trigger an immune response.

The breakthrough on a mumps vaccine helped promote widespread public acceptance of childhood vaccination. In 1971 Merck won Centers for Disease Control and Prevention (CDC) approval for Hilleman's combination of mumps vaccine with vaccines for measles and rubella. (Rubella, or the German measles, causes a distinctive red rash.) Required for school enrollment in many districts, the measles-mumps-rubella (MMR) vaccine became a quick and inexpensive tool to protect children from these diseases. Eventually, it became a fixture of public health worldwide.

## Seeking an AIDS Vaccine

Successes like the vaccines for polio and MMR strengthened the public's faith that medical research was on the road to eliminating most threats from contagious disease. But the appearance of acquired immunodeficiency syndrome (AIDS) in the early 1980s belied these hopes. AIDS was caused by the human immunodeficiency virus (HIV). The virus attacked the immune system of an otherwise healthy person, rendering it incapable of fighting off other infections. AIDS initially spread among gay males and intravenous drug users in the United States and Europe, causing some politicians and pundits to dismiss its impact on the wider society.

However, as the death toll rose, AIDS became the most politically charged disease in the United States before COVID-19. AIDS activists protested the lack of progress on a cure. In 1990 more than one thousand members of ACT UP, a radical gay activist group, stormed into the NIH to demand more participation in trials for a vaccine and other treatments. Their target was Dr. Anthony Fauci, then as now director of the NIH's National Institute of Allergy and Infectious Diseases (NIAID). Unbeknownst to the ACT UP protesters, Fauci actually was lobbying his colleagues for more input from gay activists.

## A Rising Star at the NIH

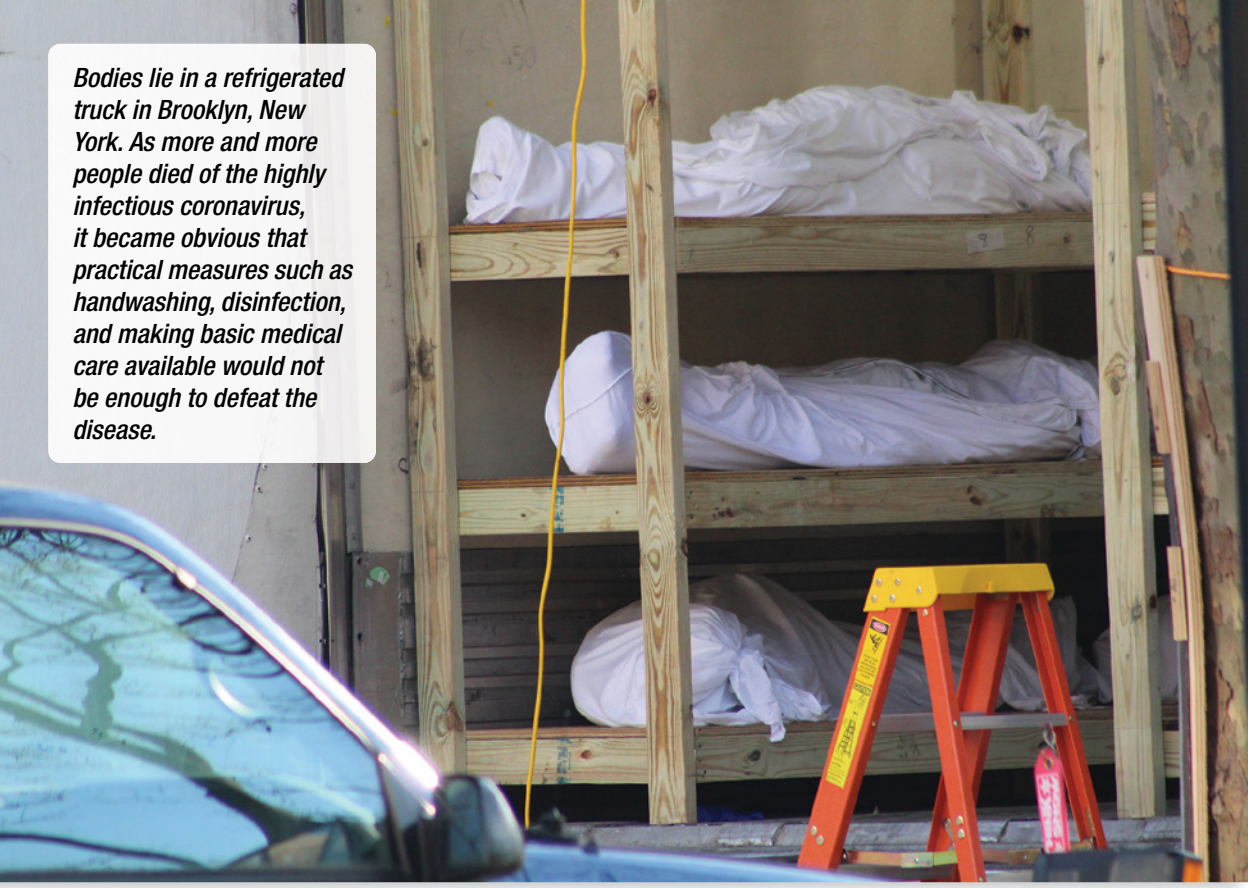
During a visit to the National Institutes of Health in March 2020, President Donald Trump sought information about the research center's work with Moderna on a COVID-19 vaccine. Among the NIH scientists he met was one of the project's chief architects, Dr. Kizzmekia Corbett. The thirty-four-year-old doctor and immunologist explained how the vaccine could teach the body how to recognize the virus's spike protein and then fight to eliminate it. As Corbett later told *Nature* magazine, "If you want to go fast in a pandemic, then messenger RNA (mRNA) is a shoo-in. It can be manufactured very quickly in very vast quantities, and it's plug and play in that you can essentially just swap out the protein once you have the system down."

