Phase 3 COVID-19 Vaccines – Rev a

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1. Introduction

It is very difficult for utility business leaders to plan future projects and resource allocations when they do not know when the COVID-19 Pandemic will end. Currently it seems to be getting worse every day.

Utilities are losing revenue because of the inability of many of their residential and small commercial accounts to pay. Many states, counties and municipalities have put moratoriums on power shutoffs, and many small businesses have simply shut down,

In addition COVID-19 has forced all utilities to drastically modify their operations to avoid infecting their employees and the public they serve. It was already difficult to maintain staffing levels, and the loss of even a few employees due to sickness or worse will increase pressure on key skills. Record heat waves and a hurricane season with above normal number storms stretch resources even more. Also, we are a couple of months away from flu season in the U.S.

To make matters more critical, as I write this significant wildfires have been raging throughout the west. This has already been a record wildfire season for California, and the wildfires normally peak in October. Crews must be sent into areas devastated by wildfires and those impacted by public safety power shutoffs.

The only future good news will be when a COVID-19 Vaccine is available in millions of doses.

What the original post of this document attempted to do is define firms and partnerships that had entered Phase 3 trials for their COVID-19 vaccines as its posting date (July 31). In this post I will attempt to describe developers that will likely offer vaccines in the U.S. in large volumes before the end of 2020 or early 2021. I drew these new developers from additional firms that signed “The Pledge” (see section 3 below).

Per my normal practice, sources will be referenced with links, and I will verify those links as part of my normal proofing.

2. U.S. Biomedical Advanced Research and Development Authority

This agency (a.k.a. BARDA) per the source here,[1] *Biomedical Advanced Research and Development Authority (BARDA), part of the HHS Office of the Assistant Secretary for Preparedness and Response, was established to aid in securing our nation from chemical, biological, radiological, and nuclear (CBRN) threats, as well as from pandemic influenza (PI) and emerging infectious diseases (EID). BARDA supports the transition of medical countermeasures such as vaccines, drugs, and diagnostics from research through advanced development towards consideration for approval by the FDA and inclusion into the Strategic National Stockpile. BARDA’s support includes funding, technical assistance and core services, ranging from a clinical research organization*

[1] Biomedical Advanced Research and Development Authority, https://www.phe.gov/about/BARDA/Pages/default.aspx

network to Centers for Innovation in Advanced Development and Manufacturing, and a fill-finish manufacturing network. BARDA supports a diverse portfolio of medical countermeasures and these products have received a total of 55 FDA approvals, licensures, or clearances.

We will assume that any firm or partnership covered in this paper that is receiving substantial BARDA funding for trials and/or early manufacturing of their vaccine will be supplying large quantities of this vaccine to the U.S. shortly after FDA-approval of this product.

Also BARDA is starting early contracting of facilities and materials to start manufacturing the most advanced vaccines (described below) before the trials are completed.

Operation Warp Speed is a partnership among components of the Department of Health and Human Services (HHS), including BARDA, the Centers for Disease Control and Prevention (CDC), the Food and Drug Administration (FDA), and the National Institutes of Health (NIH), and the Department of Defense (DoD).

3. The Pledge

The CEOs of AstraZeneca, BioNTech, GlaxoSmithKline plc, Johnson & Johnson, Merck, Moderna, Inc., Novavax, Inc., Pfizer Inc., and Sanofi, today announced a historic pledge, outlining a united commitment to uphold the integrity of the scientific process as they work towards potential global regulatory filings and approvals of the first COVID-19 vaccines. This pledge is below.[2]

We, the undersigned biopharmaceutical companies, want to make clear our on-going commitment to developing and testing potential vaccines for COVID-19 in accordance with high ethical standards and sound scientific principles.

The safety and efficacy of vaccines, including any potential vaccine for COVID-19, is reviewed and determined by expert regulatory agencies around the world, such as the United States Food and Drug Administration (FDA). FDA has established clear guidance for the development of COVID-19 vaccines and clear criteria for their potential authorization or approval in the US. FDA's guidance and criteria are based on the scientific and medical principles necessary to clearly demonstrate the safety and efficacy of potential COVID-19 vaccines. More specifically, the agency requires that scientific evidence for regulatory approval must come from large, high quality clinical trials that are randomized and observer-blinded, with an expectation of appropriately designed studies with significant numbers of participants across diverse populations.

