mRNA Vaccine
Development Timeline

Typically, it takes 5 to 10 years to develop a vaccine.[1] When mRNA technology was used to develop and manufacture several COVID-19 vaccines in considerably less time, there was some concern about how such a truncated timeline could be possible.[2] In fact, mRNA vaccine technology has been a work in progress for decades.[3] With little fanfare, scientific breakthroughs in the 1970s, 1980s, as well as early 2000s laid the groundwork for the warp-speed initiative in 2020.[4,5] This infographic starts at the beginning in 1961 and lays out the scientific advances that cumulatively made the unfathomable possible.

1961

Jacob and Monod expanded our understanding of the role of mRNA in protein synthesis and the transfer of genetic information from DNA to mRNA.

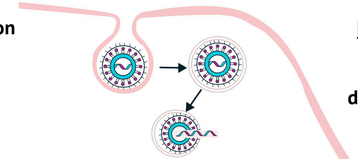
1973

Paque et al shed light on RNA's role in immune responses.

1975

Schlager et al demonstrated the potential of tumor-immune RNA extracts to induce complete and specific regression of local tumors.

1978



Magee et al reported the potential of liposome-based delivery systems to enhance the efficacy of RNA-based treatments.

1987

Felgner et al developed lipofection, a simple and efficient means of delivering DNA into cells.

1989

Malone et al found that cationic liposomes facilitated the efficient delivery of RNA into cells.

2005

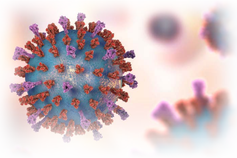
Weissman and Karikó reported that modifying certain components of mRNA, specifically by incorporating modified nucleosides, could reduce the immune response triggered by the mRNA molecules.

2010

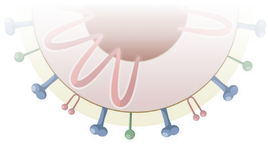
Warren et al found that modified mRNAs can express reprogramming proteins and evade antiviral response.

2013

McLellan et al published a structure-based approach to an RSV vaccine. The finding led to the development of the first stabilized proteins for use in vaccines that provoke a strong immune response to viruses such as RSV.



2016

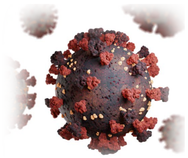


Kirchdoerfer et al stabilized the coronavirus spike protein that lets HKU1, a form of the common cold, invade cells. This led to a better understanding of coronavirus immunity.

2017

Pallesen et al built on McLellan's RSV advances and advanced the understanding of MERS-CoV spike protein structure, vaccine design, and immunogenicity assessment.

January 2020



The genetic sequence of SARS-CoV-2 was published.

2020

Operation Warp Speed launched to accelerate development and manufacturing of vaccines for COVID-19. The mRNA vaccine platform was one of several prioritized by OWS.

May 2020

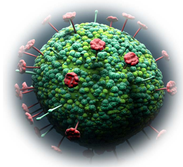
Pfizer-BioNTech and Moderna received emergency use authorization for their mRNA COVID-19 vaccines.

November 2020

The Moderna mRNA vaccine showed promising interim results in a Phase 3 trial.

2022

NIH and Moderna launched a Phase 1 trial to evaluate a Nipah virus vaccine developed with mRNA vaccine technology.



March 2022

NIH commenced a Phase 1 trial evaluating three HIV vaccines based on the mRNA platform.

July 2022

References

1. Johns Hopkins Vaccine Research Development. Accessed June 2023.
2. Anthony S. Fauci, The story behind COVID-19 vaccines. *Science* 372,109-109(2021).
3. Jacobson, E. mRNA Vaccine Technology. Biocompare. 2023.
4. NIH. Decades in the Making:mRNA COVID-19 Vaccines
5. Canadian Institutes of Health Research. The long road to mRNA vaccines

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