

# RACE FOR A CURE

With pharmaceutical companies racing to develop a vaccine for COVID-19, check out the workings of vaccines

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## HERD IMMUNITY

See how vaccines use herd immunity to prevent the spread of viruses, along with the vulnerabilities of vaccine technologies

### VACCINE PROCESS

- 1 The vaccine shot releases a deactivated virus that can no longer cause illness into the body.
- 2 White blood cells release antibodies with many varying shapes that try to match with the virus in order to deactivate it, the same process the body uses when infected and ill with a virus.
- 3 The body finds the correct antibody match for the virus within one to three weeks. The antibody latches onto the virus and destroys it. With the correct antibody shape identified, the body is now immune to the virus.



Vaccinating most of a community provides immunity to the majority of the population, thus slowing the spread of the virus and protecting those who are unable to get vaccines.



Vaccine opposers tend to live in the same communities, leaving people vulnerable to disease without the buffer of those with immunity. These communities tend to be disease hotspots.

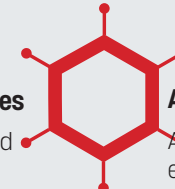
## TYPES OF VACCINES

See how vaccines use altered viruses to trigger the body's defense system



### Inactivated Vaccines

Inactive or attenuated viruses use a form of virus that cannot cause disease to trigger antibodies that work against the true virus.



### Adenovirus

A form of adenovirus enters the cells to deposit an inactive virus that the body forms defenses against.



### DNA Vaccines

Inject DNA instructions to create viral proteins, which the body builds and then defends against



### RNA Vaccines

Directly inject the DNA messenger for viral proteins to trigger antibody development

## POTENTIAL COST



I have a lot of experience over the years dealing with pharmaceutical companies in which we're trying to develop an intervention, and the one thing that is clear is that if you try to enforce things on a company that has multiple, different opportunities to do different things, they will walk away."



- Anthony Fauci, director of the National Institute of Allergy and Infectious Diseases

The Coronavirus Aid, Relief and Economic Security Act would protect a COVID-19 vaccine under all health plans, covering it as preventive health service without cost sharing.



## VACCINE SAFETY

### Rabies (1885)

Louis Pasteur administered spinal material from a rabies-afflicted rabbit to a nine-year-old boy in Paris, leading to a full recovery.

### Influenza (1940s)

Researchers at the University of Michigan, supported by the US Army, develop a flu vaccine using fertilized chicken eggs. The flu led to the use of mechanical ventilators.

### Polio (1955)

Polio outbreaks caused thousands of deaths and tens of thousands of paralysis cases in the United States. Its vaccine's cost was covered by the March of Dimes foundation. Some of the vaccines distributed by Cutter Laboratories failed to deactivate the polio virus, leading to polio cases in vaccinated subjects.

### Measles (1963)

John Enders and Dr. Thomas C. Peebles isolated the measles virus in an ill student in 1954. In 1963, they created and distributed the vaccine created from the isolated virus. The final version of the vaccine, created by Maurice Hilleman, came in 1968. It exposes the body to a weaker version of the measles virus.

### Dengue (2016)

Prematurely released vaccines for the mosquito-borne Dengue fever in the Philippines caused risk of plasma leakage syndrome in children, a fatal disease which causes fluid leakage in the blood.

## VACCINE DEVELOPMENT

### PRECLINICAL TESTING

Scientists test the vaccine on animals, seeking an immune system reaction in monkeys or other mammals.

### PHASE I TESTING

Scientists test the vaccine on a small group of humans to evoke an immune response.

### PHASE II TESTING

Scientists test the vaccine on hundreds of people divided into groups based on age to test safety and effectiveness.

### PHASE III TESTING

Scientists test the vaccine on thousands of people and compare the amount infected to those given a placebo.

### APPROVAL

Regulators look over the trials and decide whether or not to approve the vaccine. The vaccine may be approved for emergency use during a pandemic.



Factories produce and distributes the vaccine. The vaccine may still be tested beyond distribution in case of defects.



Scan to see the New York Times's coronavirus vaccine development tracker, which shows the stage of development for COVID-19 vaccines