Following guidance from expert regulatory authorities such as FDA regarding the development of COVID-19 vaccines, consistent with existing standards and practices, and in the interest of public health, we pledge to:

- *Always make the safety and well-being of vaccinated individuals our top priority.*
- *Continue to adhere to high scientific and ethical standards regarding the conduct of clinical trials and the rigor of manufacturing processes.*

[2] Business Wire, "Biopharma Leaders Unite to Stand with Science", Sep 8, 2020, https://www.businesswire.com/news/home/20200908005282/en/

- *Only submit for approval or emergency use authorization after demonstrating safety and efficacy through a Phase 3 clinical study that is designed and conducted to meet requirements of expert regulatory authorities such as FDA.*
- *Work to ensure a sufficient supply and range of vaccine options, including those suitable for global access.*

We believe this pledge will help ensure public confidence in the rigorous scientific and regulatory process by which COVID-19 vaccines are evaluated and may ultimately be approved.

Together, these companies have collectively developed more than 70 novel vaccines that have helped to eradicate some of the world's most complex and deadly public health threats.

4. Moderna mRNA-1273

Per the source here,[3] *Drugmaker Moderna said Monday* (7/27) *it has begun a 30,000-patient, third-stage clinical trial for its COVID-19 vaccine candidate -- a day after receiving an additional $472 million from the U.S. government.*

Called the COVE, or Coronavirus Efficacy, study, the trial is being performed at 100 clinical research sites in collaboration with the National Institute of Allergy and Infectious Diseases and … BARDA.

Moderna said it has begun dosing human participants.

Moderna said Sunday it received the new federal funding to support late-stage clinical development as part of the administration's Operation Warp Speed initiative to find a COVID-19 vaccine.

BARDA has so far allocated nearly $1 billion in total funding to Moderna for its vaccine candidate, mRNA-1273. Phase 1 trial results showed the vaccine spurred antibody reactions in all 45 participants, with no serious side-effects, following two injections over the course of four weeks.

The primary endpoint of the new, larger study will be preventing COVID-19. Secondary endpoints include preventing severe COVID-19 cases and infection by SARS-CoV-2, the novel coronavirus that causes the disease.

"The company remains on track to be able to deliver approximately 500 million doses per year, and possibly up to 1 billion doses per year, beginning in 2021," Moderna said.

Per the source referenced here,[4] *Moderna (NASDAQ:MRNA) has apparently settled on a price for its potential blockbuster product. Citing "people familiar with talks between the company and potential buyers," the Financial Times reported Tuesday that the company aims to sell its vaccine at roughly $50 to $60 per two-dose treatment course.*

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[3] Don Jacobson, UPI, "Moderna begins 3rd stage of trial for potential COVID-19 vaccine", July 27, 2020, https://www.upi.com/Top_News/US/2020/07/27/Moderna-begins-3rd-stage-of-trial-for-potential-COVID-19-vaccine/4391595848461/

[4] Eric Volkman, The Motley Fool, "Report: Moderna Sets Price Range for Coronavirus Vaccine", July 29, 2020, https://www.fool.com/investing/2020/07/29/report-moderna-sets-price-range-for-coronavirus-va.aspx

That price applies to relatively prosperous countries such as the U.S. The article quoted "other people familiar with the plans" saying that the young biotech company has prioritized these markets. The report's sources claim that Moderna's pricing "causes considerable concern and difficulties in negotiations, in view of the fact that other companies have pledged much lower prices."

From this source here,[5] *"For Moderna's trial, volunteers will receive two injections about 28 days apart. Half the participants will receive the vaccine candidate, and the other half will get a placebo. It's a double-blind trial, which means neither the researchers nor the volunteers will know who got which doses."*

Moderna is a Massachusetts drug-maker that was incorporated in 2010. Their primary focus is using mRNA Technology. The explanation of this below is from the Moderna website.[6]

What does mRNA do? *mRNA produces instructions to make proteins that may treat or prevent disease*

mRNA medicines aren't small molecules, like traditional pharmaceuticals. And they aren't traditional biologics (recombinant proteins and monoclonal antibodies) – which were the genesis of the biotech industry. Instead, mRNA medicines are sets of instructions. And these instructions direct cells in the body to make proteins to prevent or fight disease.

