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COMMENTARY

The NIH-Moderna Vaccine: Public Science, Private Profit, and Lessons for the Future

Christopher J. Morten

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Abstract: This commentary highlights the scientific history of the NIH-Moderna COVID-19 vaccine and corroborates Sarpatwari’s theme of private capture of value created by the public. The commentary also identifies missteps by the Trump and Biden Administrations and offers policy recommendations: better contracts with and incentives for pharmaceutical manufacturers and a not-for-profit “public option” for pharmaceutical development.

In Public Returns on Public Investment: Moderna’s Violation of the Social Contract, a new article in this issue, Ameet Sarpatwari traces the extraordinary history of the NIH-Moderna COVID-19 vaccine from three perspectives: financial, legal, and political-economic. He describes a broken partnership and broken bargain between the U.S. government and Moderna. As Sarpatwari shows, Moderna received unprecedented “derisking” in the form of research funding, support for clinical trials, and an advanced market commitment; in return, the U.S. government and American people expected affordable access and some level of shared control. Moderna broke that partnership and that bargain.

This commentary responds to and builds on Sarpatwari’s article in two respects. First, it describes the history of the NIH-Moderna vaccine from a fourth perspective — scientific — which corroborates Sarpatwari’s theme of private capture of value created by the public. Second, it echoes Sarpatwari’s diagnoses and calls for reform. More specifically, this commentary identifies missteps by the Trump and Biden Administrations and offers three recommendations for the future: (1) better contracts with pharmaceutical manufacturers, (2) better incentives for those manufacturers, and (3) a not-for-profit “public option” for pharmaceutical development.

Moderna’s Violation of the Social Contract Highlights Moderna’s Unprecedented “Derisking” and the Harms of High Vaccine Prices

Building on testimony Sarpatwari delivered to the United States Senate Committee on Health, Education, Labor and Pensions (HELP) in March 2023, Moderna’s Violation of the Social Contract describes how the U.S. government’s collaboration with Moderna to develop the wildly successful NIH-Moderna vaccine “turned the traditional model of therapeutic development on its head.” Sarpatwari’s central theme is “derisking”: the government, not Moderna, provided substantial capital and bore much of the risk.

Much of Moderna’s Violation of the Social Contract deftly synthesizes what others have reported about Moderna to provide a thorough accounting of the risk-reducing financial subsidies Moderna received in 2020 and 2021. Sarpatwari then builds on that synthesis with incisive analysis and timely recommendations, which I comment upon below.

Several aspects of Sarpatwari’s factual account are worth reiterating. Particularly important are two
major details of Moderna’s subsidies that have escaped widespread attention. First, the U.S. government’s August 2020 procurement contract with Moderna — worth $1.5 billion, in exchange for 100 million doses of the NIH-Moderna vaccine — was apparently executed at risk. This means the contract seemingly committed the government to pay Moderna even if the vaccine never obtained FDA authorization or approval. As such, this first procurement contract “derisked” Moderna’s development process enormously. Second, Sarpatwari observes that, with the same contract, the U.S. government attempted to shield Moderna from any liability it might face for infringing other companies’ patents in the course of manufacturing and distributing the vaccine. In February 2023, the Department of Justice confirmed the government’s intent to provide this additional subsidy to Moderna: “the effect of the Government’s ‘authorization and consent’ is to relieve Moderna of any liability for patent infringement resulting in performance of the [August 2020 procurement contract] and to transfer to the United States any liability for the manufacture or use of the inventions claimed in [patents asserted against Moderna] resulting from the authorized and consented acts.” This liability shield may be worth tens or even hundreds of millions of dollars, as Moderna defends itself from claims of patent infringement brought by Alnylam, Arbutus, and Genevant, all of which hold patents on lipid nanoparticle technology used in mRNA delivery.

Yet Moderna, and its executives and other shareholders, have managed to capture the value produced by this public-private collaboration. Moderna has now decided to quintuple its prices, from about $25 per dose to $130 — a price its executives describe as “consistent with” the full value of vaccine. Sarpatwari shows that these price increases are unjustifiable and likely to harm patients, public health, and American taxpayers for years to come.

