Government funding in patents related to COVID-19 technology: CRISPR diagnostics, antibodies, and mRNA vaccines

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KEI webinar on government funding of COVID-19 vaccines and other medical technologies
October 2020

CRISPR diagnostics

Patents and licensing of CRISPR diagnostics

company	COVID-19 test status	public funding	patent status
Mammoth	authorized by the FDA	yes, via Jennifer Doudna	exclusive license
Sherlock	authorized by the FDA	yes, via Feng Zhang	exclusive license
Tata Group	approved in India	yes, via CSIR-IGIB	non-exclusive license
CASPR	under development	yes, via CONICET	applications filed

Patents and licensing of CRISPR diagnostics

patent id	assignee or licensee	CRISPR proteins	geographical scope, based on the applications we know of
10,253,365	Mammoth	Cas12	Israel, Australia, Singapore, Japan, the EPO, China, and India
10,337,051	Mammoth	Cas13	U.K, Germany, Canada, Australia, Japan, the EPO, and China
20200299768	Mammoth	Cas12	unknown
10,266,886	Sherlock	Cas13	Australia, EPO, Canada, China, Brazil, and Korea
10,266,887	Sherlock	Cas13	Australia, EPO, Canada, China, Brazil, and Korea
unknown	Tata Group	reportedly Cas9	unknown
unknown	CASPR	reportedly Cas12	unknown

COVID-19 antibody treatment

US010787501B1

(12) **United States Patent**
Babb et al.

(10) **Patent No.: US 10,787,501 B1**
(45) **Date of Patent: Sep. 29, 2020**

(54) **ANTI-SARS-COV-2-SPIKE GLYCOPROTEIN ANTIBODIES AND ANTIGEN-BINDING FRAGMENTS**

(71) Applicant: **Regeneron Pharmaceuticals, Inc.**, Tarrytown, NY (US)

(72) Inventors: **Robert Babb**, River Edge, NJ (US); **Alina Baum**, Pleasantville, NY (US); **Gang Chen**, Yorktown Heights, NY (US); **Cindy Gerson**, Irvington, NY (US); **Johanna Hansen**, Greenwich, CT (US); **Tammy Huang**, Cross River, NY (US); **Christos Kyratsous**, Irvington, NY (US); **Wen-Yi Lee**, New Hyde Park, NY (US); **Marine Malbec**, Port Chester, NY (US); **Andrew Murphy**, Croton-on-Hudson, NY (US); **William Olson**, Yorktown Heights, NY (US); **Neil Stahl**, Carmel, NY (US); **George D. Yancopoulos**, Yorktown Heights, NY (US)

(73) Assignee: **Regeneron Pharmaceuticals, Inc.**, Tarrytown, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/912,678**

(22) Filed: **Jun. 25, 2020**

Related U.S. Application Data

(60) Provisional application No. 63/004,312, filed on Apr. 2, 2020, provisional application No. 63/014,687, filed on Apr. 23, 2020, provisional application No. 63/025,949, filed on May 15, 2020, provisional application No. 63/034,865, filed on Jun. 4, 2020.

(51) **Int. Cl.**

C07K 16/10	(2006.01)
A61K 45/06	(2006.01)
A61K 39/395	(2006.01)
A61K 39/15	(2006.01)

(52) **U.S. Cl.**
CPC ***C07K 16/10*** (2013.01); ***A61K 39/15*** (2013.01); ***A61K 39/395*** (2013.01); ***A61K 45/06*** (2013.01); *C07K 2317/31* (2013.01); *C07K 2317/52* (2013.01); *C07K 2317/565* (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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U.S. Appl. No. 63/014,687, filed Apr. 23, 2020, Pending, 10753P2.
U.S. Appl. No. 63/025,949, filed May 15, 2020, Pending, 10753P3.
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(Continued)

Primary Examiner — Benjamin P Blumel
(74) *Attorney, Agent, or Firm* — Schwabe, Williamson & Wyatt PC; Gabe Amodeo

