Covid-19 vaccine science

December 10, 2020

1. Operation Warp Speed
2. How does it work?
3. Should I get it?
4. History of “cell lines” in research.

Operation Warp Speed:

April 2020

- Public interagency + private partnership to facilitate and accelerate the development, manufacturing, and distribution of COVID-19 vaccines, therapeutics, and diagnostics.

- Congress allocated nearly $10 billion for Operation Warp Speed through the Coronavirus Aid, Relief, and Economic Security (CARES) Act

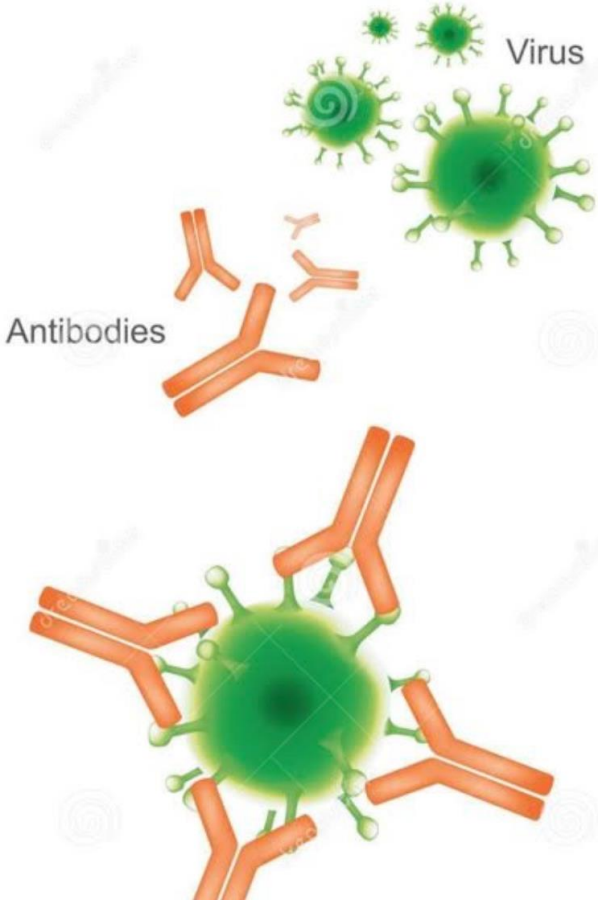
- May 15, 2020

Operation Warp Speed: The players

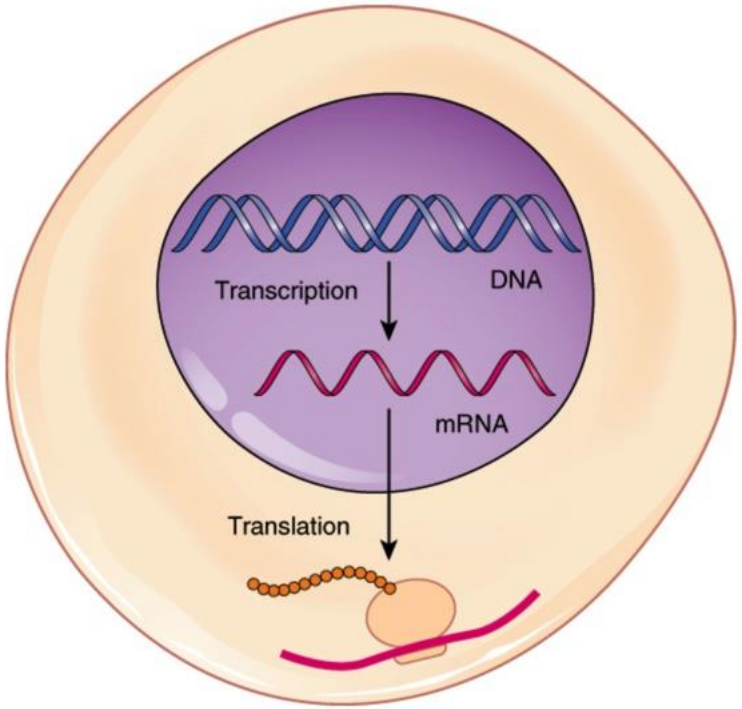
- Pfizer-BioNTech → $ 2 billion promised in July
- Moderna → $ 483 million in June
- AstraZeneca-University of Oxford and Vaccitech → $ 1.2 billion in June
- Johnson & Johnson (Janssen Pharmaceutical)
  - "to Supply 1 Billion Vaccines Worldwide."

