

COVID-19 Vaccine

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Vaccine Development

About a dozen different vaccines are in various stages of testing worldwide, including in Britain, China, India, Russia and the U.S.

People in the country where the first effective vaccine is developed will benefit first.

There will be a COVID-19 vaccine by the end of the year or early 2021.

Vaccine politics

A group of nine leading pharmaceutical and biotechnology companies pledged to only seek approval for Covid-19 vaccines demonstrated to be safe and effective

An attempt to provide public reassurance

Russia's Sputnik V vaccine in Phase III: *Turkey, Brazil*

Russia has a lot of experience but we need peer reviewed data from them.

Vaccine Competition

Several wealthy countries have already ordered millions of doses of those experimental vaccines.

If they don't work - heavy losses

At the start probably the best candidate was by Oxford University and produced by Astra Zeneca

If it works, U.K. politicians have said Britons will be vaccinated with it.

The U.S. expects to start stockpiling it this fall and also has invested in other vaccine candidates.

Amazing speed

SARS-CoV-2 genome was posted on
January 10, 2020.

Ready to launch advanced large-scale
clinical trials within 6 months after initial
awareness of a new pandemic threat.

Very unusual and fast for vaccines.

US distribution

How vaccines are distributed within a country will vary.

U.S. officials said they were developing a tiered system for that.

The system would likely prioritize groups at greatest risk of severe complications from COVID-19 and key workers.

Vaccines in poor countries

Groups including the vaccine alliance GAVI are also working to buy doses for poor countries.

AstraZeneca has agreed to license its vaccine to India's Serum Institute for the production of 1 billion doses.

The World Health Organization is drafting guidelines for the ethical distribution of COVID-19 vaccines.

Most promising

- * Joint National Institute of Allergy and Infectious Disease - Moderna candidate
- * Pfizer - German pharmaceutical firm BioNTech SE
- * Johnson-Johnson
- * Joint Oxford University - Astra Zeneca candidate
- * All Developed from the Corona virus spike protein

NIHAID / MODERNA STUDY

Moderna ([NASDAQ:MRNA](#)) continues in the phase 3 clinical trial testing its coronavirus vaccine, mRNA-1273.

More than 30,000 participants at 100 clinical research sites in the United States are participating in the study, which [launched on July 27, 2020](#),

So far so good but they were only asked to increase the number of minorities. 37% of trial volunteers are from racial and ethnic minorities.

Start date: July 27, 2020

Primary completion date: October 27, 2021

Study completion date: October 2022

NIHAID / MODERNA STUDY

Participants received 1 IM injection of mRNA-1273 (vaccine) or matching placebo on Day 1 and on Day 29

The study is designed to primarily evaluate the efficacy, safety, and immunogenicity of mRNA-1273 to prevent COVID-19 for up to 2 years after the second dose of mRNA-1273.

NIHAID / MODERNA STUDY

The interim analysis comprised 95 cases of symptomatic COVID-19 among volunteers.

the candidate was safe and well-tolerated and noted a vaccine efficacy rate of 94.5%.

90 of the COVID 19 cases occurred in the placebo group and 5 occurred in the vaccinated group.

There were 11 cases of severe COVID-19 out of the 95 total, all of which occurred in the placebo group.

Messenger RNA

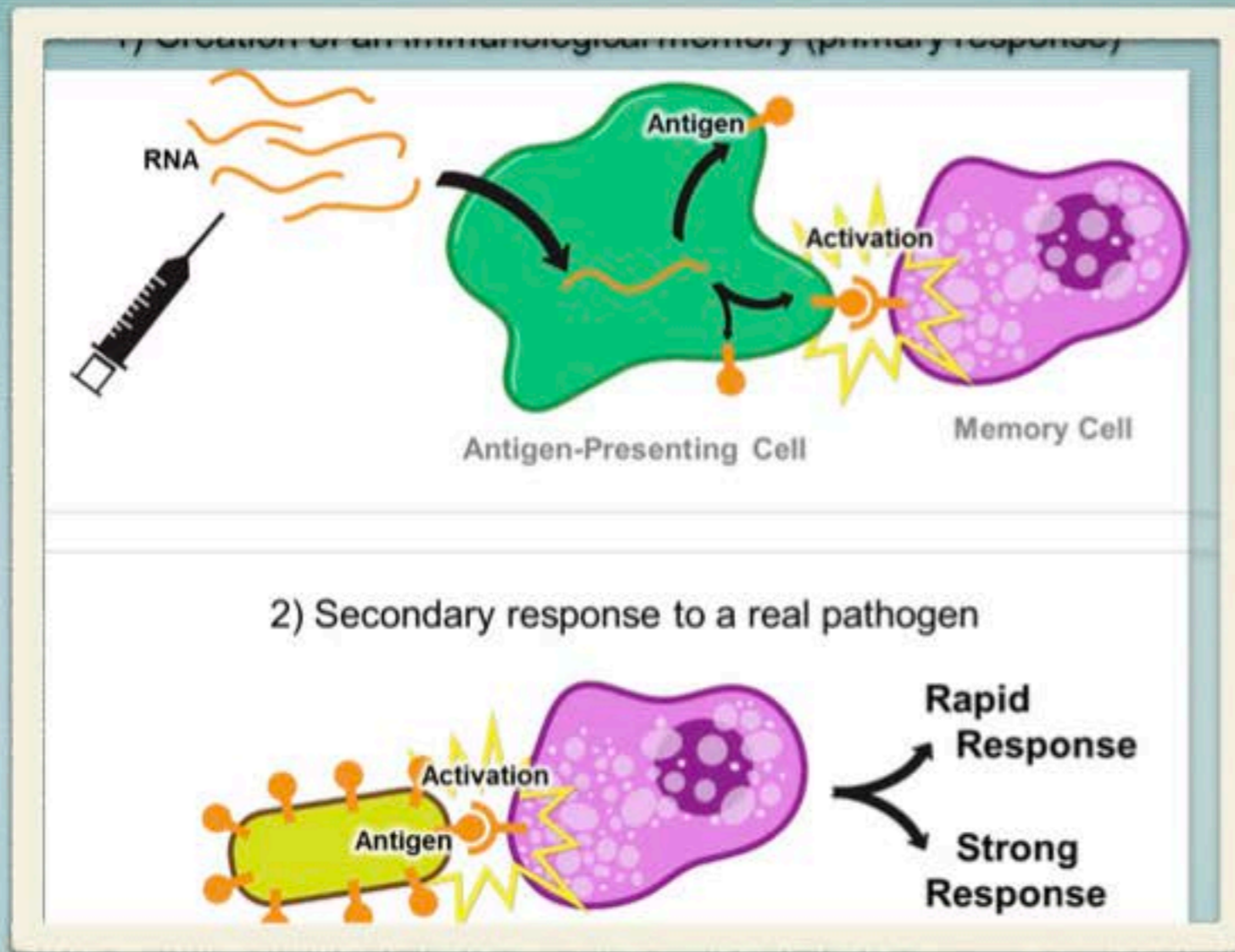
A transient intermediary called messenger RNA that carries the genetic information to the cell machinery responsible for protein synthesis.