It's actually basic human biology.

DNA (deoxyribonucleic acid) is a double-stranded molecule that stores the genetic instructions your body's cells need to make proteins. Proteins, on the other hand, are the 'workhorses' of the body. Nearly every function in the human body – both normal and disease-related – is carried out by one or many proteins.

mRNA is just as critical as DNA.

Without mRNA, your genetic code would never get used by your body. Proteins would never get made. And your body wouldn't – actually couldn't – perform its functions. Messenger ribonucleic acid, or mRNA for short, plays a vital role in human biology, specifically in a process known as protein synthesis. mRNA is a single-stranded molecule that carries genetic code from DNA in a cell's nucleus to ribosomes, the cell's protein-making machinery.

Update:

Moderna CEO Stéphane Bancel told CNBC's Squawk Box that results from the approximately 30,000-patient Phase III COVE trial (NCT04470427), evaluating the

[5] Susie Neilson, Business Insider, "Moderna's coronavirus vaccine just started its phase 3 trial — the first in the US. Here's how it'll work" Jul 27, 2020, https://www.businessinsider.com/moderna-coronavirus-vaccine-phase-3-clinical-trial-2020-7

[6] Moderna, "The Science and Fundamentals of mRNA Technology", https://www.modernatx.com/mrna-technology/science-and-fundamentals-mrna-technology

company's vaccine candidate mRNA-1273 and launched in July, could come as soon as October in a "really optimistic" scenario.[7]

5. Pfizer and BioNTech BNT162b2 Vaccine

The text below is from this source.[8]

U.S. pharmaceutical Pfizer and German biotech company BioNTech said they have started a late-stage human study of their coronavirus vaccine candidate.

In a statement on Monday, the companies said the trial will consist of up to 30,000 volunteers between the ages of 18 and 85 across 120 locations worldwide where there is significant transmission of COVID-19.

Those in the trial will receive a 30-microgram dose level of the vaccine in a two-dose regimen, it said.

"The initiation of the Phase 2/3 trial is a major step forward in our progress toward providing a potential vaccine to help fight the ongoing COVID-19 pandemic, and we look forward to generating additional data as the program progresses," said Ugur Sahin, CEO and co-founder of BioNtech. "Many steps have been taken toward this important milestone and we would like to thank all those involved for their extraordinary commitment."

The late-stage trial follows the success of a preliminary clinical phase that saw 120 patients demonstrate favorable overall tolerability to their candidate drug named BNT162b2, the companies said, adding that none of the patients exhibited serious adverse effects to the drug with some experiencing mild to transient issues, such as fever, fatigue and chills, for one to two days.

"If the Phase 2/3 trial is successful, Pfizer and BioNTech expect to be ready to seek Emergency Use Authorization or some form of regulatory approval as early as October 2020," the companies said in the release. "If authorization or approval is obtained, the companies currently aim to supply globally up to 100 million doses by the end of 2020 and approximately 1.3 billion doses by the end of 2021."

The announcement follows the U.S. government entering a $1.95 billion agreement with the two companies last week to produce and deliver 100 million doses of its COVID-19 vaccine by the end of the year. Earlier this month, they were also granted Fast Track designation by the U.S. Food and Drug Administration.

The text below is from this source.[9]

In a bit of a surprise move, Pfizer (NYSE:PFE) and their partner BioNTech (NASDAQ:BNTX) announced yesterday that they were moving their BNT162b2 mRNA vaccine candidate forward into Phase II/III trials. The surprise was because all the

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[7] GEN Genetic Engineering and Biotechnology News, Sep 8, 2020, https://www.genengnews.com/topics/drug-discovery/as-pressure-mounts-ceos-commit-to-science-safety-in-developing-covid-19-vaccines/

[8] Darryl Coote, UPI, "Pfizer begins late-stage trial of COVID-19 vaccine candidate", July 28, https://www.upi.com/Top_News/US/2020/07/28/Pfizer-begins-late-stage-trial-of-COVID-19-vaccine-candidate/7441595910470/

[9] Derek Lowe, Seeking Alpha, "Pfizer And BioNTech Pick A Vaccine Candidate", July 29, 2020, https://seekingalpha.com/article/4361788-pfizer-and-biontech-pick-vaccine-candidate

publications from this effort so far had been on another one of their four candidates, BNT162b1.