- Novavax → $ 1.6 billion promised in July *if successful*
- Sanofi and GSK → $ 2.1 billion in July

We need antibody against Covid-19 “spike protein.”



The messenger: mRNA codes for proteins.



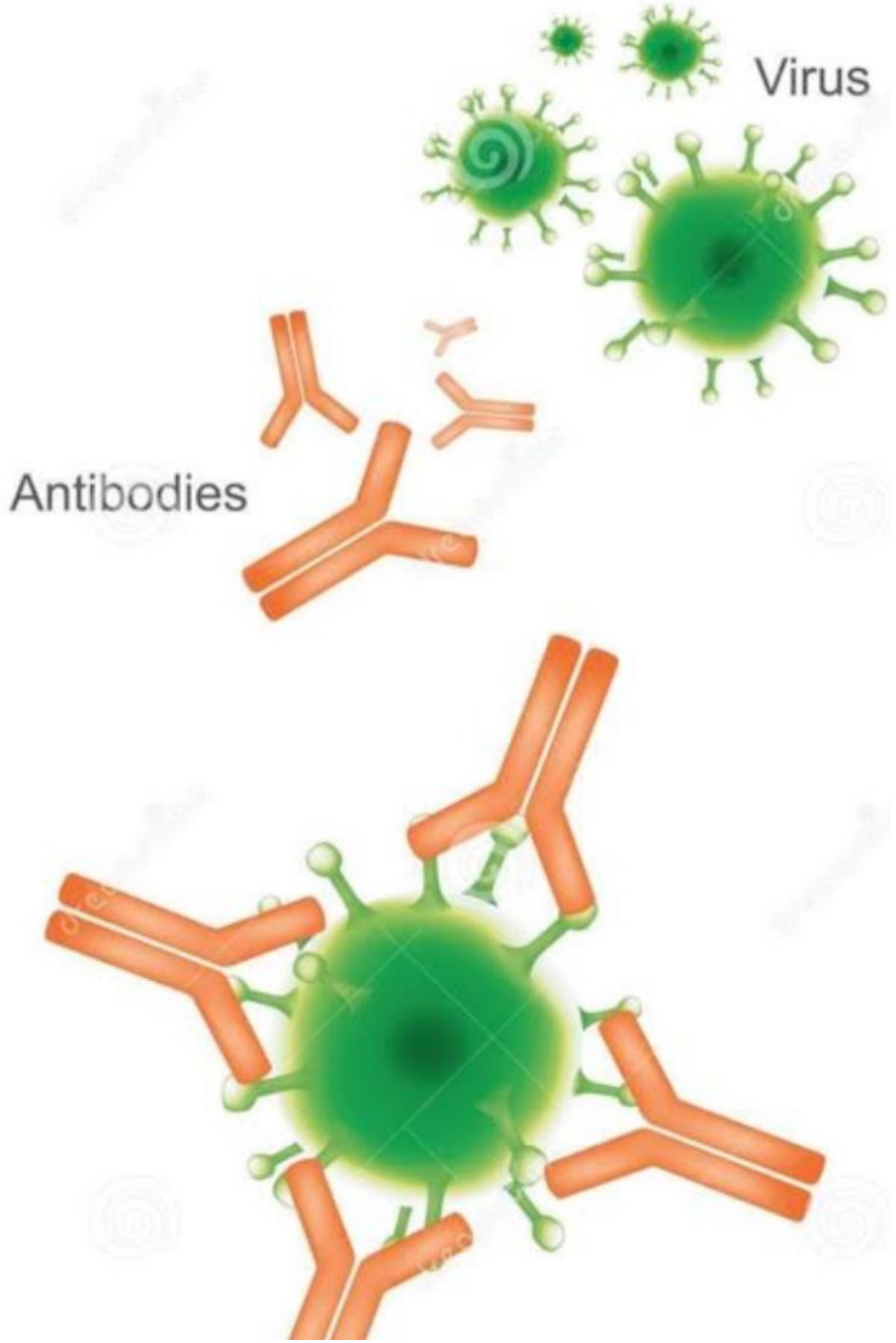


