

## **How to fight the most prevalent conspiracy theories responsible for vaccine hesitancy.**

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Vaccine hesitancy in the U.S. remains a major health issue despite the fact that nearly all COVID-19 deaths (99%) in the U.S. now are among the unvaccinated according to an Associated Press analysis ([Johnson & Stobbe 2021](#)). Vaccine hesitancy is a worldwide issue that has existed since the invention of vaccination, and it resulted in unnecessary deaths that were preventable ([Wiki link](#)). The most important factor that is driving vaccine hesitancy is the belief in conspiracy theories ([Sallam et al. 2021](#)), which can become a matter of faith ([Wiki link](#)). It is difficult to argue with someone who firmly “believes” in a conspiracy theory even though it does not have reliable scientific evidence. A significant number of social media messages and videos, sometimes from people pretending to be expert, distort the facts and warn people about the vaccine possible immediate or long-term side effects. In fact, COVID-19 vaccines are as safe as flu vaccines and other vaccines that are routinely administered to our children before they are admitted to schools. It is quite difficult to fact-check everything on social media. In one article published in "Science" ([Vosoughi et al 2018](#)), they found that falsehood spread at least six times faster than the truth. It seems that false news is more novel, and people are more likely to share novel information. Also, on social networks, people can gain attention by being the first to share previously unknown (but possibly false) information. In this article, I address some of the most prevalent misinformation that drives vaccine hesitancy.

### **Can mRNA vaccines alter human genome?**

The short and simple answer is "No". For this to happen you need an enzyme called reverse transcriptase which converts RNA to DNA. We do not have this enzyme, but there are viruses such as HIV and retroviruses that have this enzyme and can insert their genes into our chromosomes. In contrast, once inside the cell, the vaccine mRNA is exposed to the harsh environment of enzymes such as ribosomes and exonucleases which destroy the mRNA in a matter of hours. On the other hand, viruses are more likely to alter the human genome. For example, there are some influenza viruses that are associated with proteins that facilitate their entry in the nucleus which contains our DNA. Recently, it was found that some pieces of the coronavirus might be able to attach to our chromosomes under certain conditions. They speculate that if a person has COVID-19 and is also infected by HIV or a retrovirus, the enzyme provided by HIV can help to insert pieces of the coronavirus into our chromosomes. This may explain why in some very rare cases people keep testing positive for COVID-19 by PCR despite that they are no longer infected. ([Cohen 2020](#)). In conclusion, your genes are more likely to be altered by COVID-19 virus and some other viruses, whereas the mRNA vaccine simply cannot change your genes. There is strong evidence that viruses can incorporate themselves in our genome. In fact, about 8% of our DNA consists of remnants of ancient viruses, and another 40% is made up of repetitive strings of genetic letters that are also thought to have a viral origin ([Griffith 2001](#))

### **Do you need the vaccine if you are healthy or if you have been already infected?**

Many people think that they are young and healthy, so they are not afraid to get COVID-19 because they will only get mild symptoms and this will give them long-lasting immunity. According to recent studies, this is wrong because those who are infected the first time may have 6-8 months period of no re-infection, but they may be vulnerable to new variants of the virus, and they can get re-infected within 3 months with symptoms that are more severe than those of the first infection ([Natasha Hinde 2021](#)). It is well known that vaccines can much better boost the immune system against the original virus and its variants than the natural infection. Most vaccines are given in 2 doses at sufficient concentrations to maximally produce antibodies,

whereas the virus might infect each person with different degrees of symptoms and the level of antibodies produced after recovery from infection is very variable. One recent article in preprint indicates that those who got already infected by SARS-Cov-2 may need only one dose of the vaccine to boost their level of antibodies ([Krammer et al. 2021](#)). In conclusion, it is recommended to have the vaccine whether or not you had COVID-19.

### **Can COVID-19 vaccines affect fertility and is the virus harmless in most people?**

It is actually the virus, not the vaccine, that is likely to cause problems of infertility. According to a review of the scientific literature, SARS-CoV-2 can affect the sperm concentration and motility in males, and it can degrade oocyte quality and ovarian function in females resulting in infertility ([Sharma et al. 2021](#)).

COVID-19 can also cause long-term brain dysfunction. Patients who had COVID-19 have significant loss in brain grey matter (i.e., neurons) especially in areas involved in olfactory and gustatory functions as well as other brain areas ([Douaud et al 2021](#)), which might be linked in series with these two brain systems. This suggests that the virus kills neurons by spreading from one neuron to another via synapses. Moreover, more than half of surviving COVID-19 patients may suffer from long-term disabilities, and psychological disorders such as depression, posttraumatic stress disorder, anxiety, obsessive-compulsive behavior and insomnia ([Mazza et al. 2020](#)).

### **Conclusions**

Human beings have only two choices: the virus or the vaccine. There is no third option because the virus is unavoidable unless you live on a remote island or another planet. Everybody is going to get infected sooner or later, even if you have very few contacts. If you do not get infected this month, you are going to get infected next year. It is just a matter of time.

Even if you are at low risk (young age) and you think that the virus will just produce minor symptoms or no symptoms at all, there could be some long-term effects that are not immediately apparent. The COVID-19 adverse effects have now been extensively studied and some of them are irreversible or long-lasting. In contrast, mRNA vaccines are 99.999% safe, effective and biodegradable. An analysis of the risk/ benefit ratio will always show that the vaccine option is the best choice. According to CDC, as of July 19, 2021, 339 million doses of COVID-19 vaccines have been administered so far in the United States under the most intense safety monitoring system in U.S. history. Reports of adverse events to Vaccine Adverse Event Reporting System (VAERS) following vaccination, including deaths (0.0018%), do not necessarily mean that the vaccine is the culprit ([CDC 2021](#)).

The COVID-19 pandemic is unlikely to end anytime soon because COVID-19 viruses might become similar to flu viruses which are constantly changing, so the vaccine composition might need to be reviewed each year and updated as needed based on which variants are making people sick ([CDC 2020](#)). The vaccine is recommended for all people irrespective of age because the virus, even if it causes minor symptoms, it may affect fertility and brain function and possibly alter human genome. We need to fight the virus with a preemptive strike (the vaccine) and we should not wait to get infected because all available drugs may only reduce slightly the duration of the disease but at the price of serious side effects.