…There were originally four candidates: two with modified RNA bases, one with extra uridines (one of four major components of RNA; others are adenosine, guanine and cytidine)*, and one self-amplifying RNA. …it appears that the latter two fell behind during the preclinical and early clinical studies - we haven't seen that data, but apparently, BNT162b1 and BNT162b2 have been the front-runners for some time as far as the two companies were concerned. …So, what's the difference between the two remaining ones?*

It comes down to the antigen(s) being coded for. The b1 candidate, the one we've been hearing about, codes for the coronavirus spike protein's receptor-binding domain (RBD), and this was constructed as a trimer, three RBDs attached to a "foldon" protein core. Meanwhile, the b2 candidate codes for what they say is an "optimized full-length spike" protein instead, not just the receptor-binding domain. Pfizer's press release says that both the b1 and b2 candidates "induced favorable viral antigen-specific CD4+ and CD8+T cell responses, high levels of neutralizing antibody in various animal species, and beneficial protective effects in a primate SARS-CoV-2 challenge model". But they made the choice for the b2 variety partly because it seemed to be better tolerated on injection, and also because it led to a wider variety of T-cell responses. These … were raised not only to recognize the RBD region, but also other regions of the spike protein that weren't contained at all in the b1 candidate. And they're quite right - that could well be beneficial, and the better tolerability is a bonus. The release says that the neutralizing antibody response was similar between the two candidates…

Pfizer's headquarters are in New York City, and they have 10 manufacturing plants in the U.S. East and Midwest. However Pfizer is a multinational company. Pfizer ranked No. 57 on the 2018 Fortune 500 list of the largest United States corporations by total revenue.

Pfizer was founded in 1849. In their early years they were mainly a chemicals business. They produced an antiparasitic called santonin. This was an immediate success…

World War I caused a shortage of calcium citrate, which Pfizer imported from Italy for the manufacture of citric acid, and the company began a search for an alternative supply. Pfizer chemists learned of a fungus that ferments sugar to citric acid, and they were able to commercialize production of citric acid from this source in 1919. The company developed expertise in fermentation technology as a result. These skills were applied to the mass production of the antibiotic penicillin during World War II in response to the need to treat injured Allied soldiers.

Pfizer discovered the antibiotic Terramycin in 1950, and this changed the company from a manufacturer of fine chemicals to a pharmaceutical company.

Update:

Pfizer and BioNTech… have said that if their up-to-30,000 patient Phase II/III trial succeeds for BNT162b2, the lead candidate of their BNT162 program, they expect to be ready to seek an EUA or other regulatory approval as early as October. Upon such authorization or approval, the companies plan to supply up to 100 million doses by the end of this year, and approximately 1.3 billion doses by the end of 2021.[7]

6. Oxford University and AstraZeneca's AZD-1222 Vaccine

The text below is from this source.[10]

…The new results (July 21) showed Oxford University and drug company AstraZeneca's candidate vaccine, AZD-1222, led to strong immune responses for nearly two months in a trial that continues to track more than 1,000 healthy adults. A second dose, given to 10 patients, seems to have boosted their immune response further without adding significant side effects, according to a paper published Monday in The Lancet.

"I think it's very exciting," Barry Bloom, an immunologist and global health expert at the Harvard T.H. Chan School of Public Health, said Monday on a call with media. "The unlikely possibility that we will have vaccines ready for approval and large-scale distribution by the end of the year – which seemed utterly crazy seven months ago – may well be a real possibility."

He and others Monday emphasized that the process is being sped up not by cutting corners on safety but by conducting research steps simultaneously that are typically done sequentially. Oxford-AstraZeneca's trial is considered a Phase 1-2, and the pair is already getting ready to launch a large-scale Phase 3 trial within a few weeks (of 7/21)*.*

Pascal Soriot, CEO of AstraZeneca, said Monday that he was pleased with the results.

"So far so good in terms of the data we've produced," he said. "All this needs to translate into clinical protection. People need to be protected from infections, and that's what we want to demonstrate in our Phase 3 program."

