Science, Fears, Misinformation and Facts about Vaccines and COVID-19 Vaccines

CLTE Faculty Learning Series

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Science, Fears, Misinformation and Facts about Vaccines and COVID-19 Vaccines

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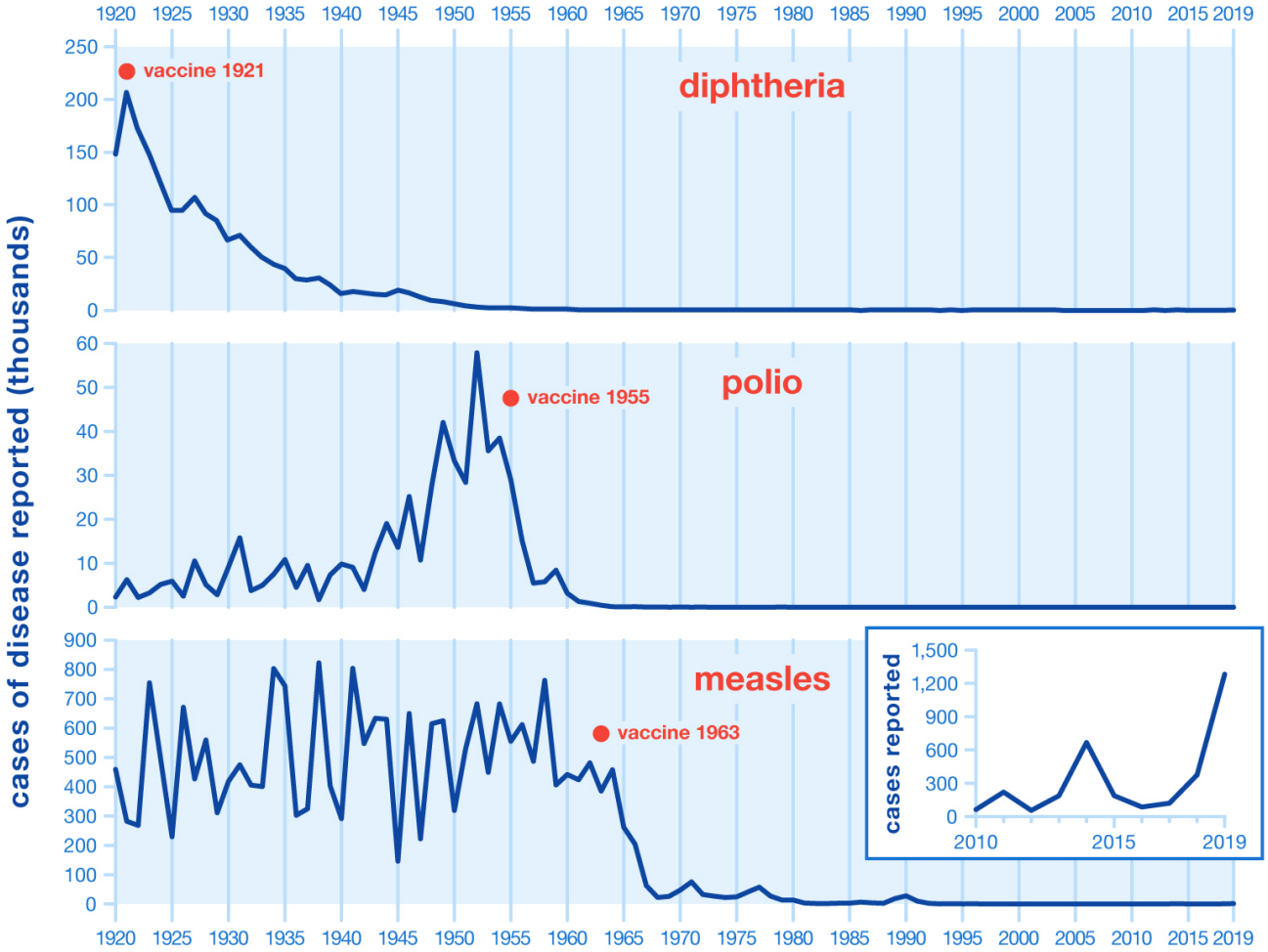
Associate Professor and Associate Dean of Sciences

Vaccination
(the warp speed version)



