How did prior research help?

**Pre-clinical and Phase 1 trials**

Preclinical trials check that vaccines are safe and produce an immune response.

- **In vitro testing**
  - Tests carried out on cells or molecules outside of their usual biological surroundings.

- **In vivo testing**
  - Testing in living organisms, allowing efficacy and side effects to be studied.

**Work on other coronaviruses**

Development of the COVID-19 vaccines was aided by previous work on SARS and MERS, which indicated vaccines based on the virus spike protein may be effective.

**SARS (2003)**

Severe Acute Respiratory Syndrome

**MERS (2012)**

Middle East Respiratory Syndrome

**Innovations in vaccine technology**

Methods to stabilise RNA and the lipid nanoparticles used to get it into our cells were developed over the past decade.

**Methods to stabilise RNA**

Scientists started creating viral vectors in the 1980s. Development of viral vector vaccines for other diseases (2000s) helped inform SARS-CoV-2 vaccine development.

In March 2020, Moderna’s mRNA vaccine entered Phase 1 clinical trials to assess vaccine safety. The Pfizer/BioNTech and Oxford vaccines followed afterwards.

**Who was involved?**

Moderna’s phase 1 trial included 45 healthy adults (18-55) who got 2 injections of the trial vaccines.

**What was tested?**

Moderna’s phase 1 trial tested different doses of the vaccine to determine the optimum effective dose with minimal side effects.

**How did it help?**

**Vaccine safety**

The phase 1 trials helped to show that vaccines for COVID-19 are safe. They also allowed common side effects to be identified before wider trials on efficacy.

**Adapting vaccines**

Improved knowledge of the technology used to make these vaccines means we should be able to modify them easily to tackle different strains of the virus.

**Other diseases**

Proof that new vaccine technologies such as RNA vaccines are effective may help us develop vaccines for other diseases using similar approaches.