

Principles of elaboration and usage of mRNA-based vaccines.

Haim Lital^{1*}, Sidorenko Ludmila¹

¹Department of Molecular Biology and Human Genetics, SUMP Φ *Nicolae Testemițanu*, Chisinau, Republic of Moldova.

Introduction. The COVID-19 pandemic and the mRNA vaccines that were developed for it catapulted the topic of mRNA vaccines to the forefront and brought them to the attention of the scientific community and the general public. Hundreds of millions of people have received the COVID-19 mRNA vaccine and they were considered a great success. **Objective of the study.** Providing an overview of the articles available on mRNA vaccines, a description of the method of its development, its mechanism of action, its applications and to discuss of the benefits and limitations of the vaccine.

Material and Methods. This is a systematic review study. The databases PubMed and Google Scholar were searched for studies reporting on mRNA vaccine elaboration, mechanism of action, and applications by searching keywords. Studies that were peer-reviewed, and were published in platforms with higher impact factors were preferred. Also were included relevant publications in the time period of 2012-2023.

Results. The mRNA vaccine development includes- the isolation of a pathogenic genetic material, synthesis of mRNA using a template, mRNA purification, and addition of a delivery system. mRNA vaccine mechanism of action involves the introduction of the vaccine to a recipient, mRNA uptake by targeted cells, mRNA-mediated protein expression, and immunogenicity development. Potential applications of the vaccine are as a protein replacement therapy, cancer immunotherapy, vaccines against various pathogens, and treatment of autoimmune diseases and allergies. The benefits of the technique are-rapid production which is useful in emerging infections, high efficacy, high adaptability to different antigen designs, possible titration, and high safety profile. Challenges and limitations of mRNA vaccines include the requirement of colder conditions in comparison to traditional vaccines, there is need of understanding the role of adjuvant addition to the vaccine, and the formulation of a vaccine in case of rapidly changing targeted antigens (breakthrough infections and immune escapes of cancers).

Conclusion. mRNA vaccine technology has many benefits over traditional vaccines, which makes them a good possible alternative. These vaccines have various potential applications in different fields of medicine, further research should be performed in order to integrate them in the future in clinical practice.

Keywords: vaccine, mRNA, COVID-19, pandemic, elaboration, mechanism of action, applications.