Ideally, several candidate vaccines will eventually prove safe and effective. "It's important to bet on all the technologies," Soriot said. "Ultimately, hopefully, we have different vaccines and they may have advantages or disadvantages."

Half the volunteers in the Oxford-AstraZeneca trial were given the SARS-CoV-2 vaccine and half were given a meningitis vaccine. The so-called AZD-1222 vaccine caused more side effects considered minor than the meningitis one, but acetaminophen (Tylenol) *relieved most of the effects, the study found.*

…The next stage of trials in Britain will involve 10,000 people. In the U.S., 30,000 people will take part. And in Brazil and South Africa, about 7,000 people will test the efficacy and safety of the vaccine. If everything goes to plan, the vaccine could be rolled out widely by early next year, according to the Oxford Vaccine Group…

"Our hope is we can start delivering vaccine (more widely) before the end of the year," Soriot said. How soon, he said, depends on the infection rate in places where their studies are underway. Trials need enough people to become infected in order to see whether their candidate vaccine is effective…

The Oxford-AstraZeneca vaccine uses a weakened chimpanzee cold virus to carry a protein from SARS-CoV-2 into human cells. Once there, it triggers the person's cells to

[10] Karen Weintraub and Kim Hjelmgaard, USA TODAY via MSN Lifestyle, "UK's Oxford University coronavirus vaccine candidate is safe and effective with few side effects, early trial results show" July 21, 2020, https://www.msn.com/en-us/health/medical/uk-e2-80-99s-oxford-university-coronavirus-vaccine-candidate-is-safe-and-effective-with-few-side-effects-early-trial-results-show/ar-BB16XYZa

produce the spike protein found on the surface of SARS-CoV-2, causing the immune system to recognize and attack the virus.

Nearly a month after receiving a shot, 32 of 35 participants tested showed they had developed neutralizing antibodies to SARS-CoV-2 – the kind of immune response that is believed essential to provide protection. None of the participants had COVID-19, so it's not clear whether they were actually protected against it. Only a larger, Phase 3 trial, several of which are set to start this summer, will show actual protection.

About 70% of participants in the Oxford-AstraZeneca trial suffered fatigue and headache after the AZD-1222 shot, compared with only 41%-48% of those who received the meningitis vaccine. Among the 10 people who received an extra dose of the COVID-19 vaccine, side effects were less common after the second dose.

The study's authors recommended that the vaccine should now be tested in older adults, who have weaker immune systems and are more vulnerable to severe cases of COVID-19.

The information below is per this source.[11]

Phase I data from the COVID-19 vaccine under development by AstraZeneca and Oxford University's Jenner Institute is showing a robust defense against the novel coronavirus that has infected more than 13 million people across the globe.

On Wednesday, U.K. media began to report hints of data from the early-stage study of the vaccine candidate that was provided by an unnamed "senior source." The Telegraph reported the vaccine candidate is producing both antibodies and Killer T cells in healthy patients who received the medication. That double defense could be critical, particularly as some reports suggest that antibodies developed in recovered COVID-19 patients may not be lasting. And while those antibodies could fade away over a period of months, T-cells can remain active in the body for years. News of the early data sent AstraZeneca's shares up more than 7% on Wednesday.

"I can tell you that we now know the Oxford vaccine covers both bases – it produces both a T cell and an antibody response," the senior source told the Telegraph. "It's the combination of these two that will hopefully keep people safe.

While the news is hopeful, the senior source told The Telegraph that there is still significant work to be accomplished before the vaccine could potentially be available to the world. These early results also do not provide enough information regarding a sustained protection against COVID-19 by the vaccine, the source noted.

Full results of the Phase I trial will be published in the journal The Lancet next week (week of July 20).

…AstraZeneca announced last month that it planned to manufacture two billion doses of its vaccine, with 400 million slated for the U.S. and UK, and one billion allotted for low- and middle-income countries.

