Cheat Sheet: **COVID-19 vaccine pipeline**

AVAC
25 Years and Counting

Primary sponsor(s)	Description	Platform	Funders	Status	Considerations	Read more
Pfizer / BioNTech	**Comirnaty** *mRNA that encodes for SARS-CoV-2 spike protein.* ❄❄❄ | 💉	mRNA	Pfizer ($500M) USG ($1.9M) *Warp Speed Finalist*	**Ph. I/II ongoing:** 456/Germany Ph. II planned: 960/China **Ph. II/III ongoing:** 44K US +5 **Authorization:** EUA in EU, US, +9; WHO Emergency Validation **Approval:** Bahrain, Saudi Arabia, Switzerland	**Immunogenicity:** Interim analysis shows that the candidate was safe and well-tolerated with an efficacy rate of 95%. **Manufacturing/delivery:** see above. **Platform history:** No previous mRNA vaccines licensed for use.	*New York Times*
Moderna	**mRNA-1273** *Synthetic messenger RNA that encodes for SARS-CoV-2 spike protein.* ❄❄ | 💉	mRNA	USG ($2.48B) CEPI/GAVI (Undisclosed) *Warp Speed Finalist* *COVAX Portfolio*	**Ph. I ongoing:** 155/US **Ph. II ongoing:** 600/US; 3000/US (planned) **Ph. III ongoing:** 30,000/US **Authorization:** EUA in Canada, EU, Israel, US **Approval:** None	**Immunogenicity:** Interim analysis shows that the candidate was safe and well-tolerated with an efficacy rate of 94.5%. **Manufacturing/delivery:** mRNA vaccines are relatively easy to scale and manufacture (potential for 1B doses by 2022); likely to require two doses, but a third may be necessary. **Platform history:** No previous mRNA vaccines licensed for use.	Moderna Statement AVAC Webinar
U. of Oxford AstraZeneca	**AZD1222** *Chimpanzee Adeno vector expressing SARS-CoV-2 spike protein.* ❄ | 💉	Viral vector	USG ($1.2B) CEPI/GAVI ($750M) EU ($923M) *Warp Speed* Finalist* *COVAX** Portfolio*	**Ph. I/II ongoing**: Japan, Kenya, RSA, UK **Ph. II/II ongoing:** 12,390 vols/UK; 1700/ India **Ph. III ongoing**: 40K /US+; 10K/Brazil **Authorization:** EUA in Argentina, India, UK **Approval:** None	**Immunogenicity:** Ph. III interim analysis shows vaccine was safe and well-tolerated, efficacy averaged 70.4% (62 - 90% depending on dose). **Manufacturing/delivery:** Adeno vector vaccines can be manufactured quickly and at scale (capacity to produce 2B doses has been secured). **Platform history:** Vaccine utilizing the Ad26 platform (Ad26.ZEBOV) has been approved for use against Ebola Virus Disease.	*Science*
Sinopharm / Beijing Institute of Biologic Products / Wuhan Institute	**BBIBP-CorV x 2** ❄ | 💉	Whole inactivated	No Funding Disclosed	**Ph. I/II: ongoing**: 640/China **Ph III ongoing:** 45K/UAE. Bahrain, Jordan, Egypt; 3K/Argentina; 6K/Peru **Authorization:** EUA in Egypt **Approval:** Bahrain, China, UAE	**Immunogenicity:** Ph. III interim analysis showed an effficacy of 86%. **Manufacturing/delivery:** Inactivated vaccines may require booster doses; relatively shelf-stable compared to other platforms. **Platform history:** Numerous whole inactivated vaccines, including polio, Hep A and rabies.	Cell GEN
Gamaleya Research Institute	**Sputnik V** *Combination Ad5 and Ad26 vector expressing the SARS-CoV-2 spike glycoprotein* ❄ | 💉	Viral vector	Ministry of Health- Russia	**Ph. I complete:** 38/Russia; 38/Russia **Ph. II/III planned:** 1600/ India **Ph. III ongoing:** 40K/Russia **Ph. III planned:** 100/Belarus;1000/UAE; 2000/ Venezuela **Authorization:** EUA in Argentina; Early/ limited use in Belarus, Russia **Approval:** None	**Immunogenicity:** Ph. III analysis shows vaccine was safe and well-tolerated; efficacy averaged 91.4% and >90% in individuals over 60. **Manufacturing/delivery:** Adeno vector vaccines can be manufactured quickly and at scale (Russia has orders for 1.2 billion doses from 50 countries). **Platform history:** Vaccine utilizing the Ad26 platform (Ad26.ZEBOV) has been approved for use against Ebola Virus Disease.	Sputnik V
Sinovac Biotech	**CoronaVac** ❄ | 💉	Whole inactivated	No Funding Disclosed	**Ph. I/II ongoing:** 1166/China **Ph III ongoing:** 8K/Brazil, 1600/ Indonesia, 4K/Bangladesh, 13K/Turkey, 1K/China **Authorization:** EUA for limited use in China **Approval:** None	**Immunogenicity:** Preliminary data showed the vaccine elicited neutralizing antibodies. **Manufacturing/delivery:** Inactivated vaccines may require booster doses; relatively shelf-stable compared to other platforms. **Platform history:** Numerous whole inactivated vaccines, including polio , Hep A, and rabies.	medRxiv Pharmaceutical Technology