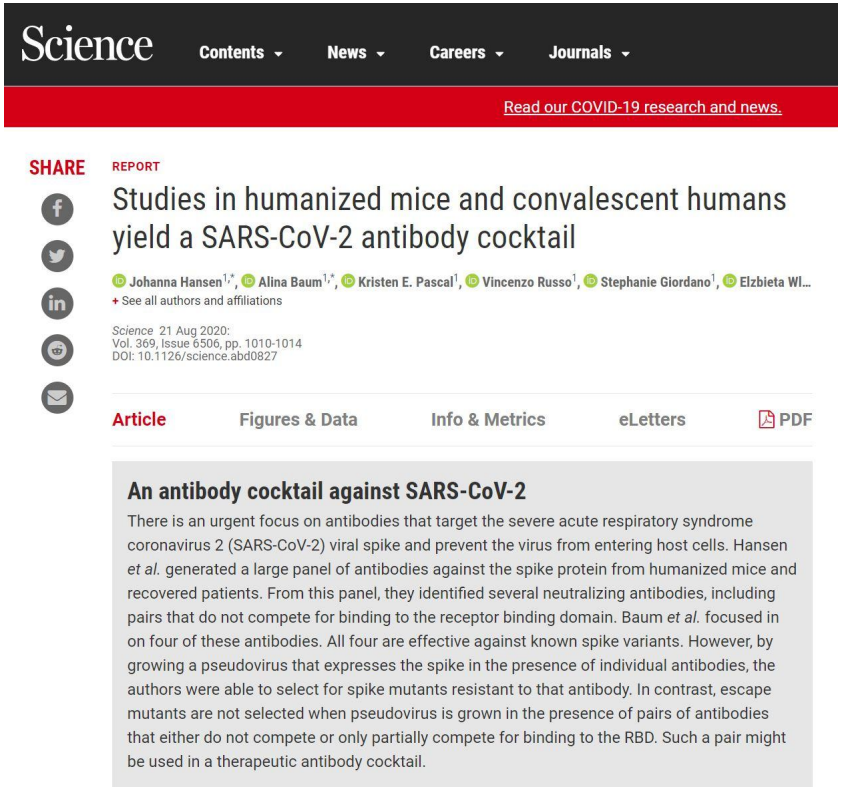
(57) **ABSTRACT**

The present disclosure provides antibodies and antigen-binding fragments thereof that bind specifically to a coronavirus spike protein and methods of using such antibodies and fragments for treating or preventing viral infections (e.g., coronavirus infections).

20 Claims, 14 Drawing Sheets

Specification includes a Sequence Listing.

At least two academic papers co-authored by Regeneron scientists acknowledge BARDA funding



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REPORT

Studies in humanized mice and convalescent humans yield a SARS-CoV-2 antibody cocktail

Johanna Hansen[1,*], Alina Baum[1,*], Kristen E. Pascal[1], Vincenzo Russo[1], Stephanie Giordano[1], Elzbieta Wl…

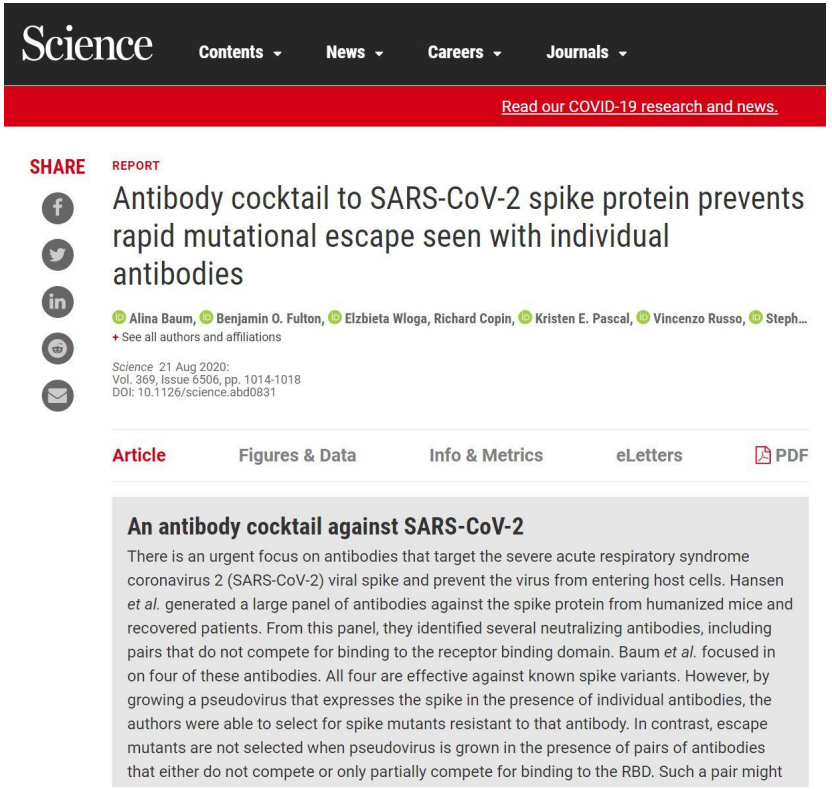
+ See all authors and affiliations

Science 21 Aug 2020:
Vol. 369, Issue 6506, pp. 1010-1014
DOI: 10.1126/science.abd0827

Article Figures & Data Info & Metrics eLetters PDF

An antibody cocktail against SARS-CoV-2

There is an urgent focus on antibodies that target the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) viral spike and prevent the virus from entering host cells. Hansen *et al.* generated a large panel of antibodies against the spike protein from humanized mice and recovered patients. From this panel, they identified several neutralizing antibodies, including pairs that do not compete for binding to the receptor binding domain. Baum *et al.* focused in on four of these antibodies. All four are effective against known spike variants. However, by growing a pseudovirus that expresses the spike in the presence of individual antibodies, the authors were able to select for spike mutants resistant to that antibody. In contrast, escape mutants are not selected when pseudovirus is grown in the presence of pairs of antibodies that either do not compete or only partially compete for binding to the RBD. Such a pair might be used in a therapeutic antibody cocktail.