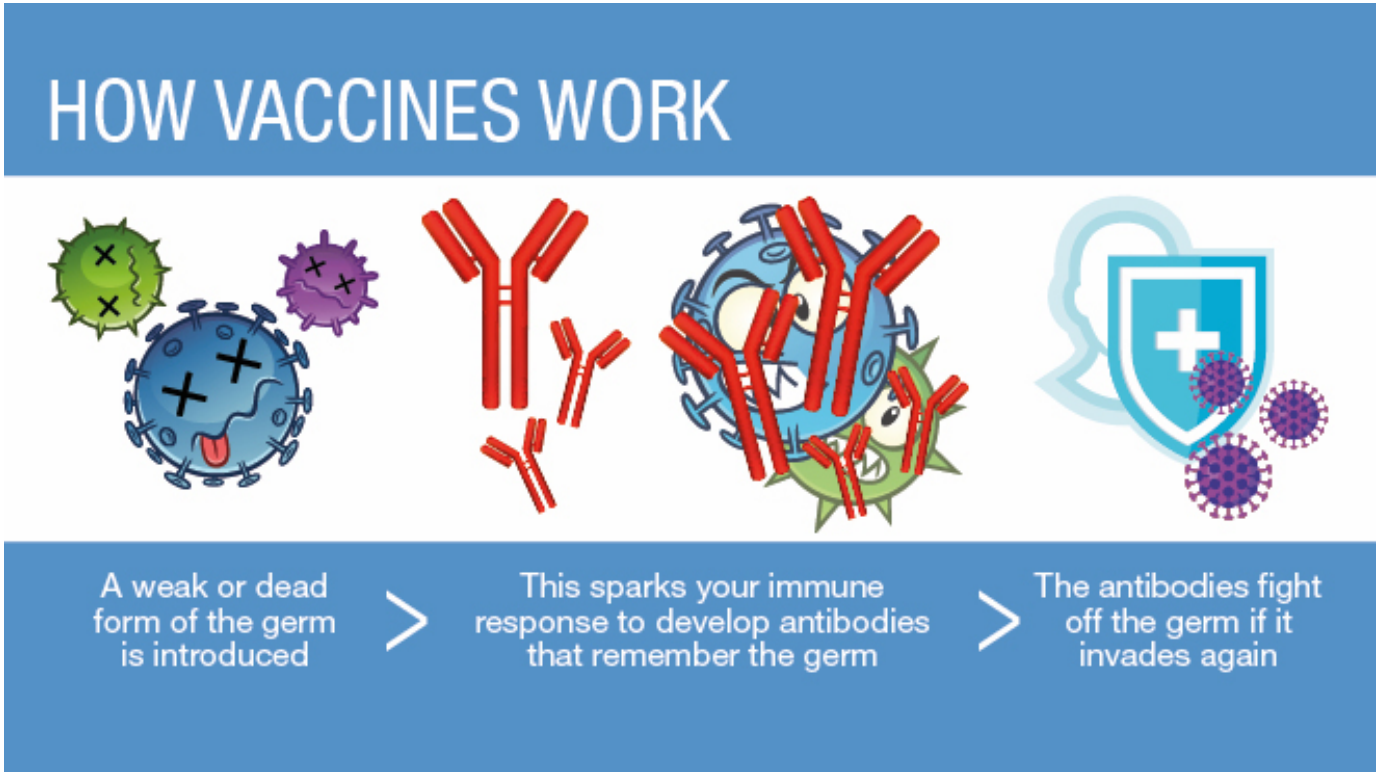


Image from: https://www.mayoclinichealthsystem.org

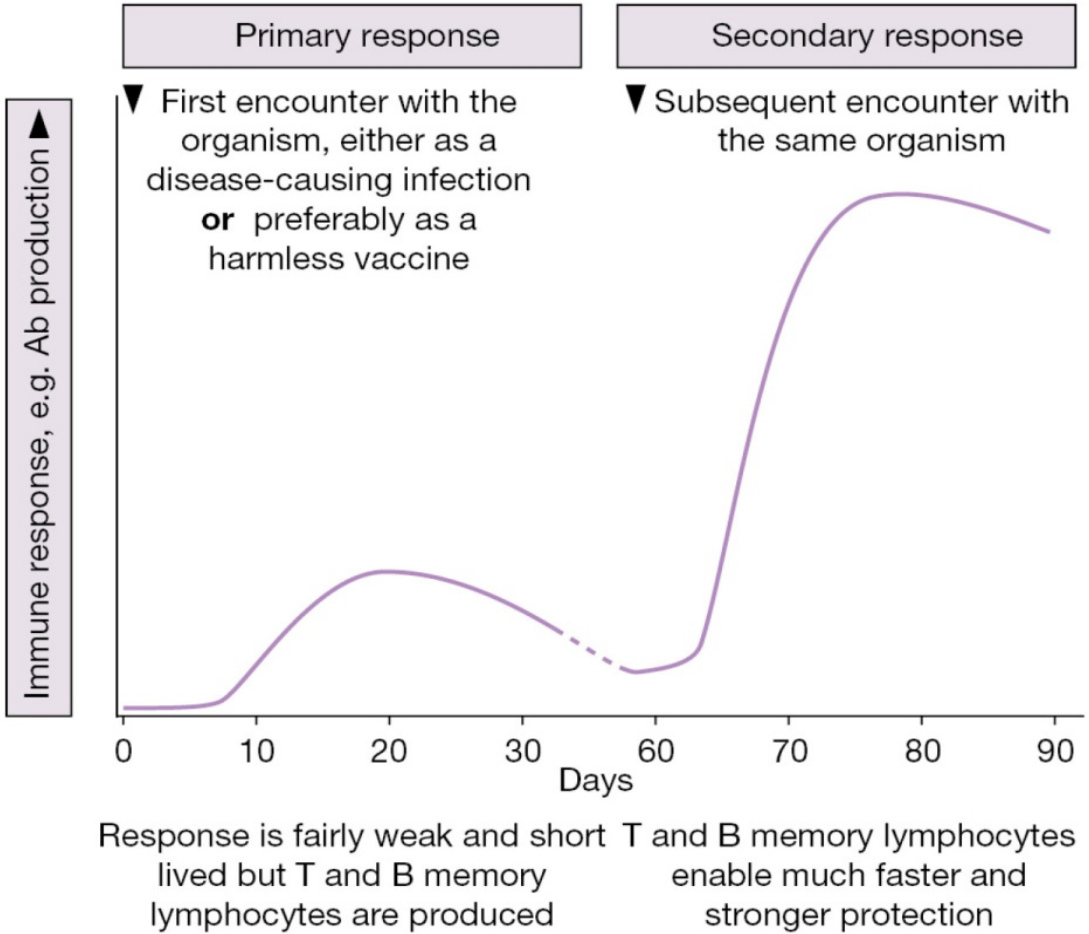


Image from: Riott's Essential Immunology

Examples of Traditional Types of Vaccines:

- Polio vaccine: killed polio viruses
- Measles vaccine: live attenuated (weakened viral strain)
- Hepatitis B: recombinant vaccine
  - A portion of the hepatitis B virus gene, coding for a hepatitis viral protein, is cloned into yeast.
  - The vaccine injects this viral protein isolated from the yeast culture with adjuvant added.

