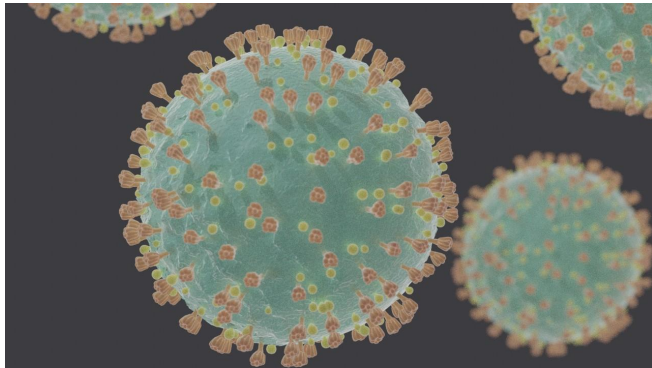
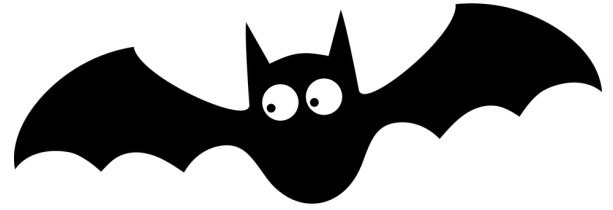


Covid-19 and the mRNA Vaccines

How they work and what to expect



Background



- Covid-19 was identified in Wuhan China in December of 2019.
- Jumped to humans through zoonosis, likely from bats or an intermediate host.
- By the end of January 2020, Covid-19 had been identified in other parts of Southeast Asia, Europe, Africa, and North America.
- The first case in the United States was identified January 21st in Washington State.
- Life center outbreak in Kirkland was occurred in late february confirming local transmission.
- Covid-19 spread rapidly throughout the country with a large portion of cases originating from travel from both Asia and Europe.

The Numbers so far ...

- 21.7 million confirmed US cases, roughly 6.5 % of population
- 365,000 deaths
- Washington State has had 269,000 cases, roughly 3.5% of population
- 3,711 deaths
- Current Washington State R_t is 1.11



How to make a Vaccine

- The idea is to trick your immune system into thinking there is an infection.
- The differences between vaccines lie in what you use to trick the immune system.
- Live attenuated virus (smallpox, measles, mumps, rubella, chickenpox)
- Inactivated virus (Hepatitis A, Influenza, Polio, Rabies)
- Subunit (Hep B, HPV, Whooping Cough, Pneumonia, Meningitis, Shingles)
- Toxoid (Diphtheria, tetanus)



Cowpox!

What is messenger RNA

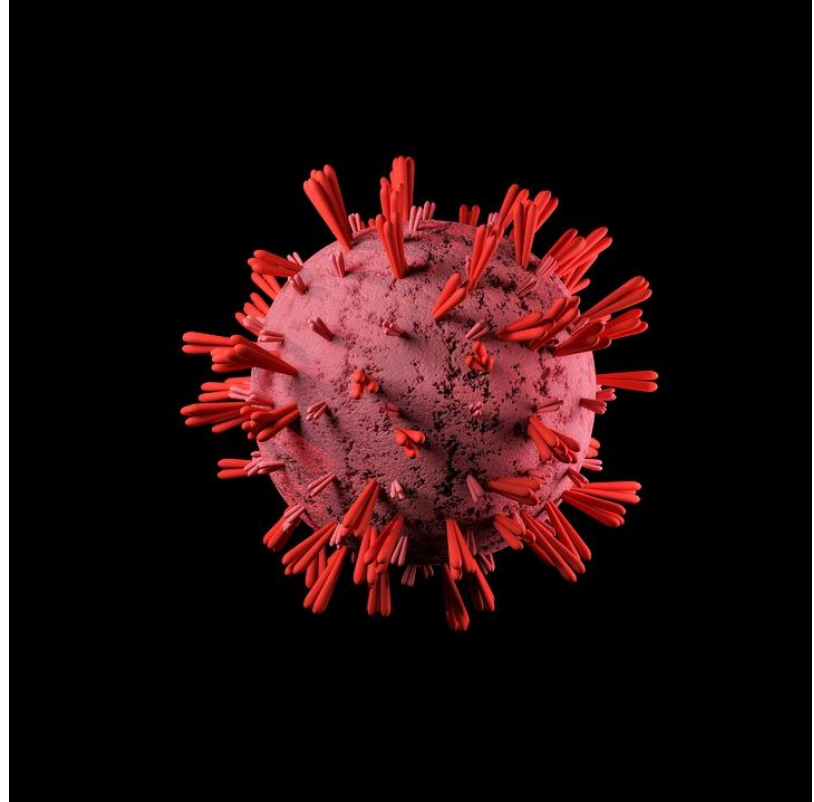
- DNA is a genetic code is the recipe book for making proteins
- mRNA is a recipe that is written down and brought to the chef.
- Ribosomes are the Chef that reads the recipe and makes the proteins.