An Additional Scientific Perspective Corroborates Sarpatwari’s Account: Moderna Captured Valuable Science Created by the Public

I testified alongside Sarpatwari at the March 2023 hearing of the Senate HELP Committee, and I sought to present a distinct and complementary perspective on the NIH-Moderna vaccine: scientific. I attempted to answer two basic questions about the scientific history of the NIH-Moderna vaccine: What are the key features of the vaccine that make it safe, effective, stable, and otherwise valuable? Whose insights and labor created these features and this valuable product?

My research and testimony focused on three key scientific features of the NIH-Moderna vaccine:

1. The immunogen — the chemically modified coronavirus spike protein the vaccine produces once inside the body, sparking a protective immune response;
2. The modified mRNA — the stabilized, chemically modified mRNA that “encodes” the immunogen; and
3. The delivery system — the lipid nanoparticle that helps the mRNA stay stable and enter cells in the body to begin producing protein.

The choice of these three was not arbitrary; Moderna and its scientists have at points identified these three features of the NIH-Moderna vaccine as particularly important to the vaccine’s success.

I found that Moderna did not invent any of these three features on its own. In fact, Moderna cannot claim to be the driving force behind any of these three features. Here, I provide a summary.

First, the immunogen was not invented by Moderna; it was instead invented by a publicly funded team of NIH scientists and academic collaborators working at the Scripps Research Institute and Dartmouth College, years before SARS-CoV-2 emerged. Before entering its collaboration with NIH in early 2020, Moderna had never done any work on a coronavirus vaccine, and the company relied heavily on NIH’s longstanding expertise. Writing to NIH scientist Barney Graham in January 2020, Moderna CEO Stéphane Bancel stated that Moderna would be “ready to run when you give us a sequence” of viable SARS-CoV-2 immunogen — and NIH delivered that sequence to Moderna days later. Moderna’s reliance on NIH in 2020 has not stopped the company from exaggerating its own scientific role in the years since, or from attempting, brazenly, to obtain its own patent on the immunogen sequence, omitting NIH.

Second, the modified mRNA was likewise not invented by Moderna. Primary credit for the invention of the modified mRNA belongs to researchers working at the University of Pennsylvania, including Katalin Karikó and Drew Weissman. This work, and other work on modified mRNA, was again supported by NIH.

Third, the delivery system was probably not invented by Moderna. The scientific history of lipid nanoparticle delivery systems is complex and somewhat murky, and details of the specific nanoparticles that Moderna uses in its vaccines are hard to come by. Yet it seems that the nanoparticles Moderna uses were invented...
and initially developed by researchers affiliated with the University of British Columbia and certain startup companies in British Columbia, not Moderna.

I also examined how NIH and Moderna collaborated to combine these three features (and others) into a single product, manufacturable at scale. Combining these features into a complete, validated vaccine in a matter of months was a momentous achievement in its own right. However, as I described in my testimony, again it seems the U.S. government did at least as much as Moderna. For example, NIH designed, partner in its partnership with Moderna to a helpless customer.

The shrunken power of the government is arguably best highlighted by a July 2023 letter that Xavier Becerra, Secretary of Health & Human Services, sent to Moderna and Pfizer. Becerra essentially begged the companies not to increase vaccine prices: “Price gouging behavior takes advantage of the trust the American people have placed in you through the COVID-19 response.”

Neither Moderna nor Pfizer has given any indica-

Operation Warp Speed’s negotiators botched their negotiation. Back in the hectic, horrible, uncertain days of 2020, the Trump Administration failed to extract legally binding concessions from Moderna in exchange for the unprecedented derisking it gave the company. These concessions might have included contractual commitments to fair pricing, data sharing, and global access to mRNA vaccines; shared control of intellectual property, manufacturing data, and Moderna’s scientific agenda; or perhaps some of the more quotidian concessions given to major private investors, such as shares and voting board seats.

paid for, and ran the early clinical trials on the original NIH-Moderna vaccine, and it later helped Moderna develop its first variant-specific booster shot. Moreover, Operation Warp Speed provided equipment and other support to expand Moderna’s manufacturing. Then-head of Operation Warp Speed Moncef Slaoui summed it up in late 2020: “We held Moderna by the hand on a daily basis.”