Image ref: lumenlearning.com

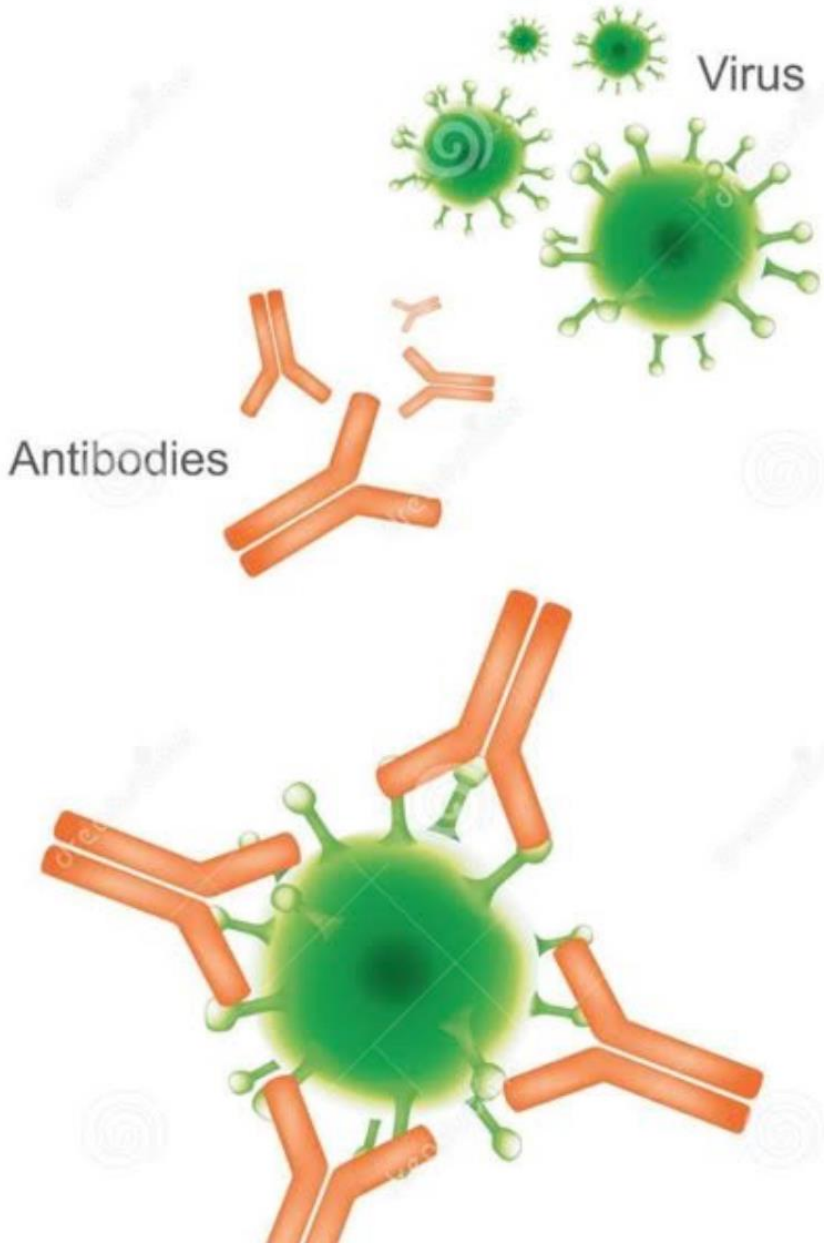
Covid-19 vaccine is based on…

mRNA codes **spike protein**:

1. Pfizer - BioNTech
2. Moderna

Adenovirus carries the **spike protein**:

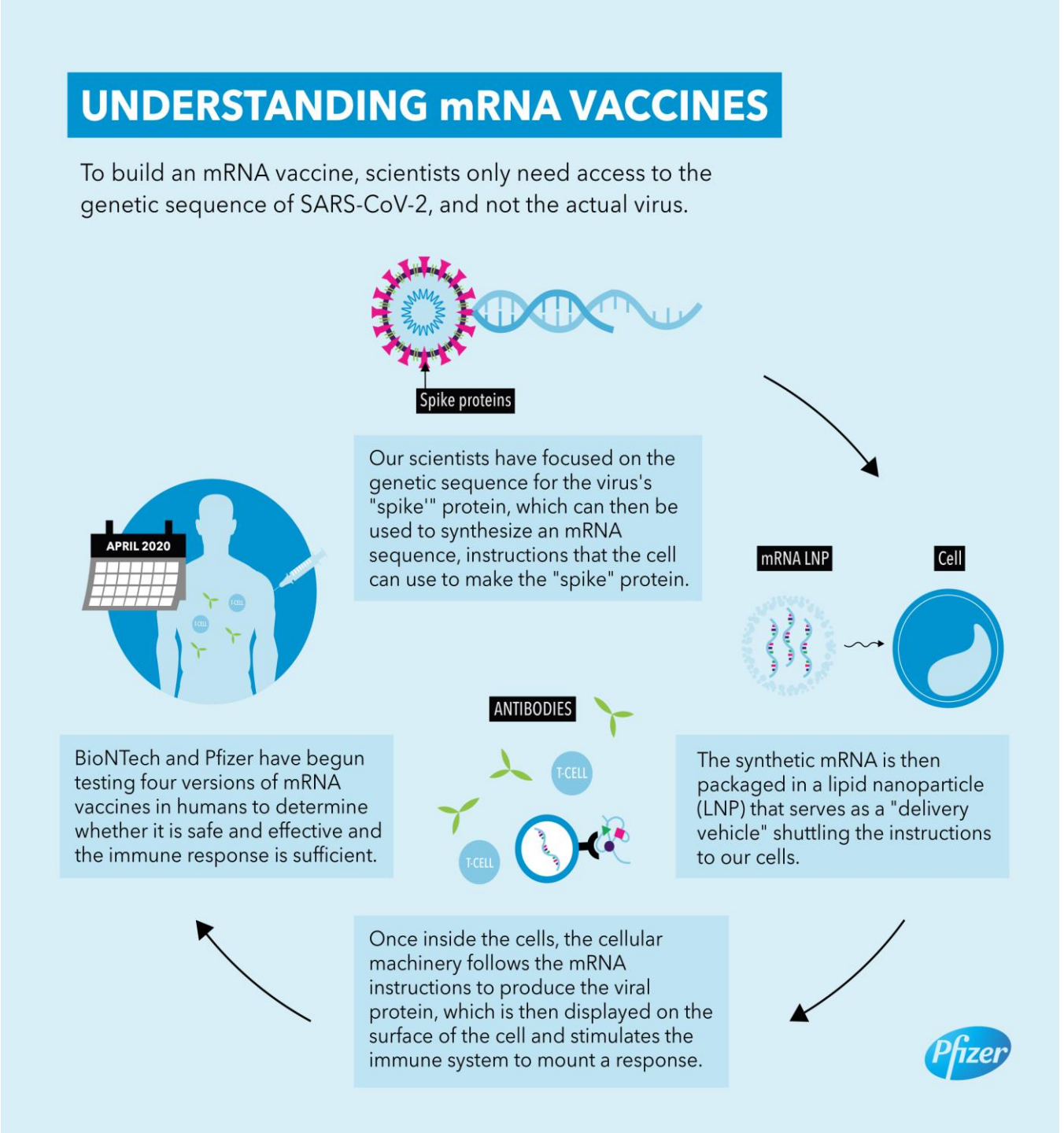
1. AstraZeneca
2. J&J/Janssen



- Pfizer ®
- Moderna ®

Success

- ~95% response.
- Safety was closely monitored.
- First large scale vaccine using mRNA technology.