nature reviews drug discovery

Published: 12 January 2018

mRNA vaccines – a new era in vaccinology

Norbert Pardi, Michael J. Hogan, Frederick W. Porter & Drew Weissman

Nature Reviews Drug Discovery **17**, 261–279(2018) | Cite this article

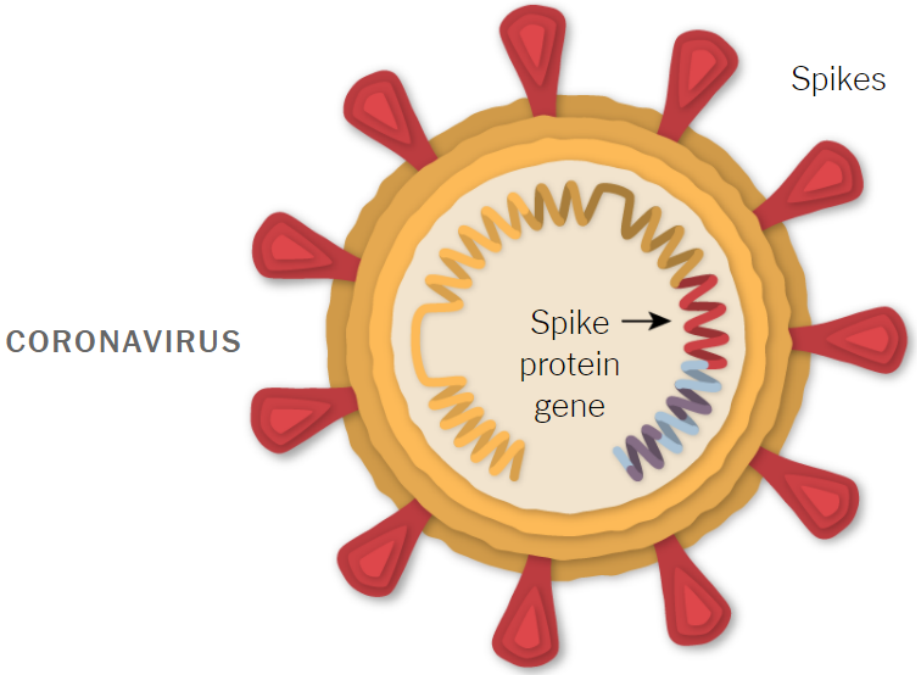
Abstract

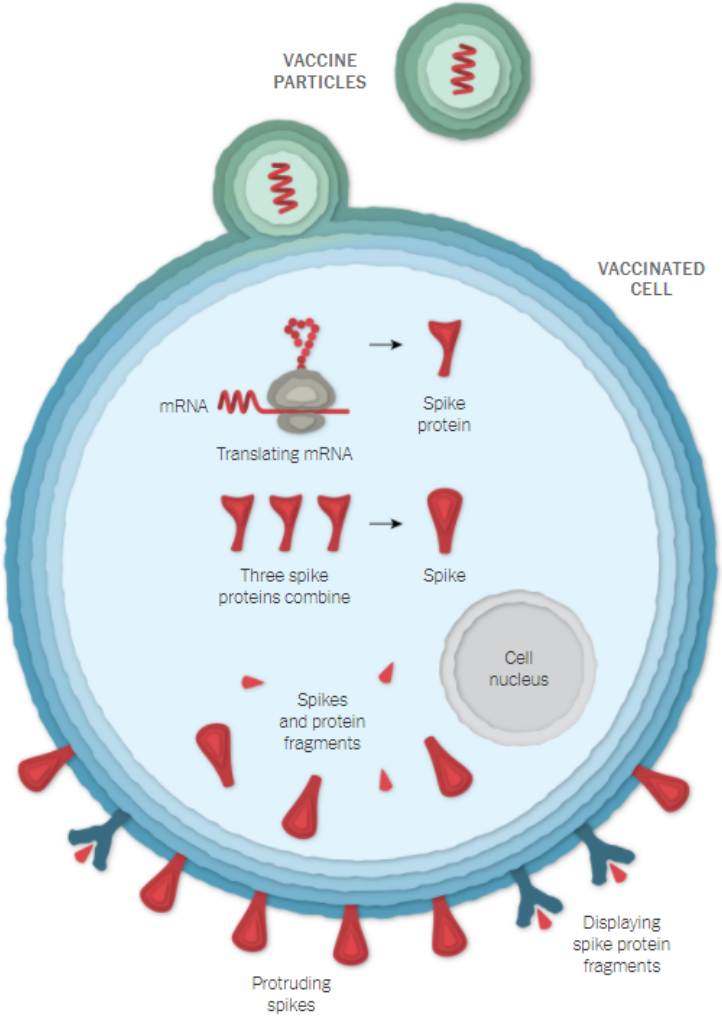
mRNA vaccines represent a promising alternative to conventional vaccine approaches because of their high potency, capacity for rapid development and potential for low-cost manufacture and safe administration. However, their application has until recently been restricted by the instability and inefficient *in vivo* delivery of mRNA. Recent technological advances have now largely overcome these issues, and multiple mRNA vaccine platforms against infectious diseases and several types of cancer have demonstrated encouraging results in both animal models and humans. This Review provides a detailed overview of mRNA vaccines and considers future directions and challenges in advancing this promising vaccine platform to widespread therapeutic use.

NYTimes:
How Moderna's Vaccine Works

By Jonathan Corum and Carl Zimmer; Updated Jan. 21, 2021

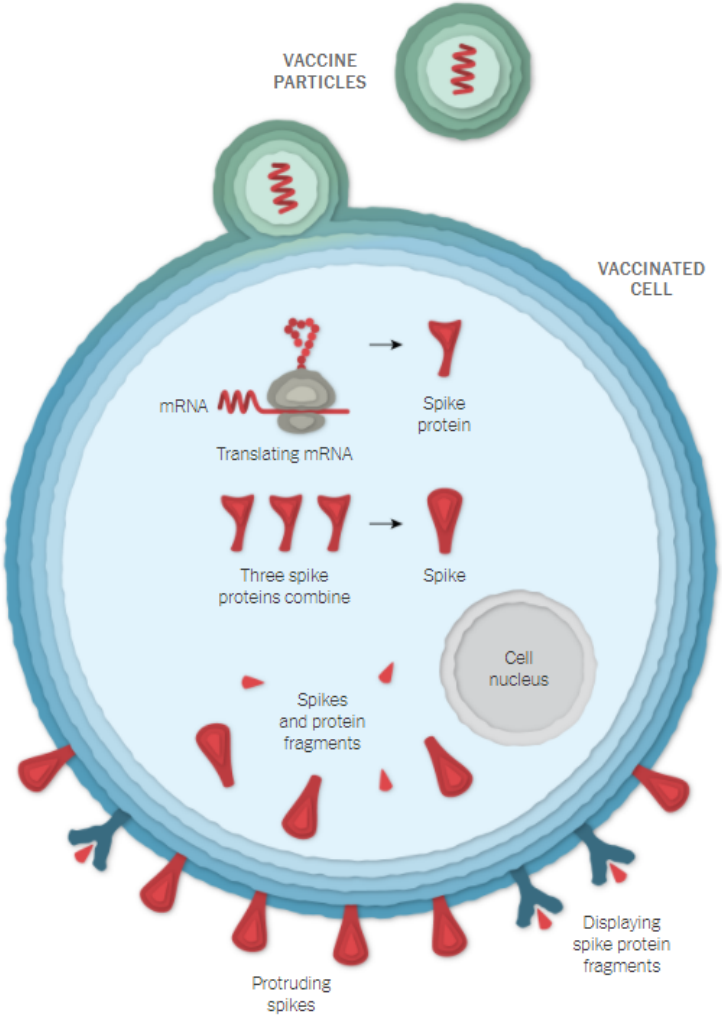
The Pfizer-BioNTech vaccine works this same way.