As an analogy, one can see the DNA as a cook book in a library: the recipe is stored here but cannot be used.

The *commis*, or chef's assistant, first makes a copy (the RNA) of a specific recipe and brings it to the kitchen.

The information is now ready-to-use by the chef, who can add the ingredients in the order specified by the recipe and create a cake (the protein).

COVID genetic structure (relatively simple) is known and therefore can be synthesized.



Synthetic mRNA injected

Used by both Moderna and Pfizer

Pfizer Vaccine

- * So far no holds
- * Also being developed for children
- * November 2020 announcement of 90% effectiveness (efficacy)

Pfizer vaccine

- * Preliminary results indicate 90% efficacy
- * Availability and usage awaits completion of the trial, peer review of full data, and approval by the FDA
- * Company intent: 50 million doses in 2020 and another 1.3 billion 2021.

Pfizer - 90% efficacy

It means they took a group of people who had NOT previously had COVID-19

gave half of them the vaccine and half a placebo injection and followed them

90% of COVID - 19 cases occurred in placebo group

10% of COVID -19 cases occurred in vaccine group

Pfizer excitement

Hoping for at least 50-60% effective (similar to most seasonal flu vaccines)

Therefore 90% far exceed those expectations.

Other COVID-19 vaccines in the pipeline might be equally effective.

No reason to mistrust: released by independent data monitoring committee and not by the company.

Still an early result.

Pfizer - limitations in study & implications

- * Study not yet peer reviewed and published.
- * Vaccine efficacy in those who are most vulnerable to severe COVID-19, including older adults and people with underlying medical conditions - **still needed.**
- * Storage and distribution at **very cold temperatures** - distribution will be difficult.
- * 2 doses needed to control a worldwide pandemic
- * We can anticipate the world running out of dry ice if this is the only vaccine.

Pfizer vaccine

must be shipped and stored at -70 degrees Celsius (minus 94°F),

significantly below the standard for vaccines of 2-8 degrees Celsius (36-46°F).

Johnson-Johnson vaccine Study

- * A hold due to serious illness in a participant
- * Masking: Investigators and subject not informed as to whether vaccine or placebo involved.
- * Scheduled to resume Nov. 2020
- * Planning to test vaccine in 12 to 18 year olds
- * Later in < 12 year olds if safe in 12 - 18 year olds.

Oxford AstraZenica

A Phase III Randomized, Double-blind, Placebo-controlled Multicenter Study in Adults to Determine the Safety, Efficacy, and Immunogenicity.

Masking (hiding the study progress): Quadruple (Participant, Care Provider, Investigator, Outcomes Assessor)

Estimated Enrollment: 30000 participants

Start: August 17, 2020

Primary Completion: December 2, 2020

Study Completion: October 5, 2022

AstraZeneca On hold

Covid-19 vaccine being developed by AstraZeneca and the University of Oxford at dozens of sites across the U.S. was placed on hold due to a suspected serious adverse reaction in a participant in the United Kingdom. *Main study sites: US, Britain and India*

Participant had serious neurological symptoms: *Transverse Myelitis*

Oversight Board confirmed participant was injected with vaccine *not* placebo.

Second time for this vaccine to be placed on hold

The pause/hold

The pause was also a reminder of the importance of large-scale trials, which are needed to detect rare, potentially serious side effects that might not show up in small, early tests.

Following an investigation, an independent safety review committee and the U.K.'s Medicines Health Regulatory Authority concluded testing could safely restart.

Still on hold in US for months after that.

Vaccine order of preference

- * Moderna NIHAID
- * Pfizer
- * Johnson - Johnson
- * Oxford AstraZenica