[11] Alex Keown, BioSpace via PharmaLive.com, "Report: Astrazeneca's Covid-19 Vaccine Generates Antibodies and T-Cells Against The Virus in Phase I Trial", July 16, 2020, https://www.pharmalive.com/report-astrazenecas-covid-19-vaccine-generates-antibodies-and-t-cells-against-the-virus-in-phase-i-trial/

The U.S. government is certainly planning on boosting manufacturing capabilities for vaccine programs. Through Operation Warp Speed, the government has provided billions of dollars to multiple vaccine programs, including those from AstraZeneca and Moderna. Earlier this week, an unnamed U.S. official told Reuters that large-scale manufacturing of a vaccine could begin by the end of summer. The official said the government has begun to procure the raw materials and equipment necessary to manufacture large batches of a vaccine in conjunction with the government's Operation Warp Speed program.

AstraZeneca PLC is a British-Swedish multinational pharmaceutical company. Its headquarters are in Cambridge, England. Its R&D is in Cambridge, Gaithersburg, Maryland and Mölndal, Sweden. AstraZeneca produces products for major disease-types including cancer, cardiovascular, gastrointestinal, infection, neuroscience, respiratory and inflammation.

Update:

Pharmaceutical giant AstraZeneca said it has paused global trials of its COVID-19 vaccine candidate after it caused an unexplained illness in one of its volunteers.[12]

The Britain-based drug company said the pause of randomized, controlled trials of its coronavirus vaccine candidate developed with Oxford University was led by a standard review process to allow an independent committee to look over safety data.

"This is a routine action, which has to happen whenever there is a potentially unexplained illness in one of the trials," an AstraZeneca spokesman said in a statement emailed to UPI.

Illnesses during large trials "will happen," the company said, adding that they must undergo a careful and independent review, a process the drugmaker is working to expedite to minimize any potential impact on the trial's projected timeline.

"We are committed to the safety of our participants and the highest standards of conduct in our trials," the spokesman said.

Matt Hancock, Britain's health secretary, told Sky News on Wednesday that the pause isn't a cause for concern and shouldn't yet be considered a setback.

"It depends on what they find when they do the investigation," he said. "There was a pause earlier in the summer and that was resolved without a problem."

7. Sanofi/GSK Vaccine

The Sanofi/GSK (GlaxoSmithKline) vaccine combines Sanofi's S-protein COVID-19 antigen, which is based on recombinant DNA technology, and GSK's pandemic AS03 adjuvant (an adjuvant boosts the immune response of a vaccine to produce more antibodies and longer-lasting immunity).[13]

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[12] Darryl Coote, UPI, "AstraZeneca halts COVID-19 vaccine trials after mystery illness", Sep 9, 2020, https://www.upi.com/Top_News/World-News/2020/09/09/AstraZeneca-halts-COVID-19-vaccine-trials-after-mystery-illness/4251599641184/?ur3=1

[13] GEN Genetic Engineering and Biotechnology News, "Sanofi, GSK Advance COVID-19 Vaccine into the Clinic", Sep 3, 2020, https://www.genengnews.com/news/sanofi-gsk-advance-covid-19-vaccine-into-the-clinic/

Sanofi and GSK said today (Sep 3) they have launched a Phase I/II trial assessing their COVID-19 vaccine in up to 440 healthy adults. This is one of several vaccines against the virus whose development is being funded by the U.S. government.

The Phase I/II trial is a randomized, double blind and placebo-controlled study designed to evaluate the safety, tolerability, and immune response of the COVID-19 vaccine candidate. The 440 healthy adults are being enrolled across 11 investigational sites in the U.S.

Sanofi and GSK said they anticipate first results in early December 2020, when the companies expect to launch a Phase III trial. Should the data prove positive, Sanofi and GSK said, they plan to request regulatory approval for their vaccine in the first half of 2021.

On July 31, Sanofi and GSK joined the U.S. Departments of Health and Human Services (HHS) and Defense (DoD) to announce that the companies were awarded up to $2.1 billion by the U.S. government toward developing and manufacturing their COVID-19 vaccine.

HHS and DoD are providing the funding through Operation Warp Speed, described at the end of section 2.

8. Johnson & Johnson / BIDMC Ad26-based Vaccine

Johnson & Johnson's Janssen Pharmaceutical Cos. Working with Harvard-affiliated Beth Israel Deaconess Medical Center (BIDMC) expects to start Phase I human trials in September for a lead COVID-19 vaccine candidate, and has expanded its vaccine R&D and clinical testing partnership between these organizations. [14]

The vaccine uses a common cold virus, called adenovirus serotype 26 (Ad26), to deliver the SARS-CoV-2 spike protein into host cells, where it stimulates the body to raise immune responses against the coronavirus. This technique for vaccinating patients is commonly called viral vector delivery.