Or maybe…

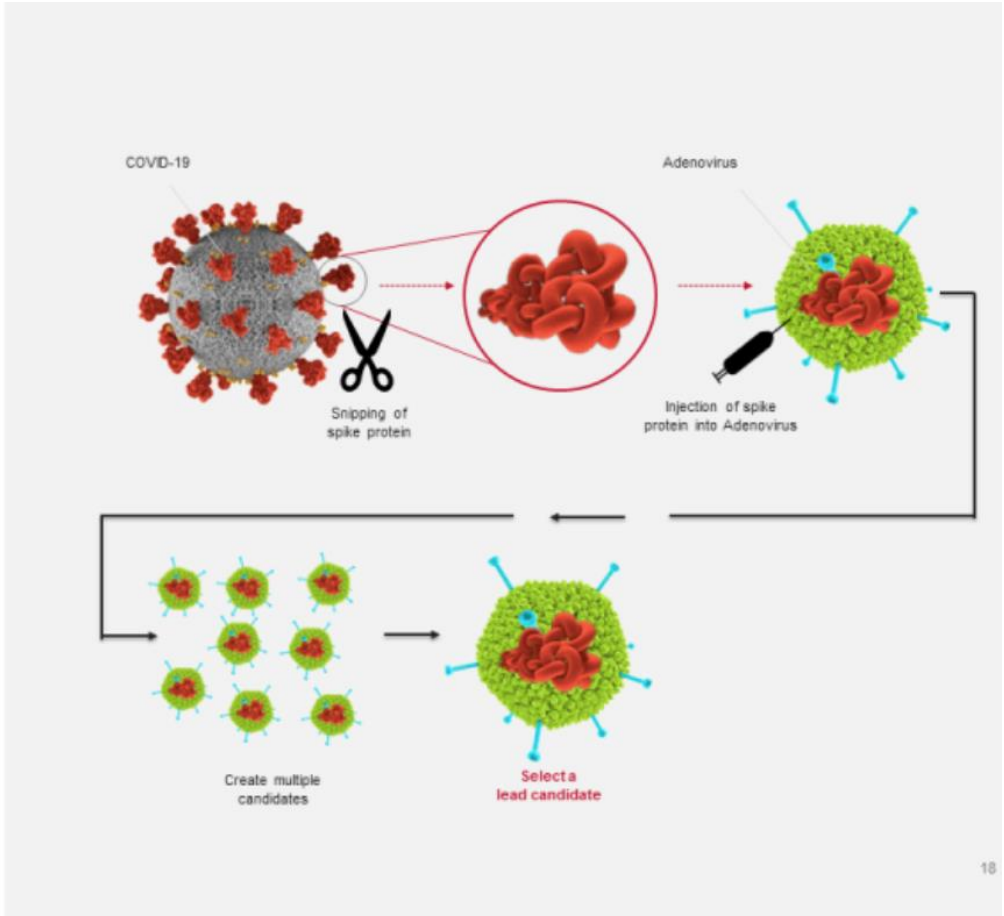
- AstraZeneca ®
- J&J ®

Designing a vaccine

January – March 2020

- January 2020: SARS-CoV-2 sequence available
- Vaccine design commences
- SARS-CoV-2 spike protein inserted into Ad26 vector
- Multiple vaccine candidates constructed
- March 2020: Validated with pre-clinical testing to identify lead candidate

Johnson & Johnson



How some COVID-19 vaccines use human fetal **cell lines**:

- HEK-293, a kidney cell line widely used in research and industry that comes from a fetus aborted in about 1972.
  - AstraZeneca.
- PER.C6, a proprietary cell line owned by Janssen Pharmaceuticals of Johnson & Johnson, developed from retinal cells from an 18-week-old fetus aborted in 1985.

- Used as mini "factories" → adenoviruses → to carry **spike protein**.
- Univ. of Pittsburgh (HEK-293) produces protein of the virus…same idea.

What are immortalized “cell lines” ?

- Sentinel example featured in HBO’s “The Immortal life of Henrietta Lacks.”
- Industry took cervical cancer cells and grew them in the lab.
  - No consent. No compensation.
  - Thousands of research experiments used HeLa cells from 1951 until today.
  - DNA sequence published in 2013.
  - Family eventually aware.

Feds, family reach deal on use of DNA information

Originally published August 7, 2013 at 1:00 pm | *Updated August 7, 2013 at 8:31 pm*

1 of 4 | This 1940s photo shows Henrietta Lacks. In 1951, a doctor in Baltimore removed cancerous cells from Lacks without her knowledge or consent. Those cells eventually helped lead to a multitude of medical treatments and formed the groundwork for the multibillion-dollar biotech industry. **Less**

Some 60 years ago, a doctor in Baltimore removed cancer cells from a poor black patient named Henrietta Lacks without her knowledge or consent. Those cells eventually helped lead to a multitude of medical

Skloot, Rebecca (2010), *The Immortal Life of Henrietta Lacks*, New York City: Random House.

Ritter, Malcolm August 7, 2013. "Feds, family reach deal on use of DNA information". *Seattle Times*.

Take home thoughts

- The mRNA technology used by Pfizer & Moderna appear to be safe and effective without use of fetal cell lines.
- J&J/Janssen and AstraZeneca/Oxford U. vaccines using a more traditional carrier virus delivery mechanism are still under study and use fetal cell lines early in their vaccine production process.
- The use of immortalized cell lines was dramatized by the true story of HeLa cells, but continues to receive relatively minimal attention.