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THE DNA VACCINE IS THE NEXT STEP IN THE EVOLUTION OF VACCINES

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Introductions. The 2019 coronavirus (COVID-19) remains a global health problem, causing millions of cases and thousands of deaths each year. DNA vaccines are a promising alternative to traditional vaccines because they can cause both humoral and cellular immune responses. This gives them the potential for more effective protection against COVID-19 than vaccines that only cause a humoral response**.**

In the 1990s, scientists developed methods for delivering DNA to cells. In 1993, scientists from the University of Pennsylvania used electroporating for the first time to deliver DNA to mice. In 1995, scientists from the University of Wisconsin-Madison developed the first DNA vaccine against HIV-1. Since the mid-1990s, DNA vaccines have been developed against a variety of pathogens, including malaria, tuberculosis and cancer. DNA vaccines have also been used to

protect animals from disease [4].

DNA vaccines are third-generation vaccines that contain DNA that encodes the pathogen's antigens. They are safer, easier to produce, more stable and can cause both humoral and cellular immune responses; they are not affected by anti-vector immunity.

However, DNA vaccines also have some limitations, including:

– *Immunogenicity:* The immunogenicity of DNA vaccines may be low, especially in people with weakened immunity.

– *Delivery:* DNA vaccines must be delivered to the cells of the body in an active state so that they can be expressed. This can be difficult because DNA is a polar molecule that cannot easily penetrate the cell membrane.

The DNA vaccine is currently licensed to immunize horses against the West Nile virus. DNA vaccines have been evaluated as candidates against many new viruses, including HIV-1, influenza, Zika virus, cancer, EBOV, RVFV, dengue virus and CHIKV [1].

Materials and methods. DNA vaccines have a future, as proven by numerous tests. The DNA vaccine against HIV-1 was able to cause a T-cell response in 90% of participants. Another DNA flu vaccine could protect participants from getting infected when they are infected with a live virus.

Some of the most promising clinical trials of DNA vaccines include:

– DNA vaccine against HIV-1 developed by Moderna. The vaccine is currently in phase 3 clinical trials and could potentially be the first DNA vaccine approved for human use.

– A DNA flu vaccine developed by Inovio. The vaccine is currently in phase 2 clinical trials and has been shown to be safe and effective in protecting people from flu infection.

– A DNA cancer vaccine developed by BioNTech. The vaccine is currently undergoing the first phase of clinical trials and is being tested on patients with different types of cancer [3].

Results and discussion. The results of these and other clinical trials of DNA vaccines will be closely monitored in the coming years. If DNA vaccines are proven to be safe and effective, they can revolutionize the way diseases are prevented and treated.

DNA vaccines are relatively easy to produce and can be adapted to specific strains of the virus, such as SARS-CoV-2, which causes COVID-19. In addition, DNA vaccines can be combined with other vaccines to provide greater protection.

As of November 2023, more than 20 clinical trials of the DNA vaccine against COVID-19 for people of all ages, including children and the elderly, are ongoing.

Some of the most promising clinical trials of the DNA vaccine against COVID-19 include:

– INO-4800 (Inovio Pharmaceuticals): This DNA vaccine is in phase 2 clinical trials. It has been proven to be safe and has an immunogenic effect on humans.

– MVC-COVID 1901 (Moderna): This DNA vaccine is in phase one of clinical trials and is tested in people of all ages.

– BNT162B2 (BioNTech): The DNA vaccine is in phase 3 clinical trials, and it has shown good results in protecting people from COVID-19 infection.

The results of these and other clinical trials of the DNA vaccine against COVID-19 will be closely observed in the coming months. If DNA vaccines are proven to be safe and effective, they can play an important role in the fight against COVID-19 [2].

Conclusions. So, DNA vaccines are a promising new type of vaccine that has the potential to solve many of the challenges that humanity faces when using traditional vaccines. DNA vaccines are safe, effective, and easy to manufacture, and they can revolutionize the way we prevent and treat diseases.

REFERENCES

1. Recent Developments in Applied Microbiology and Biochemistry, edited by Buddolla Viswanath. Vol. 2. 2020, 380 p. URL: https://www.sciencedirect.com/

topics/immunology-and-microbiology/dna-vaccine

2. Marcelle Moura Silveira, Gustavo Marçal Schmidt Garcia Moreira, Marcelo Mendonça. DNA vaccines against COVID-19: Perspectives and challenges. Life Sciences, Vol. 267, 2021, 118919. URL: https://www.sciencedirect.com/science/article/pii/S0024320520316799?via%3Dih ub

3. Speicher, David J., et al. DNA fragments detected in monovalent and bivalent Pfizer/BioNTech and Moderna modRNA COVID-19 vaccines from Ontario, Canada: Exploratory dose response relationship with serious adverse events. OSF Preprints, 19 Oct. 2023. URL: https://osf.io/2qdp6.

4. Sthefany Pagliari, Barbara Dema, Alexandra Sanchez-Martinez, Gerardo Montalvo Zurbia-Flores, Christine S. Rollier. DNA Vaccines: History, Molecular Mechanisms and Future Perspectives, Journal of Molecular Biology, Volume 435, Issue 23, 2023. URL: https://doi.org/10.1016/j.jmb.2023.168297.