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REPORT

Antibody cocktail to SARS-CoV-2 spike protein prevents rapid mutational escape seen with individual antibodies

Alina Baum, Benjamin O. Fulton, Elzbieta Wloga, Richard Copin, Kristen E. Pascal, Vincenzo Russo, Steph…

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Science 21 Aug 2020:
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Regeneron failed to disclose BARDA funding in their REGN-COV2 patent

Posted on October 20, 2020 by KEI Staff

Regeneron Pharmaceuticals failed to disclose U.S. government funding in a patent that claims antibodies against COVID-19. The obligation to acknowledge U.S. government funding in patents is required under an existing contract between Regeneron and the Biomedical Advanced Research and Development Authority (BARDA), as well as the Bayh-Dole Act and regulations issued by the United States Patent and Trademark Office (USPTO). The patent in question is U.S. patent 10,787,501 (the "'501 patent"), titled Anti-SARS-CoV-2-spike glycoprotein antibodies and antigen-binding fragments, claimed the priority benefits of U.S. provisional applications 63/004,312, filed April 2, 2020; 63/014,687, filed April 23, 2020; 63/025,949, filed May 15, 2020; and 63/034,865, filed June 4, 2020.

A research note by Luis Abinader on this issue is available here: rn-2020-4

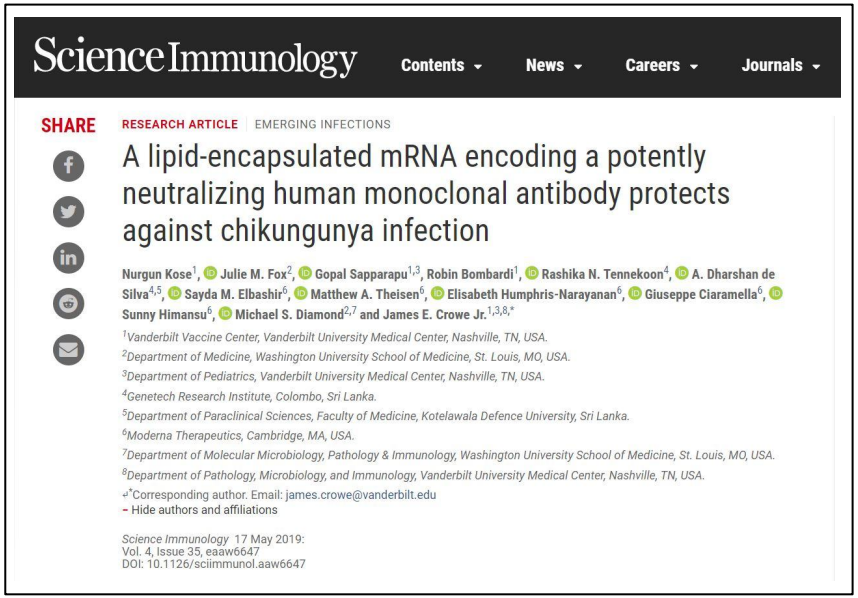
mRNA vaccines

None of the published U.S. patents assigned to Moderna acknowledge government support

U.S. patents and applications assigned to Moderna as of August 24, 2020			
priority year	N applications	N patents	N with GOVT
2010	3	8	0
2011	24	12	0
2012	40	41	0
2013	10	9	0
2014	7	7	0
2015	38	34	0
2016	13	12	0
2017	16	3	0
2018	2	0	0
2019	1	0	0
total	154	126	0

data collection: we used USPTO databases to search for all patents and applications assigned to “Moderna” or “ModernaTx.” A total of sixteen patents and seven applications were dropped from the dataset, and are not reflected above, because they were assigned to companies other than Moderna.

At least two academic papers co-authored by Moderna scientists acknowledge DARPA funding



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RESEARCH ARTICLE | EMERGING INFECTIONS

A lipid-encapsulated mRNA encoding a potently neutralizing human monoclonal antibody protects against chikungunya infection

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Science Immunology 17 May 2019:
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DOI: 10.1126/sciimmunol.aaw6647

Article Cell

Vaccine Mediated Protection Against Zika Virus-Induced Congenital Disease

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http://dx.doi.org/10.1016/j.cell.2017.06.040

KEI asks DOD to investigate failure to disclose DARPA funding in Moderna patents

Posted on August 28, 2020 by James Love

(More on Moderna here: https://www.keionline.org/moderna)

Luis Gil Abinader has taken a deep dive into Moderna's surprising practice of never declaring government funding in its 126 patents and 154 patent applications, despite having had funding from multiple federal agencies.