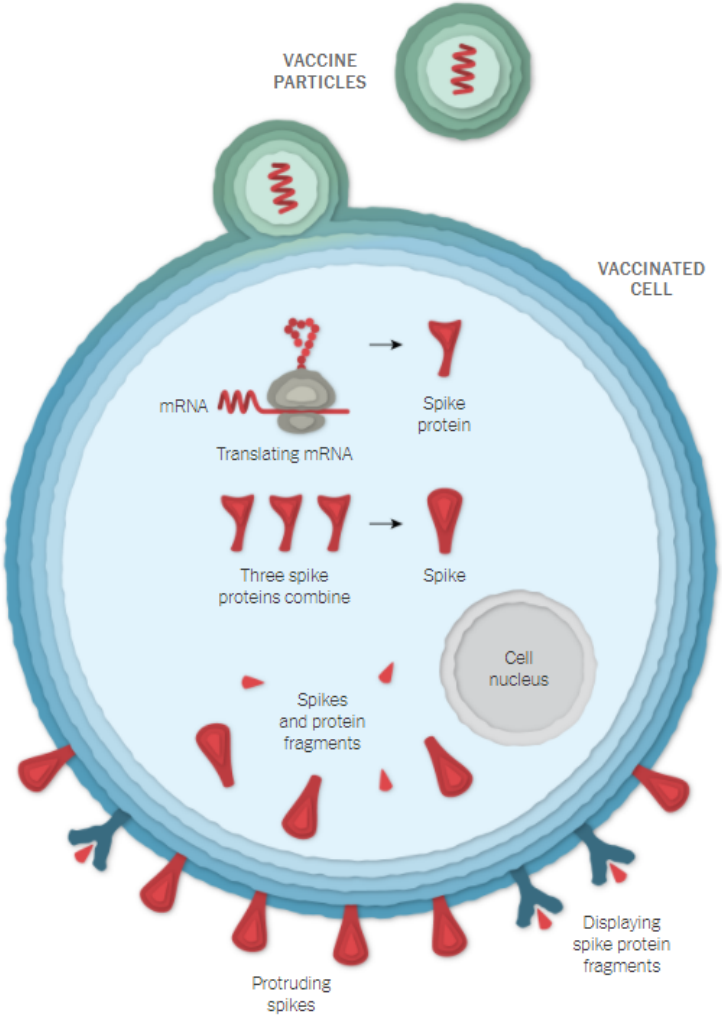
What occurs after vaccination?

- The vaccine contains messenger RNA, genetic material that our cells read to make proteins, wrapped in oily bubbles made of lipid nanoparticles.
- Vaccine particles bump into cells and fuse to them, releasing mRNA into the cell.
- The cell's molecules read its sequence and build spike proteins.



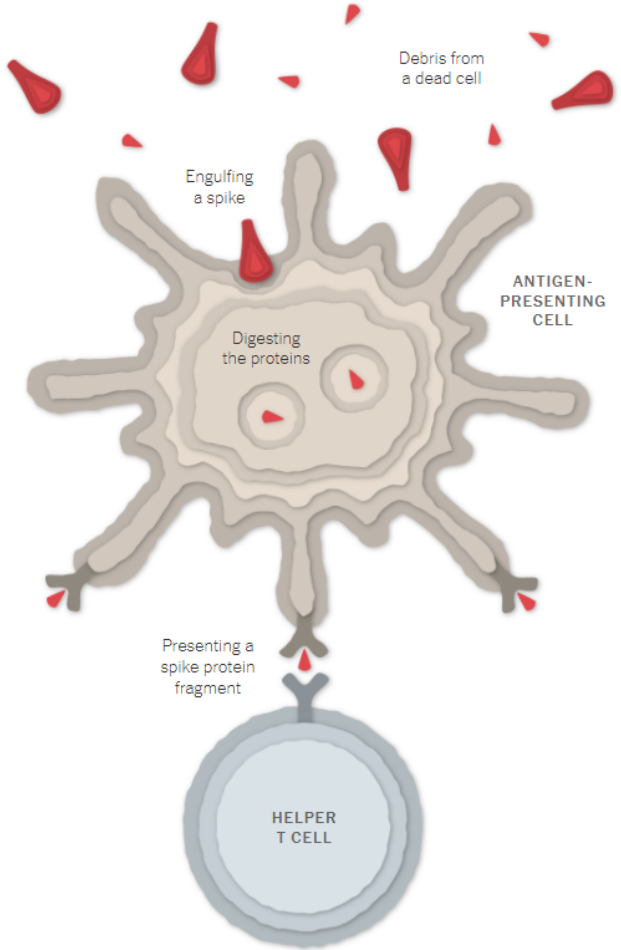
Common concerns:

- This is only instructions for making one viral protein, not the entire virus.
- The vaccine does NOT include any actual viruses.
- The viral mRNA cannot become part of your human DNA.
- The mRNA from the vaccine is eventually destroyed by the cell, leaving no permanent trace.

