

DIFFERENT TYPES OF VACCINES

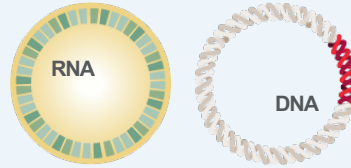
There are several types of vaccines currently under development for COVID-19, each with different potential strengths and weaknesses.

NUCLEIC ACID VACCINES

- New type of vaccine that uses fragments of mRNA or DNA to produce an adaptive immune response through the host cells, producing copies of that target antigen
- Elicits both antibody and cytotoxic T-lymphocyte responses
- Can scale up and produce quickly
- Expensive & booster doses likely needed
- >90% efficacy in initial phase 3 data from Moderna, Pfizer

Vaccines in development

- Moderna
- Pfizer
- Inovio
- CureVac
- Sanofi/Translate Bio

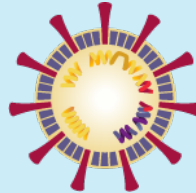


INACTIVATED VACCINES

- Uses a killed version of the virus to generate immunity
- Elicits neutralizing antibodies without a cell-mediated response
- Can be safely given to immunocompromised patients
- Proven vaccine technology already in use for several diseases (eg, hepatitis A, influenza, polio, rabies)
- Booster doses likely needed

Vaccines in development

- Chinese Academy of Medical Sciences
- Wuhan Institute of Biologic Projects
- Sinovac

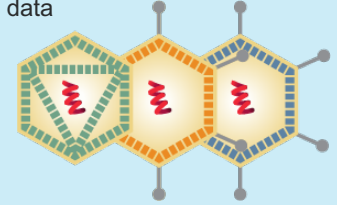


VIRAL VECTOR

- Uses modified non-coronaviruses (adenoviruses, vesicular stomatitis virus) expressing SARS-CoV-2 spike protein
- Elicits both antibody and cytotoxic T-lymphocyte responses
- Potential safety concerns in immunocompromised patients
- Host immunity to the viral vector may reduce efficacy
- 82% efficacy with two doses from AstraZeneca/Oxford data
- 66%-85% efficacy from J&J data

Vaccines in development

- Johnson & Johnson
- CanSinoBIO
- Merck
- AstraZeneca/Oxford



PROTEIN

- Uses recombinant viral proteins to induce immune response
- Elicits neutralizing antibodies without a cell-mediated response
- Can be safely given to immunocompromised patients
- Proven vaccine technology already in use for many diseases (eg, hepatitis B, HPV, pertussis, herpes zoster)
- Booster doses likely needed

Vaccines in development

- Sanofi/GSK
- Novavax
- Walter Reed Army Institute of Research (WRAIR)