Spike Protein Anyone?

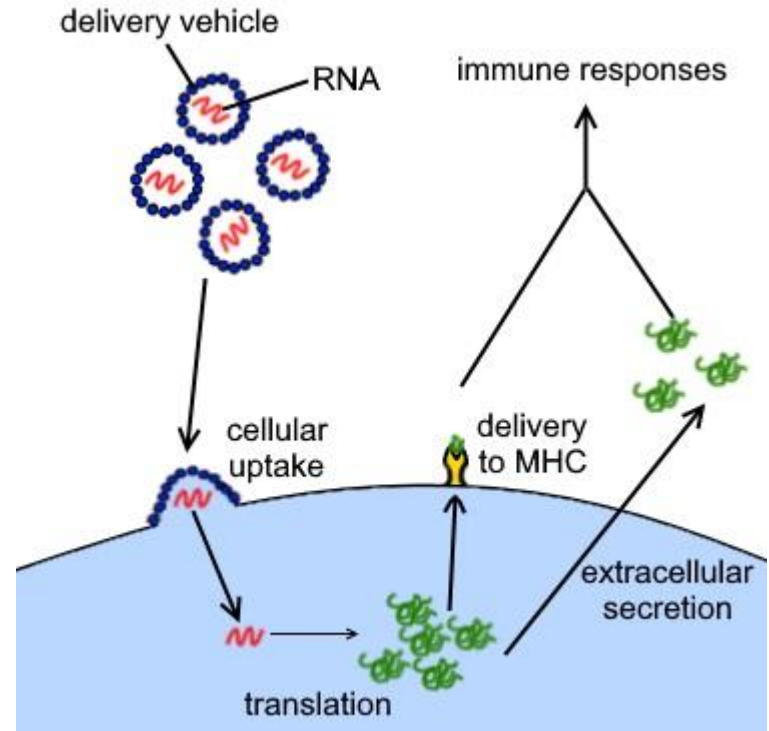
When Covid-19 Attacks

- Covid-19 virus containing mRNA attaches to the cell.
- Cell absorbs the virus and the capsule breaks down.
- Viral mRNA is released in the cell.
- Ribosomes start reading viral mRNA and building virus
- Cell eventually dies releasing more virus
- The virus gives the chef a recipe to make more virus.



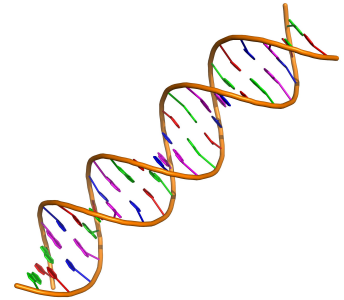
mRNA Vaccines

- Contain a copy viral mRNA that encodes for the spike protein which is found on the outer surface of Covid-19.
- Cells get the recipe for the spike protein, build it, and display it on their surface
- Your immune system recognizes the spike protein as foreign.
- An immune response develops that will give you protection the next time your body sees the protein.



This is not brand new technology...

- The idea of giving personalized mRNA has been around for decades.
- mRNA is fragile and the problem was getting it into cells before it was destroyed by our immune systems.
- In the last 15 years researchers have made breakthroughs in synthesizing mRNA and effectively getting it into cells.
- Can be used for vaccines, cancer immunotherapy, and genetic diseases.



Pfizer-BioNTech Vaccine

- Approved for emergency use December 11th, 2020.
- BioNTech did the mRNA development, Pfizer supplied the money and the infrastructure.
- 1 of 4 mRNA candidates that was chosen from Phase 1 trials.
- Phase 3 trial had 43,448 participants that received two doses of the vaccine or placebo 21 days apart.
- Participants were age 16 or older.
- Trial looked at efficacy against confirmed Covid (symptoms with a positive test)

BIONTECH

It Works!