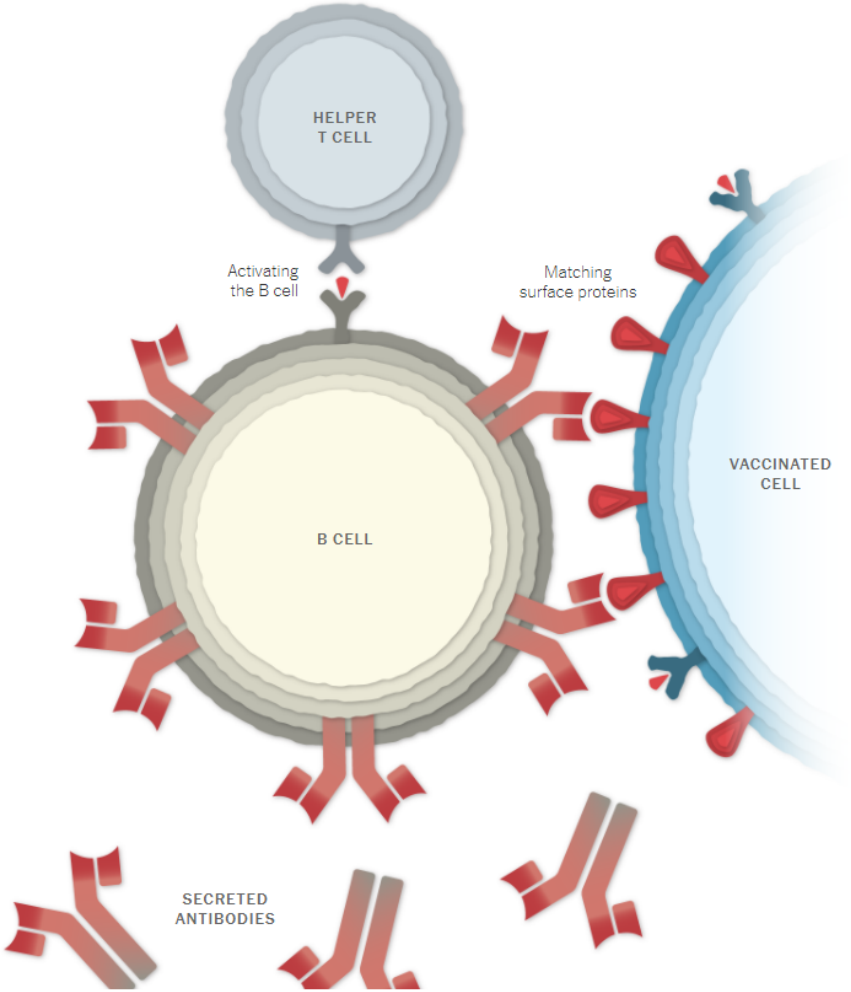


What occurs after vaccination?

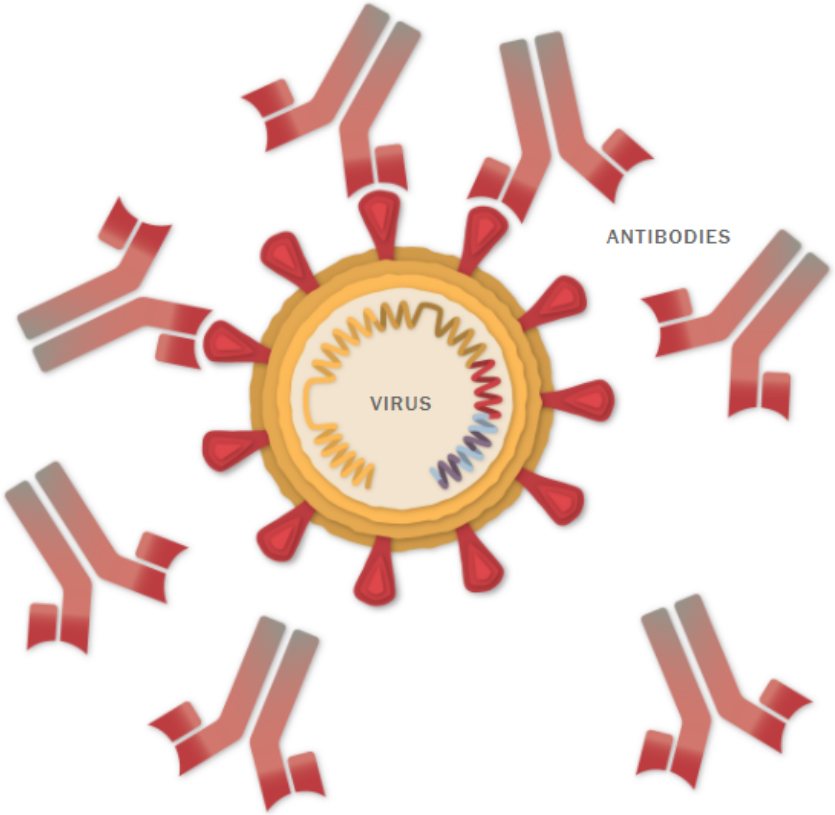
- Some of the spike proteins form spikes that migrate to the surface of the cell and stick out their tips.
- The vaccinated cells also break up some of the proteins into fragments, which they present on their surface.
- These protruding spikes and spike protein fragments can then be recognized by the immune system.