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The COVID-19 vaccine pipeline 'Cheat Sheet' reflects front-runner candidates along with products with significant investments from the USG, CEPI and the ACT-A COVAX pillar.

Cold Chain Considerations

❄ Refrigeration (2-80 C)
❄❄ Freezer (-20 C)
❄❄❄ Deep Freeze (-70 C)

Doses

💉 Anticipated number of doses

Emergency Use Authorization:
A regulatory mechanism to facilitate the availability and use of unapproved medical products, including vaccines, during public health emergencies.

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Bharat Biotech/ Indian Council of Medical Research	**Covaxin**	Whole inactivated	No funding disclosed	**Ph. I/II ongoing:** 755/ India **Ph. III ongoing:** 25.8K/ India **Authorization:** EUA in India; still pending final Ph. III efficacy data **Approval:** None	**Immunogenicity:** Ph. I/II trial data showed the vaccine was safe and triggered an antibody response. **Manufacturing/delivery:** Inactivated vaccines may require booster doses; relatively shelf-stable compared to other platforms. Covaxin is stable at room temperature for atleast a week. **Platform history:** Numerous whole inactivated vaccines, including polio, Hep A and rabies.	medRxiv
CanSino Biologics	**Convidecia** *Ad5 vector expressing SARS-CoV-2 spike glycoprotein.*	Viral vector	No funding disclosed.	**Ph. I complete:** 108/China **Ph. II ongoing:** 508/China **Ph.III ongoing:** 40K/ Argentina, Chile, Mexico, Pakistan, Saudi Arabia **Authorization:** Limited use in Chinese military as a "specially needed drug" **Approval:** None	**Immunogenicity:** Ph. I participants developed binding antibodies, neutralizing antibodies and T-cell responses; potential for pre-existing immunity against Ad5. **Manufacturing/delivery:** TBC. **Platform history:** Vaccine utilizing the Ad26 platform (Ad26.ZEBOV) has been approved for use against Ebola Virus Disease.	*Lancet* *FiercePharma*
Novavax	**NVX-COV2373** *Full-length recombinant SARS-CoV-2 glycoprotein nanopartical vaccine adjuvanted with Matrix M.*	Protein Subunit	CEPI ($388M) USG ($1.6B) *Warp Speed Finalist* *COVAX Portfolio*	**Ph. I ongoing:** 130/Australia **Ph. II ongoing:** 2900/ RSA **Ph. III ongoing:** 15,000/ UK; 30K/US, Mexico	**Immunogenicity:** Ph. I data showed both antibody and T-cell responses. **Manufacturing/delivery:** GMP production initiated with capacity for large-scale manufacturing (est. 1B doses by end of 2021). **Platform history:** The same nanoparticle platform succeeded in a Ph. III trial for NanoFlu, an influenza vaccine for older adults.	Novavax statement
