4 vaccine concerns debunked

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The Therapeutic Goods Administration (TGA) has today provisionally approved Australia's first COVID vaccine, the Pfizer vaccine, paving the way for its rollout to begin in mid-to-late February among high-risk groups.

Two doses will be required, at least three weeks apart. The vaccine can be given to people 16 years and older.

The Pfizer vaccine is based on mRNA technology, a way of giving the body the genetic instructions it needs to make the coronavirus spike protein. The idea is to prime your immune system to mount a protective immune response if you encounter the SARS-CoV-2 virus.

As this is the first mRNA vaccine to be approved for humans, some people have taken to social media to voice their concern. But you can strike these four myths about mRNA vaccines straight off your list.

Myth 1: they enter your DNA and change your genome

Our genome is the complete set of instructions for making all the molecules our cells need to function. Our genome is made of DNA, a different type of molecule to the RNA in the mRNA vaccines. It's generally not possible for RNA to become part of our genome.

The myth of mRNA vaccines modifying genomes may have surfaced as some types of RNA retroviruses, such as HIV, contain genes that make a protein called "reverse transcriptase".

A retrovirus is a type of virus that inserts a copy of its RNA genome into the DNA of a host cell it invades, therefore altering the genome of that cell. Taking the example of HIV, reverse transcriptase can convert the HIV RNA into DNA, so the HIV genes can enter our genome.

But SARS-CoV-2 is not a retrovirus and the COVID-19 mRNA vaccines don't make reverse transcriptase. They only contain one gene: the gene for the SARS-CoV-2 viral spike protein.

So, the only way the COVID-19 vaccine mRNA might enter your DNA is if you were unlucky enough to be infected at precisely the same time with HIV, or another kind of retrovirus, and this virus was active for the few short hours the vaccine mRNA was present in your cells. The chances of this happening are vanishingly small.

Unlike DNA, mRNA doesn't last long in our cells. The mRNA lasts just long enough to instruct the cell to make viral spike protein, but will then break down, like all the other thousands of mRNA molecules our cells make all the time.

Myth 2: they connect you to the internet

The Pfizer mRNA vaccine contains a piece of mRNA which is coated in a lipid (fatty) droplet. The lipid helps the vaccine enter our cells, as the membrane holding our cells together is also made mostly of lipid. The vaccine and the membrane can fuse easily, depositing the mRNA inside the cell.

Some other companies, developing different mRNA vaccines, are exploring mixing their vaccines with materials called "hydrogels". The hydrogels might help disperse the vaccine slowly into our cells.

Bioengineers have used similar hydrogels for many years in different ways. For instance, they've used them to help stem cells survive after being put inside our bodies.

The use of hydrogels for these stem cell (and other) implants has created a myth they're needed for electronic implants, which can be linked to the internet. Conspiracy theorists have jumped from implants to hydrogels to mRNA vaccines based on no evidence.

Since Pfizer's COVID mRNA vaccines don't include hydrogels as a

component (nor do Moderna's), this is not a concern. Though this wouldn't be a valid concern even if these vaccines did use hydrogels.

Myth 3: they cause autoimmune disease

Autoimmune diseases, such as arthritis and multiple sclerosis, are chronic (long-term) illnesses where our immune systems attack our own cells.

It's not entirely clear where this belief has come from, but we don't have any evidence to suggest mRNA vaccines can cause autoimmune diseases.

The fact mRNA is very short-lived inside our cells indicates this is highly unlikely, because you would usually need a long-lived foreign agent to trigger a chronic autoimmune response.

Interestingly, mRNA vaccines are now being designed and delivered to *treat* autoimmune diseases, such as multiple sclerosis. However, these are still at the early stage of development.

Myth 4: they make you infertile

Recent discussions on Twitter suggested antibodies against the SARS-CoV-2 spike protein might "cross-react" and also target a protein in the placenta. If the immune system attacks the placenta, as the argument goes, that could make women infertile.

The basis for this idea is that coronavirus spike proteins, including that of SARS-CoV-2, have a very short region of similarity to a protein called syncitin-1 found in human placenta.

That amounts to a short stretch of five or six amino acids, where three or

four amino acids are identical between coronavirus spike proteins and syncitin-1. Proteins as long as the spike protein will always share tiny regions of similarity with other human proteins. Our immune system is trained to ignore this.

The chances of making antibodies that cross-react with syncitin-1 are very small.

There's no evidence antibodies against any coronavirus cause infertility. If coronavirus spike proteins did lead the immune system to attack the placenta, we'd see widespread infertility after common cold seasons, which are caused by a range of viruses, including coronaviruses.

It's true pregnant women were not included in the clinical trials for the Pfizer vaccine. Excluding this group from clinical trials is standard practice, but many have argued more COVID vaccine trials should include pregnant women.

All technologies were new once

Of all the vaccine technologies being explored against COVID-19, mRNA vaccines have proved the most efficient in reducing the incidence of severe COVID disease.

However, we still don't fully understand their long-term safety, as with all new medicines.

The TGA's approval is valid for two years and it will continue to monitor the vaccine's safety both in Australia and overseas.

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