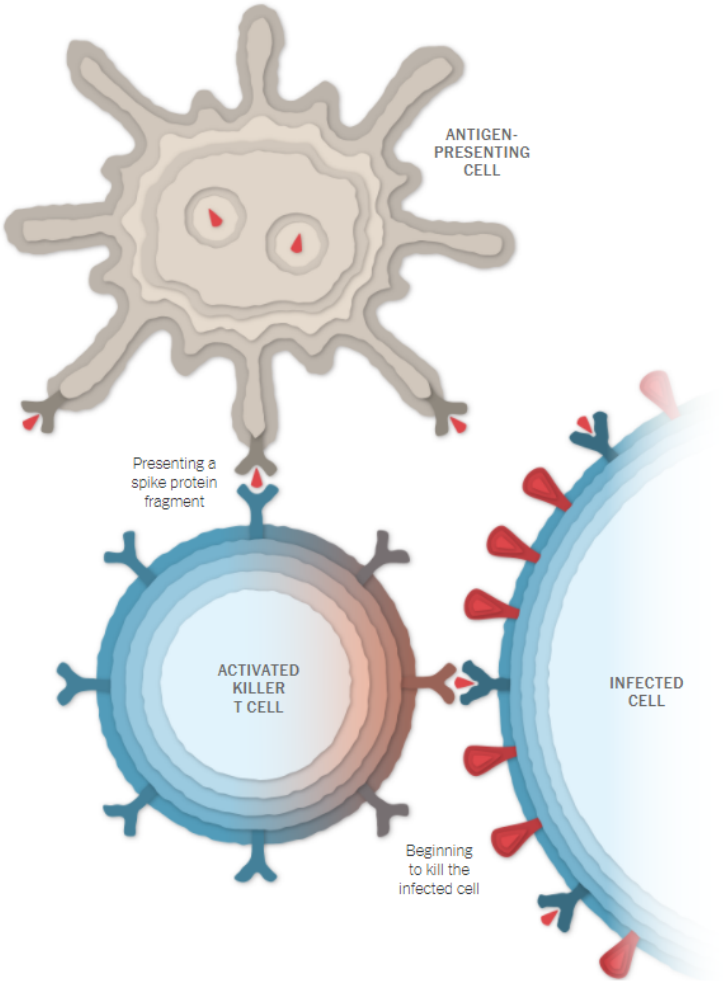
- Remember that the viral protein is being presented on the cell surface.
- Additionally, when a vaccinated cell dies, the debris will contain many spike proteins and protein fragments, which can then be taken up by a type of immune cell called an antigen-presenting cell.
- When other cells called helper T cells detect these fragments, the helper T cells can raise the alarm and help marshal other immune cells to fight the infection.



- Other immune cells, called B cells, may bump into the coronavirus spikes on the surface of vaccinated cells, or free-floating spike protein fragments.
- If these B cells are then activated by helper T cells, they will start to proliferate and pour out antibodies that target the spike protein.



- The antibodies can latch onto coronavirus spikes, mark the virus for destruction.
- Antibodies can also prevent infection by blocking the spikes from attaching to other cells.



- The antigen-presenting cells can also activate another type of immune cell called a killer T cell.
- Killer T cells seek out and destroy any coronavirus-infected cells that display the spike protein fragments on their surfaces.
- This kills the human cell before it can turn into a virus production factory.

