

EDITORIAL

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The Vaccine Against COVID-19: A Race Against Time

More than 16,5 million people have been infected with COVID-19 worldwide, resulting in 655,300 deaths and immeasurable economic disruption. After the initial outbreak and more than 220,000 cases and 7,000 deaths in Colombia, COVID-19 has widespread across 188 countries. The infection progresses daily, and cases and deaths increase mainly in the United States, Brazil, Russia, India, and South American countries such as Peru, Mexico, Chile, and Colombia.

This pandemic has challenged both policymakers and scientists around the world and created the need to provide effective solutions to reduce the spread of the disease. However, we still do not have a successful treatment, let alone a vaccine that neutralizes the rapid escalation of the pandemic. Science is advancing rapidly. There are hundreds, even thousands, of studies that explain the disease and its infection patterns. In Colombia, the sequencing of more than 100 virus genomes has already been carried out, an achievement never accomplished before in our country. According to the studies of strains currently circulating in the country, about 80% of infections are caused by a strain coming from Spain.

Currently, around 250 vaccines against COVID-19 are being developed. Among these, there are varied and revolutionary methods such as mRNA vaccines, replicating or non-replicating viral vaccines, DNA vaccines, autologous dendritic cell-based vaccines, and inactive virus vaccines. Today, 17 of these vaccines are under evaluation in clinical trials.

Long gone are traditional vaccines based on agonizing viruses that awaken the immune response of our cells. We are in a time of almost implausible initiatives and enormous human inventiveness. Science works at an unbeatable speed to get a vaccine. This accelerated pace was believed impossible to achieve and current altruism and collaboration between international research groups are unprecedented.

Developing a vaccine against a coronavirus could take around 10 years, but science is creating new expectations, resulting in optimists believing that it could arrive as early as late 2020. Others (no less optimistic) think that we could have a vaccine by mid-2021. It seems feasible, but not an easy task. The race against the coronavirus is in a stage of high expectation and on Monday 07-21-2020 three of the candidate vaccines have published their preliminary clinical results. The University of Oxford-AstraZeneca, the Chinese consortium CanSino Biologics, and Moderna, the American multinational. There is a fourth consortium at this stage: Pfizer-BioNTech (Switzerland-Germany). The World Health

Organization collaborates and supports the development of these promising vaccines to combat COVID-19. This situation leads immediately to phase 3: The international, multi-centered, randomized, double-blind, and controlled effectiveness trial. This represents the greatest global public health challenge of our generation.

Both Oxford and CanSino Biologics vaccines are based on an adenovirus that causes the common cold in chimpanzees. This adenovirus was genetically modified so that it does not cause side effects or infections in humans and also to make it appear as similar to SARS-CoV-2 as possible. To modify the adenovirus, researchers transferred the DNA sequence encoding the SARS-CoV-2 “spike protein” or S protein. This protein is what gives the virus entry into our cells, using a protein that is found in our cell membranes called the ACE2 human receptor. It seems that the coronavirus S protein evolved in one of two animals, bats and/or pangolins, and managed to mutate to fit in a lock and key manner with the ACE2 protein. In conclusion, Oxford and CanSino vaccines resemble the coronavirus, and this gives the immune system a chance to learn how to attack it.

Unlike traditional vaccines, vaccines developed by Moderna and Pfizer-BioNTech use messenger RNA to trigger the production of the “spike protein” of the SARS-CoV-2, just like Oxford and CanSino vaccines. Participants in the vaccine prospect evaluation were given a low, medium, or high dose. The higher dose caused more side effects. However, volunteers who received the lowest dose produced the same level of antibodies detected in recovered COVID-19 cases. Those who received medium doses had significantly more antibodies than recovered patients.

Messenger RNA vaccines are produced from a DNA fragment that is transcribed in vitro in a cell-free system. The produced messenger RNA is injected into the patient and then this genetic material infects a dendritic cell by endocytosis. The mRNA molecule exits into the cytoplasm and the synthesis of protein S, which encodes what we call the antigen, takes place in the ribosomes. This antigen gives rise to antigen-specific cellular immune responses. The vaccine does not integrate genomic information in the host (humans) because the process takes place in the cytoplasm and not in the nucleus. Additionally, when produced in a cell-free environment, the probability of contamination with bacterial components is extremely reduced.

After this simple and crude explanation, the only thing I can conclude is that the inventiveness of the scientists of our time is more than exciting, and the speed at which they work day and night is unmeasurable.

The virus advances, its only objective being to infect and replicate, even without realizing how much damage it causes in its attempt to do so. It does not want to kill, only defend its replicative capacity. If the S protein in vaccines produces the desired antibodies, all humans will be vaccinated. We would deny the virus entry to our cells and, therefore, it will not be able to replicate.

Questions still stand, though. ¿When exactly will a vaccine be available? ¿Will everyone be able to get the vaccine in a timely manner? And, ¿for how long will it give us immunity? Six months? A year? Therein lies the question.

REFERENCE

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