- 95% effective at preventing laboratory confirmed Covid-19.
- Appears effective at preventing severe covid with only 1 case in vaccine group vs. 9 in placebo group.



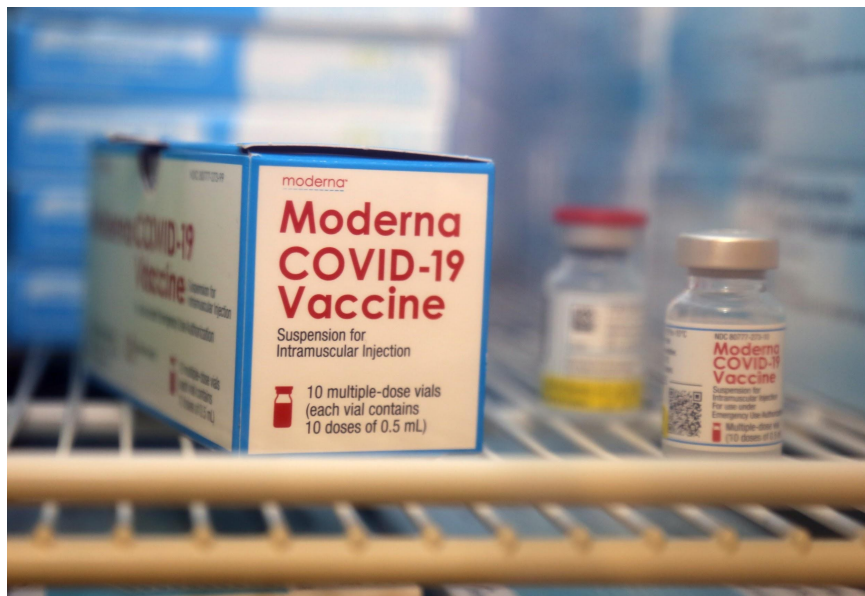
Moderna Vaccine

- Founded in 2010 located in Cambridge, MA.
- Specializes in mRNA technology.
- Approved for emergency use authorization December 18th, 2020.
- Phase 3 trial had 30,420 volunteers who received either vaccine or placebo 21 days apart.
- Participants were 18 or older
- Trial looked at laboratory confirmed symptomatic Covid-19 infection



It Works!

- Vaccine was 94.1% effective at preventing Covid-19 infection
- There were no cases of severe Covid in the vaccinated group



But is it safe.....Pfizer/BioNTech

- 66-83% **pain** at injection site (10% placebo)
- 6% **redness** and **swelling** (1% placebo)
- 1-16% had **fever** (less than 1% placebo)
- 34-51% had **fatigue** (17-33% placebo)
- 25-52% had **headache** (14-34% placebo)
- 6-35% had **chills** (3-6% placebo)
- 14-37% had **muscle pain** (5-11% placebo)
- 9-22% had **joint pain** (4-6% placebo)
- Diarrhea and vomiting was the same in both groups.
- Participants under 55 typically had stronger reactions with second dose. Side effects were less common people over 55.



But is it safe..... Moderna

- 75% reported an adverse local event, typically pain at injection site.
- 60% Headache, fatigue, myalgia
- 50% Joint pain
- 55% Muscle aches
- 40% Chills
- Again, side effects were more common in younger participants with the second dose.

Ok, its gonna hurt and I won't feel good but is it safe?

- Neither trial was stopped due to an adverse event.
- Serious adverse events in both trials were rare and were similar in both the placebo and vaccine groups.
- There were a small number of deaths in both the vaccine and placebo groups. Number of deaths in both groups was essentially the same and none of them were attributed to the vaccine or placebo.
- Causes of death in the studies included heart attack, stroke, unknown causes (all in placebo), leukemia, intraabdominal peforation, and suicide.
- There was no evidence of vaccine enhanced respiratory disease.

Kids

- We know they can carry.
- We know they can transmit.
- They are more likely to be asymptomatic.
- Transmission and outbreaks have more commonly been associated with older children and teenagers but have been seen in settings such as daycares.
- It's likely vaccines will be effective in children but will they be safe?
- Concern would be for stronger systemic reactions as younger participants in trials were more likely to have them.
- Both companies have started trials including children 12 and older.



My Experience...



Questions?