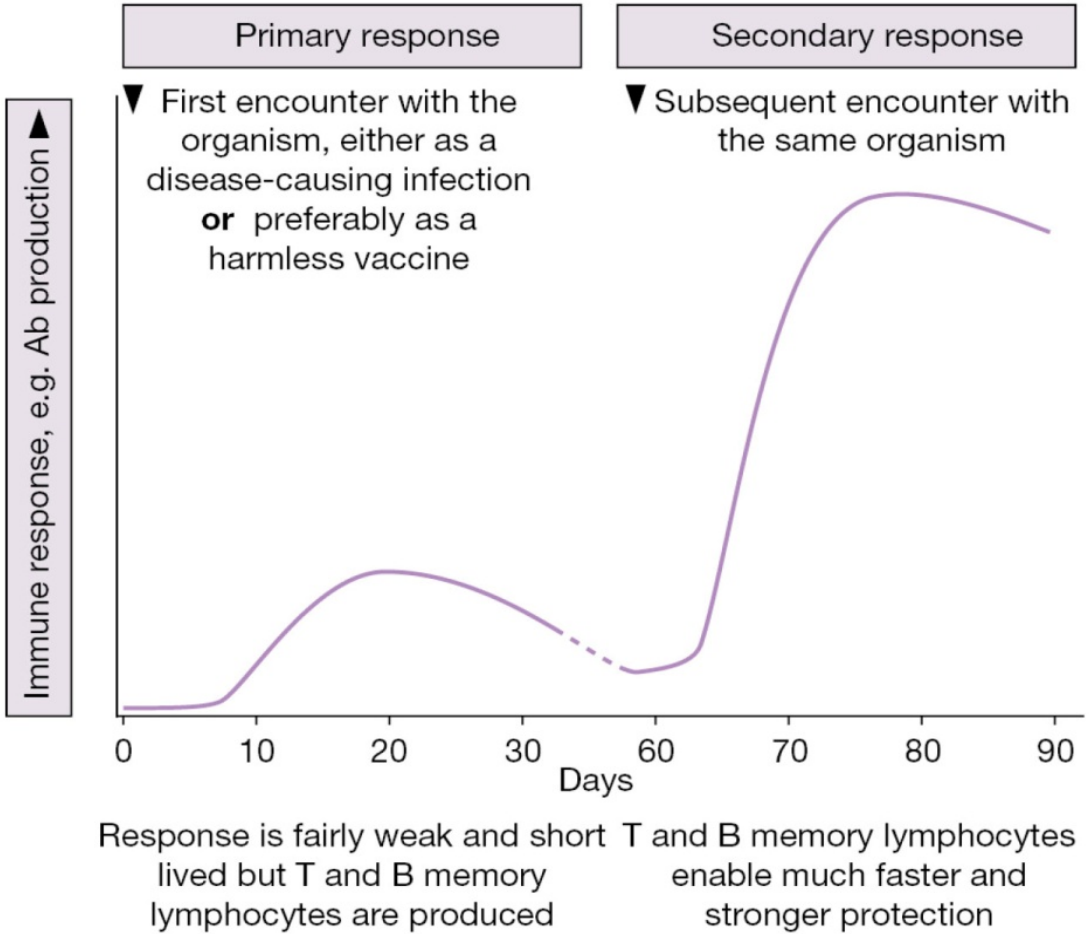
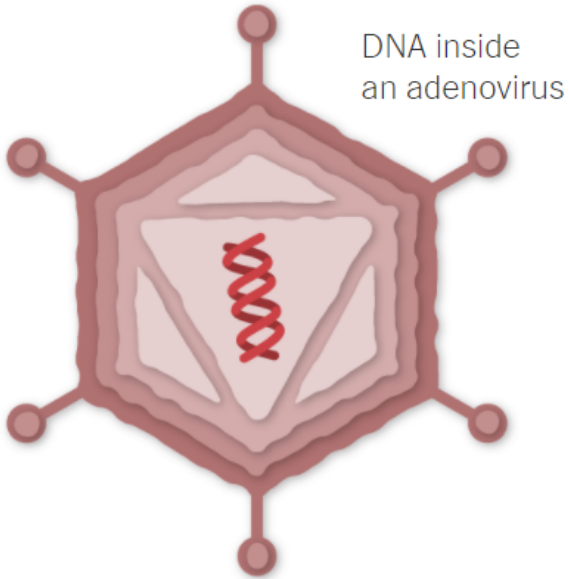
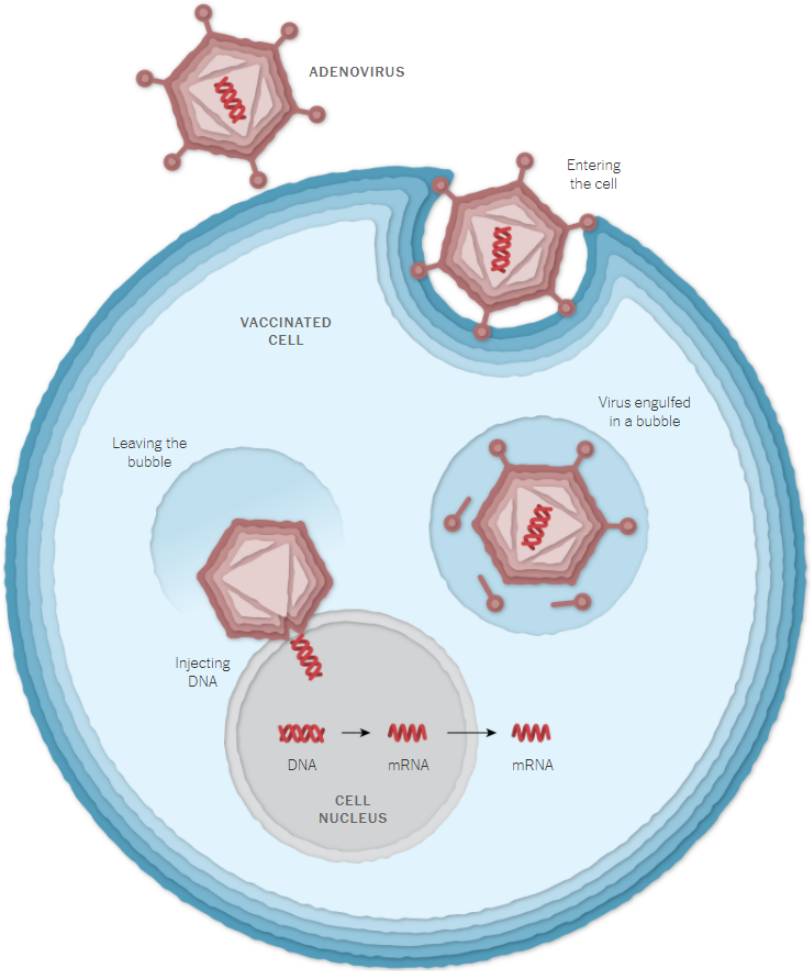


Image from: Riott's Essential Immunology

Other Vaccine Strategies
(NYTimes images)



- Johnson & Johnson vaccine (not authorized yet)
- Oxford-AstraZeneca vaccine called AZD1222 or Covishield (authorized for emergency use in Britain, India, Mexico and other countries)
- Both added the DNA gene for the coronavirus spike protein to another virus called Adenovirus.
- Adenoviruses are common viruses that typically cause colds or flu-like symptoms but the vaccine uses a modified adenovirus that can enter cells but can’t replicate inside them or cause illness.



- The cell engulfs the virus in a bubble and pulls it inside.
- Once inside, the adenovirus escapes from the bubble and travels to the nucleus.
- The adenovirus is engineered so it can't make copies of itself, but the gene for the coronavirus spike protein can be read by the cell and copied into a molecule called messenger RNA, or mRNA.
- You know what happens from here.

NATURE: 18 DECEMBER 2020
The lightning-fast quest for COVID vaccines
https://www.nature.com/articles/d41586-020-03626-1

- How was this fast even possible?
  - Previous years of research on related viruses
  - mRNA vaccine technology now available
  - This virus doesn't mutate a lot or have effective strategies for foiling the human immune system (not compared to HIV or herpes)
  - Funding:
    - Preclinical and phase I, II and III trials, as well as manufacturing, were run in parallel instead of sequentially
    - Multiple companies all working on it
  - Trials:
    - Easy to find trial participants
    - Virus was still active so quick to gather trial data
  - Didn't have things sit and wait at any of the steps

Vaccination and pro-life considerations

https://www.christianitytoday.com/ct/2021/january-web-only/covid-19-vaccine-christian-ethical-questions-fetal-cells.html

- The Christian Medical and Dental Association commended the Moderna and Pfizer vaccines because they do not contain fetal cells and do not rely on fetal cells for in production.
  - The companies did use fetal cell lines in testing—to check for potential side effects or damage to cells—as is standard practice for vaccine review. The fetal cell lines themselves do not contain fetal tissue; they were grown in labs from fetal cells obtained decades ago.
- The AstraZeneca and Johnson & Johnson vaccines used the old fetal cell lines to develop and create the vaccine itself, as well as in lab testing.

