# Coronavirus variants and the evolution of the Covid-19 pandemic

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*Several recent studies show that certain variants of SARS-CoV-2 decrease the neutralization of the virus by antibodies generated by natural infection or by vaccination. On the other hand, new, more reassuring studies show that the immune response associated with T lymphocytes remains intact despite these mutations, which would limit the damage caused by these variants.*


**EXPLOSION OF MUTATIONS**

During each reproductive cycle, several biochemical mutations appear spontaneously in the genetic material of a virus.

The vast majority of these mutations are neutral, that is, they do not impact the properties of the virus, but some of them can give it a reproductive advantage and are then kept to be passed on to subsequent generations.

What makes the variants of the coronavirus currently in circulation so special is the fact that the virus acquired them simultaneously. For example, the British variant (called B.1.1.7) has 23 mutations absent from the original virus, with 17 of them acquired suddenly and giving it a greater ability to infect cells.

According to a recent study, the appearance of these types of mutations, which make the virus more contagious or more virulent before being transmitted to another individual, is an exceedingly rare phenomenon (1).

In this sense, it should be noted that other studies have shown that the coronavirus can persist for more than 8 months in some immunosuppressed patients, which gives it ample time to progress to more virulent forms (2).

**NEUTRALIZE THE VARIANTS**

By analyzing more than 2 million positive cases of COVID-19 and 17,452 deaths caused by the disease that occurred in England from September 1st, 2020 to February 14th, 2021, the researchers determined that infection with the variant was associated with an increase in approximately 60% of the risk of mortality (3).

Concretely, this means that for a person aged 55-69, the absolute risk of dying from the disease increases from 0.6% to around 0.9%. Given the high transmissibility of this form of the virus, this increased risk of mortality is therefore significant.

Fortunately, the data collected so far indicates that the immune response generated by natural infection with the coronavirus or by vaccines is as effective against the British variant as that produced to neutralize the original virus (4).

People who have been infected with the virus before these mutations appear, as well as those who have been vaccinated with any of the currently available vaccines, protected against this variant.

**THE SOUTH AFRICAN VARIANT**

The situation is more problematic for the South African variant (called B.1.351). It has been observed that this variant is about 10 times more resistant to antibodies present in the plasma of convalescent patients, that is to say who were infected with the virus before the appearance of this mutation, and also 10 times more resistant to antibodies produced by vaccination (4).

In other words, this virus could infect someone who has beaten COVID-19 before or someone who has received either of the current vaccines.

In addition to antibodies, CD4 (helper) and CD8 (killer) T cells are also absolutely essential for building long-term immune memory.

**SOME GOOD NEWS**

A recent study shows that T lymphocytes from people previously infected with the coronavirus or who have been vaccinated against this virus respond to all current variants (including South African) as well as to the original virus (5).

In short, it is more and more obvious that the evolutionary pressure pushes the coronavirus to accumulate mutations in the field recognized by neutralizing antibodies in order to escape the immune system.

In contrast, the most problematic (South African) variant is not yet extremely widespread globally, which means that we are still ahead of the virus, which should be enough to stem the pandemic.

You don't win wars in one fight!

(1) Lythgoe KA et al. SARS-CoV-2 within-host diversity and transmission. Science (Published online, March 9th 2021)
(2) Baang JH et al. Prolonged severe acute respiratory syndrome coronavirus 2 replication in an immunocompromised patient. J. Infect. Dis. 2021 ; 223 : 23-27.
(3) Davies NG et al. Increased mortality in community-tested cases of SARS-CoV-2 lineage B.1.1.7. Nature (Published online, March 15th 2021)
(4) Wang P et al. Antibody resistance of SARS-CoV-2 variants B.1.351 and B.1.1.7. Nature (Published online, March 8th 2021)
(5) Skelly DT et al. Vaccine-induced immunity provides more robust heterotypic immunity than natural infection to emerging SARS-CoV-2 variants of concern. Research Square (Preprint deposited online, February 9th 2021).

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