

# Partnering for a pandemic

History has shown that collaborative efforts can have a crucial role in combating viral outbreaks such as the current coronavirus pandemic.

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Springer Nature Limited

Raveena Bhambra

As coronavirus continues to spread, organizations around the world are working together to tackle the urgent needs for diagnostic, treatment and prevention strategies. In this article, we explore the wave of partnerships that have been established to accelerate the development of vaccines for the prevention of COVID-19.

## Pandemic preparedness

In the past decade, the world has already faced two viral outbreaks that have caught regions off guard. In 2014, the Ebola virus surfaced in Western Africa. With an urgent need for infection control, but no approved therapies or vaccines and only a handful of vaccine candidates available, partnering was a must. A number of companies joined forces, including Johnson and Johnson (J&J), who partnered with Bavarian Nordic to develop a viral vector-based vaccine, and Merck & Co., who partnered with Newlink Genetics to rapidly develop and test its recombinant vaccine rVSV-ZEBOV (*BioPharma Dealmakers*, B15–17, June 2016). This candidate would eventually go all the way to be approved by the US Food and Drug Administration in 2019 as the first vaccine for Ebola. Now named Ervebo, it was already being applied from 2018 in another Ebola outbreak in the Democratic Republic of the Congo.

Shortly after the Ebola epidemic, Zika virus began to spread through South America in 2015. However, with relatively little known about the virus, researchers didn't have the head start they had with Ebola—similar to the current situation with COVID-19. Again, organizations and pharma companies came together to develop vaccines, and although the epidemic subsided by the end of 2016, several vaccines have progressed into clinical trials, putting potential responses to future outbreaks on stronger ground.

The responses to these two outbreaks highlighted the key need for coordination strategies and funding for efforts to combat future pandemics. Adding to established organizations such as the European Innovative Medicines Initiative and the US Office of Biomedical Advanced Research and Development Authority (BARDA), the Coalition for Epidemic Preparedness and Innovations (CEPI) was set up in 2017 specifically to coordinate the work of public, private, philanthropic and civil organizations for vaccine development to stop epidemics. And in the current crisis, CEPI has a key role in mobilizing funding and coordinating efforts for many organizations developing a COVID-19 vaccine.

## Partnering at pace

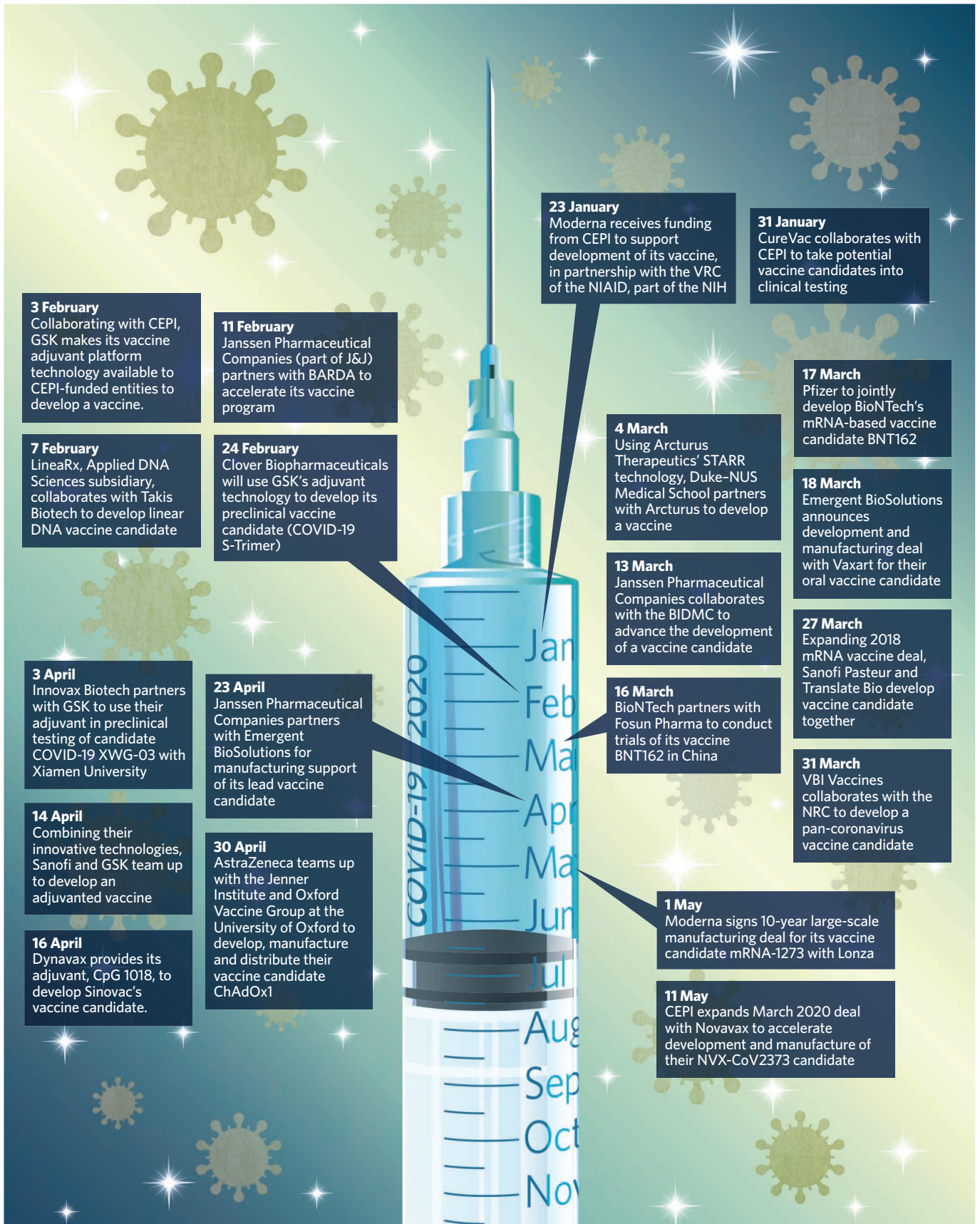
Within days of the genome sequence of SARS-CoV-2, the coronavirus that causes COVID-19, being shared on 11 January 2020, biotech companies including Moderna, BioNTech, CureVac and