Of course, Moderna’s scientists and engineers made significant contributions of their own to the NIH-Moderna vaccine. These include the vaccine’s “stop codon,” a commercial-scale manufacturing process, and improvement of the modified mRNA. Moderna’s scientists, engineers, and other employees deserve celebration alongside NIH’s and their academic collaborators.

Overall, however, the scientific history undermines Moderna’s executives’ efforts to claim the full value of the NIH-Moderna vaccine for the company.

Lessons and Recommendations for the Future

Today, Moderna controls the factories, key intellectual property and tacit knowledge, the regulatory filings, and the scientific agenda for future mRNA research. The government finds itself transformed from senior

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globally, and catalyzing new research.34
variants to the United States, saving lives here and
ing supplies and access, limiting the spread of new
with the World Health Organization, thereby expand-
able information on mRNA vaccine manufacturing
have used the DPA to compel Moderna to share valu-
ks in financial leverage to extract concessions from the company
pricing and access.32 Better yet, Biden could have
ed the Defense Production Act (DPA) — a federal
statute enacted in 1950 that gives the U.S. President
broad and unilateral authority to protect the national
defense.33 In 2021, as vaccine supplies were scarce and
global manufacturing capacity sat idle, Biden could
have used the DPA to compel Moderna to share valu-
able information on mRNA vaccine manufacturing
with the World Health Organization, thereby expand-
ings and access, limiting the spread of new
variants to the United States, saving lives here and
globally, and catalyzing new research.36
Another critical question: what to do now? Sar-
patwari argues that our government could still act to
urge Moderna to lower its prices, and/or mitigate the
harms of high prices. He proposes increased Congres-
sional pressure on the company; continuation of bulk
purchases of vaccines; and Congressional authoriza-
tion to the Centers for Medicare and Medicaid Ser-
ices (CMS) to negotiate prices.35 I agree.
Sarpatwari looks ahead to future public health
emergencies. In Moderna’s Violation of the Social Con-
tract and elsewhere,36 Sarpatwari argues for a new law
and policy framework for public-private partnerships
between the U.S. government and pharmaceutical
companies. For Sarpatwari, an essential component
of this new framework will be explicit, enforceable con-
tratual provisions in government and industry part-
nerships to ensure affordable prices.37 Again, I agree.
In separate writing,38 I elaborate on long-term les-
ses I think we should take from the successes and
failures of Operation Warp Speed. In brief, I believe
our government should both restructure its legal
arrangements with the pharmaceutical industry and,
simultaneously, explore the possibility of discovering,
developing, manufacturing, and developing pharma-
aceutical products without relying on that rapacious
industry.
The government can and should restructure legal
arrangements with industry by contracting better—
with fair pricing and global access provisions, com-
mittments to data sharing, government representatives
on corporate boards, and so on as noted above—and
by experimenting with alternative incentive struc-
tures that entice industry but leave greater control
in the hands of the public. Such incentive structures
include innovation prizes39 and “government-owned,
contractor-operated” (GOCA) partnership mod-
els.40 Government-set innovation prizes would align
R&D efforts with the greatest public health needs
would “de-link” financial incentives for industry
from prices, meaning industry could be guaranteed a
healthy financial reward for useful innovation while
also guaranteeing low prices for patients.41 The GOCO
model—already widely used by the U.S. Departments
of Defense and Energy—pays companies to operate
R&D and manufacturing facilities but retains public
ownership of those facilities.42
Simultaneously, the government can and should
foster a genuine alternative to the profit-hungry phar-
aceutical industry. We need a “public option” compr-
ising government-owned, government-operated pharma-
caceutical research and development and man-
ufacturing, and focused not on profit but on public
health and the advancement of human knowledge.43
The opportunity for reform is ripe. Congress and
the Biden Administration have announced major new
investments and initiatives in research and develop-
ment (such as Project NextGen (which will develop
new technologies against SARS-CoV-2) and ARPA-
H (which expands NIH’s ability to do high-risk, high-
reward research)). Congress is considering more
(such as a reauthorized and expanded Pandemic and
All-Hazards Preparedness Act (which invests billions
in pandemic preparedness)). Promisingly, the Biden
Administration just included an explicit, enforceable
reasonable pricing provision in a new $326 million
investment contract with Regeneron struck as part of
Project NextGen.47
The stakes are high. Debates over not just pharma
and health care but also housing, transportation,
energy, response to climate change, and more all turn
on fundamental questions of the legal structure of
public investment in new technologies. Moderna’s
Violation of the Social Contract illuminates some of
the weaknesses of the current paradigm of public-priv-
ate partnership and points us to a new one.
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of the Collaboration for Regulatory Rigor, Integrity & Transparency
at Yale University
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1. A. Sarpatwari, “Public Returns on Public Investment: Mod-
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cine, & Ethics 51, no. 3 (2023): 28–34 [hereinafter cited as
Moderna’s Violation of the Social Contract].
2. I use the term “NIH-Moderna vaccine” because I believe it
most accurately reflects the vaccine’s origins, which I summa-
ize below and which Sarpatwari describes in his paper. NIH