Corbett's own story is just as remarkable. She set her sights on a career in science at a young age. At the University of Maryland, Baltimore, she became a Meyerhoff Scholar, part of a program that develops women and minorities in science. Her meteoric rise at the NIH led to her lifesaving work on the mRNA vaccine. As an African American, she is also using her spare time—what there is of it—to keep the Black community informed about the vaccine's safety and effectiveness.

Quoted in Nidhi Subbaraman, "This COVID-Vaccine Designer Is Tackling Vaccine Hesitancy—in Churches and on Twitter," *Nature*, February 11, 2021. www.nature.com.

The protests helped fuel the federal effort to develop a vaccine. In 1997 President Bill Clinton promised that an AIDS vaccine would be created within a decade. Fauci's NIAID set up the Vaccine Research Center to focus on an AIDS vaccine. But scientists found that creating such a vaccine was a daunting task. The virus's extraordinary ability to mutate kept defeating potential vaccines. Trials not only failed but also proved risky to the test subjects. Despite the poor prospects, millions were spent on vaccine development each year. As Fauci recalls:

> Although some of us, myself included, were really less than cautiously optimistic, we were hoping that we would see some signal that would allow us to build on the next generation of a similar type of vaccine. . . . My job was to remind people that research is fundamentally a bunch of failures with an occasional bright light of a success and to tell them that we're not going to give up on vaccines.[7]



*Bodies lie in a refrigerated truck in Brooklyn, New York. As more and more people died of the highly infectious coronavirus, it became obvious that practical measures such as handwashing, disinfection, and making basic medical care available would not be enough to defeat the disease.*

There is still no vaccine that will prevent HIV infection. Instead, researchers were able to develop a cocktail of drugs that effectively control the HIV virus in those already infected. For scientists and activists alike, the failed quest for an AIDS vaccine seemed to reveal the limits of modern medicine.

## A Partnership for Speed

Such perceived limits were bound to affect the push to develop a vaccine for COVID-19. To break through such limitations, it was necessary to go where no one had gone before—and in the process, get the public to buy in. This was the thought process that occurred to Peter Marks, the slender, bespectacled doctor in charge of regulating vaccine approval at the US Food and Drug Administration (FDA). A fan of the science-fiction series *Star Trek*, Marks had the perfect name for the laser-focused effort needed to produce a COVID-19 vaccine: Operation Warp Speed.

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# FOR FURTHER RESEARCH

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