



When will we get the COVID-19 vaccine?

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Coronavirus disease-2019 (COVID-19) has been spread all around the world and confirmed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the virus strain which as a causative agent. How can we quickly develop a vaccine against SARS-CoV-2? It plays a significant role in the inhibition, prevention of viruses, and contribution to the control of an outbreak. However, this becomes a huge challenge for scientists because of the limited information about SARS-CoV-2 including its genomics, structural biology, virology, pathology, epidemiology, and the specific immune response¹. The average time for vaccine development taken from the preclinical phase, clinical trials phase I, II and III up to approve by Food and Drug Administration (FDA) and market registration required 10.71 years².

On the 21st of February in 2020, 120 whole-genome sequences of SARS-CoV-2 are analyzed from the GISAID database³. Recombinant DNA technology is the most common method to design and create a SARS-CoV-2 antigen as well as embedding it within a primate adenovirus vector. The vaccine candidates must trigger favorable T-cell responses, rather than relying solely on antibody responses, said by Sarah Gilbert⁴. SARS-CoV-2 replicates at the binding site on the surface of target cells such as bronchial and type 2 alveolar epithelial cells processed by the type 2 transmembrane protease (TMPRSS2), leading to the cleavage of angiotensin-converting enzyme 2 (ACE2) receptor and activation of the viral spike protein⁵⁻⁶. The anticipated vaccine produces a neutralizing antibody that blocks the binding site of viral spike protein and resists its uptake to the angiotensin-converting enzyme 2 (ACE2) receptor. As the vaccine has high protein expression levels, it could also induce a strong immune response and remain stable for a long time⁷.

According to the World Health Organization (WHO) draft landscape of COVID-19 candidate vaccines, there are 5 candidate vaccines in clinical evaluation up to 20th of April in 2020 consist of Adenovirus Type 5 Vector from CanSino Biological incorporated company, DNA plasmid vaccine Electroporation device from Inovio Pharmaceuticals, Inactivated virus from Beijing Institute of Biological Products, Inactivated virus plus alum from Sinovac, LNP encapsulated mRNA-1273 from Moderna⁸. Sinovac is one of the candidate vaccine companies and its researchers began using eight rhesus macaque monkeys with two different dosages of purified inactivated SARS-CoV-2 virus vaccine (PiCoVacc) for human trials on 16th of April in 2020⁹. The studies have been found that vaccine with 3 μ g or 6 μ g per dose for immunization which provided partial or complete protection against the SARS-CoV-2 challenge in rhesus macaque monkeys, also without any antibody-dependent enhancement of infection¹⁰.

However, there are some concerns about this vaccine such as i) the number of rhesus macaque monkeys for investigation are too small to yield statistically significant and reliable results⁹; ii) the immune response of monkeys might be different from that of humans. It cannot develop the most severe symptoms infected by SARS-CoV-2¹¹; iii) no shreds of evidence to support that there are no aberrant immune responses after vaccination of low levels antibodies particularly in lung damage. If animals are injected with pathogens, it might be enhancing the infection and causing pathology in the lungs or other organs based on past investigation¹².

All of the above information demonstrates that much more work needs to be done for the COVID-19 vaccine development including increasing the number of animals in clinical trials to collect

statistically significant data; defining the best animal model for studying SARS-CoV-2 as well as proving the COVID-19 vaccine safety and effectiveness in human. Fortunately, there is no evidence for SARS-CoV-2 is mutating at present but the SARS-CoV-2 variants are the possible challenge for vaccine development.

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