In July 2020, investigators at BIDMC and other institutions initiated a first-in-human Phase 1/2 clinical trial of the Ad26.COV2.S vaccine in healthy volunteers. Kathryn E. Stephenson is the principal investigator for the trial at BIDMC, which is funded by Janssen Vaccines & Prevention, B.V., a pharmaceutical research arm of Johnson & Johnson.

Pending clinical trial outcomes, the Ad26.COV2.S vaccine is on track to start a phase 3 efficacy trial in up to 60,000 participants this month (Sep).

9. Merck & Company

Merck actually has two candidates that may have phase 3 trials that start shortly. These are reviewed below. Instead of immediately developing something earlier this year, Merck evaluated potential partnerships with smaller organizations that have promising approaches, and then early this summer, they pounced.

[14] Jacqueline Mitchell, The Harvard Gazette, "Robust protection", Sep 3, 2020, https://news.harvard.edu/gazette/story/2020/09/vaccine-protection-against-covid-19-related-issues/

9.1. Merck & Themis / Institut Pasteur et al – V591

Merck, on May 26 agreed to acquire Themis for an undisclosed price, in a deal that closed in June, transforming Themis into a wholly-owned subsidiary of the buyer.[15]

The Institut Pasteur had headed a COVID-19 vaccine consortium that included Themis and the University of Pittsburgh's Center for Vaccine Research (CVR). The consortium has been awarded an initial $4.9 million by CEPI, the Coalition for Epidemic Preparedness Innovations. As a first step, CEPI funding will support the preclinical testing, initial manufacture of vaccine materials, and preparatory work for Phase I studies, CEPI said in March.

This vaccine is a Measles vector vaccine engineered to express SARS-CoV-2 proteins on its surface. The measles virus vector platform based on a vector originally developed at the Institut Pasteur.

In connection with the acquisition, Merck, Institut Pasteur, and CEPI agreed to address the COVID-19 pandemic by developing, manufacturing, and distributing the vaccine on a global basis, with "pricing that makes the vaccine both available around the world and accessible to those who need it, including low-income, middle-income and high-income countries based on the medical need when the vaccine may become available."

Merck aims to start human trials on one of its COVID-19 vaccine candidates "fairly soon," with a second vaccine candidate likely to begin trials later this year, Chief Executive Kenneth Frazier said on Thursday.[16]

9.2. CEPI

CEPI was founded in Davos by the governments of Norway and India, the Bill & Melinda Gates Foundation, the Wellcome Trust, and the World Economic Forum.[17]

To date, CEPI has secured financial support from the Bill & Melinda Gates Foundation, Wellcome Trust, the European Commission, and the governments of Australia, Belgium, Canada, Denmark, Ethiopia, Germany, Japan, Mexico, Norway and the United Kingdom.

Additional investment from sovereign governments, the private sector and philanthropic foundations has also been provided to support our COVID-19 vaccine programs.

In response to call the Governments of Austria, Australia, Belgium, Canada, European Commission, Finland, France, Greece, Germany, Iceland, Italy, Japan, Luxembourg, Kingdom of Saudi Arabia, Norway, the Netherlands, New Zealand, Serbia, Spain, Switzerland, and the United Kingdom, alongside private sector companies and donations through the UN Foundation COVID-19 Solidarity Response Fund, have pledged $1.4 billion in financial contributions.

Close collaboration with global partners is also crucial to the success of our work to develop vaccines against emerging infectious diseases. That's why work with industry,

[15] GEN Genetic Engineering and Biotechnology News, "Merck & Co. (Themis) and Institut Pasteur – V591", https://www.genengnews.com/covid-19-candidates/merck-and-co-themis-institut-pasteur-and-university-of-pittsburgh/

[16] John Miller, Reuters via Yahoo News, "Merck CEO sees human trials for COVID-19 vaccine candidate 'fairly soon' ", Sep 3, 2020, https://news.yahoo.com/merck-ceo-sees-human-trials-150518997.html

[17] CEPI Website, Who We Are, Investors and Partners, https://cepi.net/about/whoweare/

regulators, and other bodies to ensure that any vaccines we develop get licensed and can reach the people who need them.