J&J	**JNJ-78436735** *Ad26 vector expressing SARS-CoV-2 spike protein.*	Viral vector	J&J investment (~$500M) USG ($1.45B) *Warp Speed Finalist*	**Ph. I and I/II ongoing:** 250/Japan; 1045/ Belgium, US **Ph. II ongoing:** 550/Germany, Netherlands, Spain Ph. III ongoing: 30K (2 dose)/France, Germany, RSA+6; 60K(1 dose)/Argentina, Brazil, Chile+7	**Immunogenicity:** Preclinical data shows that monkeys were protected after one dose; the potential for pre-existing immunity against Ad26 exists. **Manufacturing/delivery:** Product does not need to be stored at subzero temperatures, and it may require just a single dose. **Platform history:** Utilizes the same technology used to make its Ebola vaccine, which was granted European regulatory approval in May 2020.	*Nature*
Inovio	**INO-4800** *DNA plasmid vaccine with electroporation.*	DNA	CEPI ($17.2M) BMGF ($5M) USG ($83M) *COVAX Portfolio*	**Ph. I ongoing:** 40/US **Ph. II/III ongoing:** 160/S Korea **6K/US**	**Immunogenicity:** Preliminary Ph. I data shows antibody and cellular immune responses. **Manufacturing/delivery:** INO-4800 is stable at room temperature for more than a year and is not required to be frozen in transport or storage. **Platform history:** No licensed DNA vaccines for use in humans.	Inovio Ph. 1 Statement
CureVac	**CVnCoV** *mRNA vaccine that encodes for the spike protein formulated with lipid nanoparticles.*	mRNA	CEPI ($8.3M) EU ($$421M) USG. (Undisclosed) *COVAX Portfolio*	**Ph. I ongoing:** 284/Belgium, Germany Ph. II ongoing: 691/Panama, Peru	**Immunogenicity:** TBC. **Manufacturing/delivery:** mRNA vaccines are relatively easy to scale and manufacture. **Platform history:** No previously licensed mRNA vaccines.	CureVac statement
Imperial College	*Synthetic self-amplifying RNA producing SARS-CoV-2 spike protein.*	Self-amplifying RNA	UK ($50.7M) Philanthropies ($6.2M)	**Ph. I/II ongoing:** 300/UK **Ph. III planned:** 6000/UK	**Immunogenicity:** TBC. **Manufacturing/delivery:** Imperial College created a special-purpose company to sell the vaccine (VacEquity) at lowest possible cost in UK and LMICs. **Platform history:** No licensed self-amplifying RNA vaccines.	*New York Times*
Merck / Themis / Pasteur Inst.	**V591** *Uses a weakened measles virus carrying a gene for the coronavirus spike protein.*	Replicating Viral Vector	*USG: ($19M)*	**Ph. I/II ongoing:** 260 vols/Belgium, Austria, US	**Immunogenicity:** Replicating viral vectors potentially lead to robust immune responses triggered by a single dose. **Manufacturing/delivery:** TBC. **Platform history:** Same platform as vaccine candidates for West Nile, Chikangunya, Ebola, Lassa, Zika, MERS.	STAT

