# Virus Neutralizing Antibody Therapy for COVID-19

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## ABSTRACT

Under the circumstances we are living in today, it is beneficial to understand the importance of virus-neutralizing antibodies and their relationship to SARS-Co-V-2 therapies. COVID-19 statistical data from the CDC show that as of May 2022, there have been 83,706,662 confirmed cases of COVID-19, and 1,003,743 deaths due to the COVID-19 virus in the United States. There has also been a significant decrease in vaccinations, which was an average of about 32,000 daily at the start of the year and now averaging at about 10,000. Furthermore, there continue to be breakthrough cases of COVID-19 despite individuals getting vaccinated. In this review, the relationships between virus-neutralizing antibodies and COVID-19 therapies, such as vaccines, were explored to determine if these two therapies would result in improved prevention and decreased transmission of COVID-19. Studies show that RNA viruses, such as COVID-19, have fast mutation rates. The COVID-19 vaccine regulates the spike (S) protein found on the virus from interacting with the ACE2 receptor in our bodies. Antibody therapies are used to identify and neutralize pathogenic bacteria and viruses. Unlike vaccines, antibody therapy does not involve an inactivated virus, instead it is a protein that works with the immune system to destroy antigens. The idea of combining two antibody treatments concurrently in an individual has been hypothesized to improve the prevention of COVID-19 infection, decrease transition rates of COVID-19, and also decrease the mutation rate of the virus. Literature on combining antibody therapies has shown that combining specific antibodies (e.g., AX290 and AX677) that target the spike (S) protein in COVID-19 produces higher neutralizing activity than an antibody would on its own. When using the combined antibody therapy there was a decrease in mutations in the COVID-19 virus, which helps reduce the transmission rate of the virus. These data suggest that combining antibody therapies holds the potential to decrease susceptibility to the COVID-19 virus and help fight against fast mutations of the virus that would further affect our society.

## METHODS

- Analyzing primary articles about antibody therapies and their biological process in our body.
- Analyzing articles about the SARS-CoV-2 infection and transmission.
- Researching the physiology of COVID-19 vaccines, such as what they are and how they work in our body.
- Focused on comparing the effects of COVID-19 vaccines and antibody therapies.

## SYNTHESIS

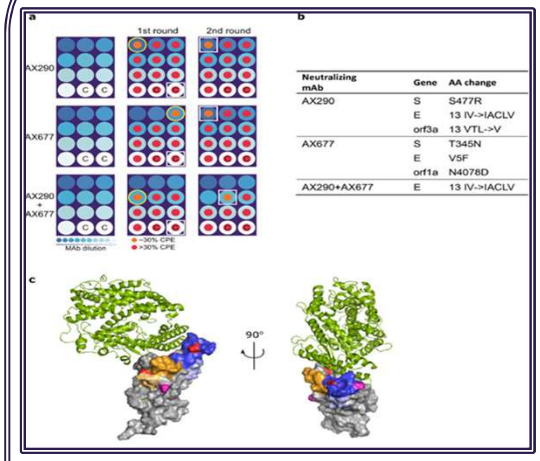


**Figure 1** Figures a-d compare the combination of AX290 and AX677 to them by themselves in terms of mutation rates. (a) Shows first and second founds of mutation rates. (b) Combination of the two antibodies prevented appearance of mutations in the Spike protein. (c) Shows a visual representation of the amino acids that are mutated due to escape from neutralizing antibodies and shows the structure of the SARS-CoV-2 Spike receptor-binding domain bound to ACE2.

## SYNTHESIS

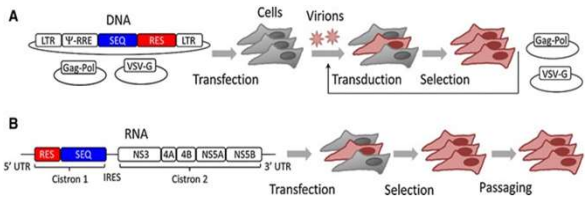


**Figure 2.** Shows a comparison of mutation rates in DNA and RNA viruses. **a** Shows the mutation process in DNA viruses. **b** Shows the mutation process in RNA viruses. Illustrates the significantly higher mutation rates in RNA compared to DNA.

## CONCLUSIONS

- Mutations occur from unvaccinated individuals with inadequate immune responses.
- The combination of AX290 and AX677 antibody therapies prevent viral mutations from occurring.
- With the combination of the two antibody therapies, there is a possibility that the mutation rates for the COVID-19 virus could decrease, helping us better tame the virus.
- COVID-19 vaccines have shown to be the most prevalent protection mechanism for this virus.

## FUTURE DIRECTIONS

- Vaccinations and participating in antibody treatments concurrently could be beneficial to better fight off this virus. This would be beneficial because the antibodies treatment will prevent mutations from occurring and further spreading of the disease, and the vaccine will prevent COVID-19 transmitting and prevent hospitalization and/or death if infection occurs.
- Future work should work to collect more data on how the vaccine and antibody therapies work together in humans to prevent COVID-19 infection.
- Interpreting the data of the effectiveness of using both COVID-19 vaccines and antibody therapies together may help us understand if this is the direction we should be advancing in for the future or if the method of being fully vaccinated has a more successful effect.

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**Slide 1**

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