One outcome of his research is a 25 page report (RN-2020-3) on Moderna's failure to report funding from DARPA, and a request by KEI to DOD and DARPA to remedy this, including by taking title to patents where disclosures should have been made. (Text of letter below, and PDF version here).

KEI will also send a letter to BARDA. The letter below was addressed to DOD and DARPA, and focuses on their funding.

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
675 NORTH RANDOLPH STREET
ARLINGTON, VA 22203-2114

September 18, 2020

Via Electronic Mail

James Love
Knowledge Ecology International
1621 Connecticut Avenue, NW, Suite 500
Washington, D.C. 20009

Dear Mr. Love:

I am responding to your letter of August 27, 2020, to Dr. Amy Jenkins at the Defense Advanced Research Projects Agency (DARPA) requesting the Department of Defense investigate Moderna Therapeutics' (Moderna) alleged failure to disclose DARPA funding support in its patented inventions. DARPA is reviewing agreements it has awarded to Moderna and U.S. patents and published patent applications for Moderna and ModernaTx, since March 2013.

Thank you for bringing this matter to our attention. Should you have any questions, please contact DARPA Deputy General Counsel, Geraldine Chanel, at 571-218-4609 or geraldine.chanel@darpa.mil.

Sincerely,

D. Peter Donaghue
Contracting Officer-Division Director
Contracts Management Office

moderna

Statement by Moderna on Intellectual Property Matters during the COVID-19 Pandemic

October 8, 2020

Moderna is a pioneer in the development of messenger RNA (mRNA) vaccines and therapeutics. From its inception in 2010, Moderna saw the potential of this new class of medicines to make a significant difference in patients' lives. With the support of our investors we have invested billions of dollars into research and development to make mRNA medicines a reality. One of the exciting discoveries advanced by Moderna was the combination of mRNA and lipid nanoparticles (LNPs) to make vaccines, and the demonstration of this potential in human clinical trials for eleven different infectious disease vaccines since 2015. Those discoveries and the expertise we developed have uniquely positioned Moderna to respond to the COVID-19 pandemic quickly. Information on our work toward a COVID-19 vaccine can be found here.

As a company committed to innovation, Moderna recognizes that intellectual property rights play an important role in encouraging investment in research. Our portfolio of intellectual property is an important asset that will protect and enhance our ability to continue to invest in innovative medicines. A summary of our intellectual property can be found here. A selection of representative issued US patents relevant to our mRNA-1273 vaccine against COVID-19 is available here.

Beyond Moderna's vaccine, there are other COVID-19 vaccines in development that may use Moderna-patented technologies. We feel a special obligation under the current circumstances to use our resources to bring this pandemic to an end as quickly as possible. Accordingly, while the pandemic continues, Moderna will not enforce our COVID-19 related patents against those making vaccines intended to combat the pandemic. Further, to eliminate any perceived IP barriers to vaccine development during the pandemic period, upon request we are also willing to license our intellectual property for COVID-19 vaccines to others for the post pandemic period.

Moderna is proud that its mRNA technology is poised to be used to help end the current pandemic.

Forward-Looking Statements

This statement contains forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995, as amended, including regarding Moderna's stance with respect to enforcement and licensing of its intellectual property rights during and following the COVID-19 pandemic. In some cases, forward-looking statements can be identified by terminology such as "will," "may," "should," "could", "expects," "intends," "plans," "aims," "anticipates," "believes," "estimates," "predicts," "potential," "continue," or the negative of these terms or other comparable terminology, although not all forward-looking statements contain these words. The forward-looking statements in this statement are neither promises nor guarantees, and you should not place undue reliance on these forward-looking statements because they involve known and unknown risks, uncertainties, and other factors, which could cause actual results to differ materially from those expressed or implied by these forward-looking statements. These risks, uncertainties, and other factors include those risks and uncertainties described under the heading "Risk Factors" in Moderna's most recent Quarterly Report on Form 10-Q filed with the U.S. Securities and Exchange Commission (SEC) and in subsequent filings made by Moderna with the SEC, which are available on the SEC's website at www.sec.gov. Except as required by law, Moderna disclaims any intention or responsibility for updating or revising any forward-looking statements contained in this statement in the event of new information, future developments or otherwise. These forward-looking statements are based on Moderna's current expectations and speak only as of the date hereof.