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Primary sponsor(s)	Description	Platform	Funders	Status	Considerations	Read more
Merck / IAVI	**V590** *VSV vector expressing SARS-CoV-2 spike protein*	Replicating Viral Vector	*USG: ($19M)*	Ph. I ongoing: 252 vols	**Immunogenicity:** Replicating viral vectors potentially lead to robust immune responses triggered by a single dose. Merck's Ebola vaccine worked as well in the elderly as it did in young, healthy adults. **Manufacturing/delivery:** Vaccine may be active when administered orally, which would be easier to distribute than injection and no cold-chain requirements. **Platform history:** Same platform as licensed vaccine for Ebola (ERVEBO) and candidates for Marburg and Lassa.	Fact Sheet
Sanofi / GSK	*DNA from the surface protein of the SARS-CoV-2 virus is inserted into insect cells, which express antigen that is then purified and combined with GSK's pandemic AS03 adjuvant.*	Subunit	USG ($2.1B) *Warp Speed Finalist*	Ph. I/II ongoing: 440/US **Ph. III planned:** 30K/ US+ (Delayed)	**Immunogenicity:** Interim results showed insufficient response in older adults; Sanofi refining antigen concentration to address. **Manufacturing/delivery:** The adjuvant system is designed to boost the immune response and allow less to be used per dose. GSK will manufacture 1B doses of its adjuvant system in 2021. **Platform history:** Same platform as vaccine candidates for Influenza, SARS-CoV (FDA approve).	Sanofi Statement
Clover BIoPharma / GSK	**SCB-2019** *A trimeric subunit spike protein developed by China-based Clover, delivered alongside an adjuvant.*	Subunit	CEPI ($3.5M)	**Ph. I ongoing:** 150/Australia **Ph. II/III planned**	**Immunogenicity:** In preclinical studies, adjuvanted SCB-2019 induced neutralising antibodies in animals. **Manufacturing/delivery:** The adjuvant system is designed to boost the immune response and allow less to be used per dose, potentially allowing more doses to be supplied. GSK will manufacture 1B doses of its adjuvant system in 2021. **Platform history:** TBC.	Press release

Refresher on vaccine platforms

Platform	About	Licensed products	Learn more
Inactivated	Inactivated vaccines consist of the whole virus, which has been killed with heat or chemicals so that it can't cause illness. In general, inactivated virus vaccines do not provide as strong of an immune response as live attenuated vaccines, so additional doses may be needed.	Polio	*Inactivated viral vaccines*
Live attenuated	Live attenuated vaccines are made up of whole viruses that have been weakened in a lab (usually through culturing). They tend to elicit a stronger immune response than inactivated vaccines.	MMR Varicella TB	*Live attenuaed vaccines: historical successes and current challenges*
Subunit	Subunit vaccines introduce a fragment or portion of the virus into the body. This fragment is enough to be recognized by the immune response and stimulate immunity.	Pertussis HPV Hep. B	*Subunit Vaccines*
Viral vector	Viral vector vaccines insert a gene for a viral protein into another, harmless virus (replicating or non-replicating). This harmless virus then delivers the viral protein to the vaccine recipient, which triggers an immune response. • **Replicating viral vectors** are able to produce copies of the viral protein, potentially triggering an enhanced immune response.	Ebola Veterinary vaccines	*What are viral vector vaccines?*
mRNA	RNA vaccines work by introducing an mRNA sequence (the molecule that tells cells what to build) coded for a disease-specific antigen. Once this antigen is reproduced within the body, it is recognized and triggers an immune response.	None	*An introduction to RNA vaccines*
DNA	DNA-based vaccines work by inserting synthetic DNA of viral gene(s) into small DNA molecules called plasmids. Cells take in the DNA plasmids and follow their instructions to build viral proteins, which are recognized by the immune system, and prepare it to respond to disease exposure.	None	*WHO: About DNA vaccines*

*__Operation Warp Speed:__ US government body responsible for strategic approach, coordination and resource allocation for COVID-19 vaccines

**__COVAX:__ The vaccine pillar of ACT-A, the global collaboration to accelerate development, production and equitable access to new diagnostics, therapeutics and vaccines. COVAX is led by GAVI, CEPI and WHO.

About AVAC. AVAC is a non-profit organization that uses education, policy analysis, advocacy and a network of global collaborations to accelerate the ethical development and global delivery of new HIV prevention options as part of a comprehensive response to the pandemic. For more information, visit ***www.avac.org***.