7. For my take, see id., at 28.


11. See Morten, Written Statement Before the Senate HELP Committee, supra note 8.

12. A 2020 paper co-authored by Moderna scientists, NIH scientists, and other states that “[t]he rapid and robust immunogenicity profile of the [NIH-Moderna] vaccine most likely results from an innovative structure-based vaccine antigen design [i.e., the immunogen], coupled with a potent lipid-nanoparticle delivery system (i.e., the delivery system), and the use of modified nucleotides that avoid early intracellular activation of interferon-associated genes [i.e., the modified mRNA].” Lisa A. Jackson et al., “An mRNA Vaccine against SARS-CoV-2 — Preliminary Report,” New England Journal of Medicine 383, no. 20 (2020): 1920–31, at 1929. Moderna also highlights these same three key features of mRNA-based COVID-19 vaccines in its complaint for patent infringement against Pfizer and BioNTech. See Complaint at 6, Moderna v. Pfizer, No. 1:22-cv-11378 (D. Mass., Aug. 26, 2022) (identifying the SARS-CoV-2 spike protein sequence encoded by the Pfizer-BioNTech and the Pfizer-BioNTech chemically-modified-mRNA platform as “critical features” of the Pfizer-BioNTech vaccine); id. at 17 (asserting that “packaging [...] chemically-modified mRNA in a lipid nanoparticle formulation allow[s] for the efficient delivery of the mRNA to cells”). These three key features of Moderna’s vaccine have also been highlighted by other analysts, such as Kaiser Health News journalist Arthur Allen. See A. Allen, Government-Funded Scientists Laid the Groundwork for Billion-Dollar Vaccines (November 2020), Kaiser Health Network Website, available at <https://khn.org/news/vaccine-pioneers-basic-research-scientists-laid-groundwork-for-billion-dollar-pharma-products/> (last visited September 14, 2023).

13. See Morten, Written Statement Before the Senate HELP Committee, supra note 8.


19. See Morten, Written Statement Before the Senate HELP Committee, supra note 8, at 20–22.

20. Id.; see also Dolgin, supra note 18, at 322–23 (stating that the crucial nanoparticle technology “[came] from the laboratory of Pieter Cullis, a biochemist at the University of British Columbia in Vancouver, Canada, and several companies that he founded or led” but that “who owns the relevant patents remains the subject of legal dispute”).


22. See, e.g., Loftus, supra note 17, at 119–21; M. Glim, “That Record-breaking Sprint to Create a COVID-19 Vaccine,” The NIH Catalyst 29 issue 5, 18 (September–October 2021), available at <https://irp.nih.gov/catalyst/29/5/that-record-breaking-sprint-to-create-a-covid-19-vaccine> (last visited September 14, 2023) (“Less than 48 hours after the release of the novel coronavirus’s genome, the team had designed the protein that their candidate COVID-19 vaccine would use to teach the immune system to fend off the virus. Sixty-five days later, the VRC began clinical trials in collaboration with Moderna and clinical investigators from NIH’s Division of Microbiology and Infectious Diseases.”).

23. See Loftus, supra note 17, at 234–35.


25. Id.


28. Id.
33. See 50 U.S.C. § 4501 et seq.
35. See Sarpatwari, Moderna’s Violation of the Social Contract, supra note 1, at 31.
37. See Sarpatwari, Moderna’s Violation of the Social Contract, supra note 1, at 31.
42. See Public Citizen, supra note 40.