9.3. Merck and IAVI – V590

Vaccine based on Merck's recombinant vesicular stomatitis virus (rVSV) platform, which uses an attenuated strain of vesicular stomatitis virus, a common animal virus that has been modified to express proteins that stimulate an immune response. Merck uses the rVSV in its approved Ebola Zaire virus vaccine.[18]

… Merck said May 26 it launched a COVID-19 vaccine collaboration with IAVI, a nonprofit scientific research organization dedicated to addressing urgent, unmet global health challenges. The partners will develop a vaccine based on Merck's rVSV platform, the basis for Merck's Ebola Zaire virus vaccine, ERVEBO® (Ebola Zaire Vaccine, Live), the first rVSV vaccine approved for use in humans.

IAVI said its rVSV vaccine preclinical development, including work on the SARS-CoV-2 vaccine candidate, is being done by scientists at IAVI's Design and Development Laboratory in Brooklyn, NY. The program is part of IAVI's longstanding effort to develop rVSV vaccines for HIV as well as other emerging infectious diseases such as Lassa fever, Marburg, and Ebola Sudan disease, an effort led by Swati Gupta, DrPH, IAVI's head of Emerging Infectious Diseases and Scientific Strategy.

Merck said it had signed an agreement with the Biomedical Advanced Research and Development Authority (BARDA), which disclosed that it agreed to provide the company and IAVI $38,033,570 in initial funding support.

The New York Times reported June 3 that Merck & Co. was among developers of five COVID-19 vaccines identified by the administration as most likely to produce a vaccine for the virus, citing unnamed "government officials." According to the report, the five will receive additional government funding, assistance with clinical trials, and financial and logistical support for manufacturing.

Author's comment: I didn't find any specific time for start of phase 3 trials for either of the Merick vaccines other than *fairly soon*, (as of Sep 3). I would guess October might be a reasonable guess.

10. Novavax

Novavax is a U.S. firm with HQ in Gaithersburg, MD. They seems to have many agreements with foreign governments, but their vaccine is *not scheduled for delivery until as early as the second quarter of 2021.*[19]

NVX-CoV2373 Vaccine is a stable, prefusion protein made using Novavax' proprietary nanoparticle technology, and incorporating its proprietary saponin-based Matrix-M™ adjuvant. [20]

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[18] GEN Genetic Engineering and Biotechnology News, "Merck & Co. and IAVI – V590", https://www.genengnews.com/covid-19-candidates/merck-co-and-iavi/

[19] Jon C. Ogg, 24/7 Wall via MSN, "3 COVID-19 Vaccine Trials Are Now in Phase 3, With More on the Way", Sep 1, 2020, https://www.msn.com/en-us/money/markets/3-covid-19-vaccine-trials-are-now-in-phase-3-with-more-on-the-way/ar-BB18ABOy

[20] GEN Genetic Engineering and Biotechnology News, "Novavax – NVX-CoV2373", https://www.genengnews.com/covid-19-candidates/novavax-and-emergent-biosolutions/

Novavax started a Phase II trials in late August with up to 1,500 volunteers at 40 sites in the U.S. and Australia, and a Phase IIb clinical trial to assess efficacy in South Africa. These trails are supported by up to $388 million in funding from CEPI (see subsection 9.2). If the Phase I/II trial is successful, CEPI said, it anticipates supporting further clinical development that would advance NVX-CoV2373 through to licensing.

Novavax said today (July 7) t has been awarded $1.6 billion toward late-stage clinical trials and large-scale manufacturing to produce 100 million doses of its COVID-19 vaccine starting this year through the "Operation Warp Speed" program.[21]

[21] GEN Genetic Engineering and Biotechnology News, "Novavax Wins $1.6B in 'Warp Speed' Funding; Plans First 100M Doses of COVID-19 Vaccine", July 7, 2020. https://www.genengnews.com/topics/drug-discovery/novavax-wins-1-6b-in-warp-speed-funding-plans-first-100m-doses-of-covid-19-vaccine/