Understanding The Vaccines in Cartoons

let's make antibodies!

The Viral-Vector (J&J) Edition
To understand the viral vector vaccines, which use an adenovirus, it can help to know how adenovirus normally works.

This is an adenovirus. It normally causes a cold.

An adenovirus enters nasal cells by attaching to cell receptors which tell the cell to bring the virus inside.

Once inside the cell, adenovirus travels to the nucleus and injects its DNA.

Once inside the nucleus, a copy of the DNA gets made called mRNA.

The mRNA leaves the nucleus and gets read by the cell's protein factories (ribosomes).

More virus gets made.

Virus leaves the cell and goes on to infect more cells.

Oh no. That's gonna be a rewrite up.

We're just doing our job.
To make the vaccine, some key genes are removed from the adenovirus so that it can’t replicate or cause illness. Then, DNA to make just a part of the Covid-19 virus (the spike protein) is added.

The adenovirus does what it usually does and infects local cells.

Only instead of making adenovirus, the cell makes spike proteins. Would ya look at that. Adorable spikes.

What exactly is the spike protein, you ask?

The spike protein is the part of coronavirus that attaches to cells. Since the spike protein is just a part of the virus, it can’t infect cells, it can’t replicate and so it can’t cause Covid-19.
Some of these spikes leave the cells and get recognized by local immune cells.

Antibodies get made that perfectly fit the spike.

Antibodies to the spike stop the virus from entering the cell and being able to replicate. These type of antibodies are called neutralizing antibodies.

The immune cells travel to the lymph nodes to get help.

Hey, B cells, could you help get rid of the spike?

We've got some kind of spike invasion in the arm.

We'll be cloning and making antibodies!

B cells

Antibodies also put a mark on the head of viruses so macrophages can focus in on eating and destroying them.

Antibody-coated virus! My favorite!

Save some for me!

After the virus is under control, extra B & T cells continue to circulate in case the virus comes back. That seemed almost too easy.

How about some extra of us stick around, so we'll be ready for next time.

These are called memory B & T cells and allow the body to make antibodies to the virus in hours, not days.
**Does the DNA from the viral vector vaccine for Covid-19 combine with human DNA?**

No. That requires an integrase enzyme to splice the DNA. Adenovirus and the vaccine do not carry the gene for integrase.

**Could the viral vector DNA stay in our cells in a latent state?**

Some viruses have tricky ways to evade the immune system's usual ways of getting rid of infected cells. These viruses can be a pain because they can go latent, happily hiding in your cells for years. Varicella, the virus that causes chicken pox, hides out in nerve cells for years and can later cause shingles.

**What happens to the cells that do have spike DNA inside the nucleus?**

The adenovirus used for the vaccine had its replicating and immune system evasion genes removed. Aw. Those were the best parts!

**These cells get recognized by immune cells and are disposed of.**

The infected cell gets broken down and the debris gets consumed by macrophages.

**The digested material gets broken down in a special compartment called the lysosome, and it's goodbye viral-vector DNA.**
If the viral-vector (J&J) vaccine doesn't make you sick, then why do some people feel sick?

Shortly after getting the vaccine, local immune cells do their job and notice an intruder.

The adenovirus acts as both a vector to bring spike DNA into cells and as an adjuvant (something to kick the immune system into action).

These local immune cells send out chemical messages (cytokines) to bring in more immune cells to the injection site.

Cytokines cause local blood vessels to dilate and vessel walls to get leaky so more immune cells can get to the injection site.
This can lead to swelling, pain and redness around the injection site. It's working!

If enough cytokines get made, some can spill into the bloodstream & signal to the brain to produce a fever. Cytokines $\rightarrow$ prostaglandins $\rightarrow$ hypothalamus $\rightarrow$ Temp $\uparrow$

This may lead you to want to lie down under some blankets and rest. It's totally working. Sure beats getting Covid!

As different parts of the immune system take over, fever-producing cytokines drop and you feel much better.

Hello, Sun! Day 3
Contra Costa County COVID Multilingual Call Center 8:00 a.m. – 5:00 p.m. 1-844-729-8410

Eligible county residents can request an appointment for vaccine online at: https://www.coronavirus.cchealth.org/vaccine

or call:

1-877-218-0381 (option 7)

This call center is open 7 a.m. – 8 p.m. weekdays and 7 a.m. – 7 p.m. on weekends.

To get connected to Mental Health and Substance Use Services in Contra Costa County,
Please Call:

Behavioral Health Access Line Phone Number 1-888-678-7277

If you or a loved one is experiencing a mental health crisis, please call:

Mobile Crisis Response Team (MCRT): at 1-833-443-2672 for adults 18 and over.
Or
Seneca Family of Agencies Mobile Response Team (MRT) for non-emergency assistance at 1-877-441-1089 for youth 17 and younger.

Contra Costa Crisis Center has a 24/7 crisis/suicide hotline:

211 or 1-800-833-2900 or text HOPE to 20121.