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Dr. Robby Franklin

Associate Professor of Psychology

Issues with communicating science

- Scientism versus romanticism
- Misinformation against science
  - Merchants of doubt and tobacco company playbook
  - Conspiracy theories and appeals to emotions
- People believe more certain claims
  - Uncertainty of science used against scientists
- People use their reasoning to support their preconceived beliefs
  - Distrust in institutions is very high in current society
  - History of mistreatment in marginalized groups

Fighting misinformation

- Power of anecdotes - much more persuasive than numbers
- Burden of proof - ask for evidence to support misleading claims
- Engage with probing questions rather than argument

Science, Fears, Misinformation and Facts about Vaccines and COVID-19 Vaccines

Dr. Howard Murphy

Associate Professor & Coordinator, Homeland Security & Emergency Services;

Chair of AU COVID-19 Task Force

COVID-19 Vaccination Rates, Allergic Reactions, and Vaccination Eligibility

COVID-19 Vaccine Doses and Percentages (as of 7 February)

1. **West Virginia**

   Percentage of distributed vaccines that have been administered: 84.22

2. **North Dakota**

   Percentage of distributed vaccines that have been administered: 81.22

3. **New Mexico**

   Percentage of distributed vaccines that have been administered: 80.75

4. **South Dakota**

   Percentage of distributed vaccines that have been administered: 75.38

5. **South Carolina**

   Doses distributed to state: 683,600

   Doses administered: 497,433

   Percentage of distributed vaccines that have been administered: 72.77

https://www.beckershospitalreview.com/public-health/states-ranked-by-percentage-of-covid-19-vaccines-administered.html

COVID-19 Vaccine Doses and Percentages (as of 12 February)

1. **Utah**
   Percentage of distributed vaccines that have been administered: 88.04
2. **West Virginia**
   Percentage of distributed vaccines that have been administered: 87.97
3. **New Mexico**
   Percentage of distributed vaccines that have been administered: 86.28
4. **North Dakota**
   Percentage of distributed vaccines that have been administered: 86
5. **South Carolina**
   Doses distributed to state: 779,500
   Doses administered: 628,496
   Percentage of distributed vaccines that have been administered: 80.63

https://www.beckershospitalreview.com/public-health/states-ranked-by-percentage-of-covid-19-vaccines-administered.html

COVID-19 Vaccine Doses and Percentages (as of 17 February)

20. **South Carolina**
Doses distributed to state: 926,750
Doses administered: 738,476
Percentage of distributed vaccines that have been administered: 79.68

Vaccinations – South Carolina and Anderson County (as of 17 February)

Total **Doses** Given in South Carolina
705,776

Total **People** Vaccinated in South Carolina
528,480

People with 1 Vaccine Dose	527,691
People with 2 Vaccine Doses	177,126

Vaccine Count by County of Administration

Anderson	32,280
Grand Total	32,280

https://scdhec.gov/covid19/covid-19-vaccine-allocation

Vaccinations – South Carolina and Anderson County (as of 16 February)

Total Doses Received in South Carolina
970,750

Total Doses Given in South Carolina
687,669

Pfizer-BioNTech Vaccine Allocations

Total Doses Received
532,550

Total Doses Used
93%

Given
First Shot / Second Shot
365,325 / 127,735

Moderna Vaccine Allocations

Total Doses Received
253,700

Total Doses Used
46%

Given
First Shot / Second Shot
111,256 / 5,117

Pfizer & Moderna Appointments Scheduled
Not including third-party providers
467,554

https://scdhec.gov/covid19/covid-19-vaccine-allocation

Allergic Reactions

Bottom Line Up Front: 0 severe reactions within Anderson County

Anaphylaxis is a severe, life-threatening allergic reaction that occurs rarely after vaccination.

During December 14–23, 2020, monitoring by the Vaccine Adverse Event Reporting System detected 21 cases of anaphylaxis after administration of a reported 1,893,360 first doses of the Pfizer-BioNTech COVID-19 vaccine (11.1 cases per million doses); 71% of these occurred within 15 minutes of vaccination.

https://www.cdc.gov/mmwr/volumes/70/wr/mm7002e1.htm

That amounts to 11.1 cases per million versus an estimated 1.3 cases per million following inactivated influenza vaccine.

https://www.medpagetoday.com/infectiousdisease/covid19/90556

Prioritization for Immunization -- Phase 1a

- Healthcare personnel - focus on workers critical to preventing deaths i.e. direct medical care to suspected and/or confirmed COVID-19 cases/patients.
- Residents and staff of long-term care facilities.
- Estimated 350K HCWs to reach.
- ≥65 y.o. regardless of co-morbidities.
- **Vaccination for Phase 1a anticipated to continue through February 2021.**
- **Priorities based on Advisory Committee on Immunization Practices (ACIP) guidance.**

Prioritization for Immunization -- Phase 1b

- Frontline essential workers - fire fighters, law enforcement/ corrections officers, food and agricultural, Postal Service, manufacturing, grocery store, public transit, **and educational - teachers, support staff, and daycare workers.**
- Per CDC – plan for Phase 1b transition once 70% of Phase 1a have been vaccinated.
- **Late Winter to early Spring.**

Prioritization for Immunization -- Phase 1c

- Essential workers not in 1b (e.g. transportation and logistics, food service, housing construction, finance, IT, communications, energy, law, media, public safety, and public health staff who are non-frontline healthcare workers).
- 16-64 years with co-morbidities that increase the risk for severe COVID-19.
- **Late Winter to early Spring.**

Vaccination Locations (1 of 2)

- **SCDHEC:**
- You may schedule your COVID-19 vaccine appointment here: www.scdhec.gov/vaxlocator
- DHEC Care Line 1-855-472-3432 (the careline cannot schedule an appointment, but can assist with providing phone numbers of locations offering vaccine appointments)
- Individuals can find facts regarding the COVID-19 Vaccine at scdhec.gov/vaxfacts
- **AnMed Health:**
- AnMed is using their Mychart system to email vaccine information to participants.

Vaccination Locations (2 of 2)

- **Ingles:** https://www.ingles-markets.com/covid19-waitlist
- **CVS:** https://www.cvs.com/immunizations/covid-19-vaccine
- **Walgreens:** https://www.walgreens.com/topic/promotion/covid-vaccine.jsp
- **Walmart:** https://corporate.walmart.com/covid-vaccine
- **Doctors Care:** https://doctorscare.com/

Questions / Comments?