Inovio Pharmaceuticals had started up vaccine development programs, with these front-runners taking advantage of the rapidity with which the underlying mRNA- or DNA-based platforms can be used to identify vaccine candidates. They were soon joined by others, ranging from universities and large pharma companies that are most active in the vaccine field in general, including Sanofi, GlaxoSmithKline (GSK), Pfizer and J&J. As of early May, almost 100 vaccines were being developed (*Nature* 580, 576–577; 2020), harnessing various platforms to design candidates, involving peptides, nucleic acids, virus-like particles, viral vectors, recombinant protein, live attenuated virus and inactivated viruses (*Nat. Rev. Drug Discov.* 19, 305–306; 2020).

Partnering has been crucial in tackling the challenges of highly novel vaccine discovery and development at such pace (Fig. 1). For example, Moderna—whose mRNA-based vaccine mRNA-1273 targeting the viral spike protein was the first to enter clinical trials in mid-March—was working on the candidate with the US National Institute of Allergy and Infectious Diseases (NIAID) just 2 days after the virus sequence was released, and shortly afterwards received funding from CEPI to support its development.

Given the likely need for vast amounts of any successful vaccines, adjuvants that enhance vaccine immunogenicity and make lower doses viable will be important. So, with only a small number of licensed adjuvants available, there has been a flurry of partnerships around them. Two vaccine big hitters, Sanofi and GSK, made headlines when they announced they would join forces. Sanofi will contribute its spike protein antigen, which is based on recombinant DNA technology, while GSK will contribute its adjuvant technology in the partnership. GSK and CEPI have established a collaboration to make GSK's adjuvant platform available to vaccine developers being funded by CEPI, and companies including Dynavax and Seqirus are also committed to making licensed adjuvants available to vaccine developers.

Finally, the need for large-scale manufacturing of successful vaccines has generated deals. For example, in March, Pfizer expanded an existing 2018 influenza vaccine partnership with BioNTech to co-develop and manufacture BioNTech's mRNA vaccines for COVID-19, which are notable in that the clinical trial program is testing four vaccine candidates, with different combinations of mRNA format and target antigen. And in April, AstraZeneca announced a partnership with the University of Oxford on the development, manufacture and distribution of their adenovirus-based vaccine targeting the spike protein. Moderna followed suit by partnering with Lonza to enable the manufacturing of up to 1 billion doses per year of its vaccine if it is successful—underlining just how big a challenge counteracting COVID-19 has become.



**Fig. 1 | The world's most wanted vaccine.** Selected biopharma partnering deals relating to the development, manufacture and distribution of a potential vaccine against COVID-19 in 2020. BARDA, Biomedical Advanced Research and Development Authority; BIDMC, Beth Israel Deaconess Medical Center; CEPI, Coalition for Epidemic Preparedness Innovations; J&J, Johnson & Johnson; NIAID, National Institute of Allergy and Infectious Diseases; NRC, National Research Council of Canada; VRC, Vaccine Research Center. Data taken up to 18th May 2020.