

Strategies for COVID-19 vaccine development and establishment of a global herd immunity

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Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causes coronavirus disease 2019 (COVID-19) and, as of July 1, 2021, has infected over 183 million people and caused almost 4 million deaths. The global pandemic has resulted in massive societal and economic disruption worldwide. It belongs to the *Betacoronavirus* genus which includes the human pathogenic coronaviruses of SARS-CoV and MERS-CoV, which have recently emerged. As a respiratory pathogen, SARS-CoV-2 primarily targets the lungs in humans.

Development of safe and effective vaccines to prevent SARS-CoV-2 infections remains an urgent priority worldwide. Over 180 COVID-19 vaccines are being developed around the world using one of seven different strategies, including: an inactivated virus vaccine, a live attenuated virus vaccine, a non-replicating viral vector vaccine, a replicating viral vector vaccine, a DNA vaccine, an mRNA vaccine, and a protein subunit vaccine. Of these seven strategies, mRNA vaccines, non-replicating viral vector vaccines, and inactivated virus vaccines are currently being used commercially. As result of vaccination, new cases of COVID-19 have dropped significantly. However, new variants of SARS-CoV-2 have now emerged, originating from several countries causing a resurgence of COVID-19 cases.

We have developed a replication competent recombinant vesicular stomatitis virus (rVSV)-based COVID-19 vaccine. We have constructed rVSV carrying the full-length spike protein gene of SARS-CoV-2 with genetic modifications (rVSV-SARS-CoV-2-*msp-S_F-Gtc*). In immunized ACE-2 transgenic mice, the recombinant rVSV-SARS-CoV-2-*msp-S_F-Gtc* induced a very high level of potent neutralizing antibodies and T cell responses. It is essential to note that rVSV-SARS-CoV-2-*msp-S_F-Gtc* vaccinated animals were completely protected from subsequent SARS-CoV-2 challenges including the alpha and beta variants of SARS-CoV-2.

Global herd immunity is the best way to terminate the COVID-19 pandemic, just like the eradication of smallpox, which used to kill millions each year. In addition, one of the world's most devastating childhood viral diseases, poliomyelitis, is close to being eradicated as result of a proactive vaccination program.

I will present the different strategies of COVID-19 vaccine development including results of our own replication competent vector-based vaccine and will discuss the prospect of ending the COVID-19 pandemic through global vaccination efforts.