

The Possibility of Preventing the Mutation of SARS-Cov2 Virus

Jiayi Wang^{1, †}, Haoran Zhong^{2, *, †}

¹The Wuhan Britain China school, Wuhan, China

²The Affiliated High School to Hangzhou Normal University, Hangzhou, China

*Corresponding author: zhongzeshan@cn.panasonic.com

†These authors contributed equally to this work as the first authors

Abstract. Since the beginning of 2020, SARS-Cov2 virus has become prevalent, and the virus has varied many times. Even though people paid their most effort to develop the vaccine and specific medicine stuff to fight against this pandemic, the virus seems unstoppable and drives the whole world into a worse situation. Human is facing an unprecedented catastrophe. This article claims the possibility to cease the mutation of the COVID virus in the biological and social aspects. The pathology part states why the virus mutates and how to stop the variation of SARS-Cov2. For the society part, the article tries to talk about the different economic situations and policies to stop the pandemic globally. So this article will get the possibility to cease the mutation of COVID-19 with a comprehensive discussion.

Keywords: SARS-Cov2, mutation.

1. Introduction

Since the beginning of 2020, COVID-19 has spread across a wide range of the world at incredibly high speed. To cease the spread of COVID-19, scientists tried to research vaccines for SARS-CoV2. Unfortunately, this virus is constantly mutating and forming different variants, from B.1.1.7(Alpha) in September 2020 to B.1.1.529(Omicron) in November 2021 [1].

One problem is that it is difficult for people to ensure that people can finish the research on a particular variant to stop the pandemic before the next mutation. There are several kinds of vaccines that are effective for one variant but are not so powerful in the prevention of other variants, even though they are effective for specific variants, like BNT162b2, which has the neutralizing ability of 5 to protect humans from the Delta variant, but only 2.6 in Alpha and 4.9 in Beta [2].

Another point is that one type of variant of concern (VOCs) could have many sublineages. According to research on the Delta variant, about half of the variants which are relative to B.1.617.1 are B.1.617.2(Delta) [3], which means Omicron can mutate hundreds of variants in the future. All things cause intractable problems to control the pandemic. Although the Pfizer-BioNTech vaccine has high protection effect on Omicron with three doses [4], this does not mean that people can eliminate COVID-19 with the development of the vaccine. For example, mRNA-1273 is a vaccine with a high vaccine efficacy of 96% to Delta. And actually, the protection would be increased if people take the vaccine for two doses [2]. But unfortunately, Omicron still appeared and spread at an incredible speed.

Even though people paid tons of work on the vaccine, the mutation still occurs, and Omicron came in November 2021. In this case, it is significant to figure out why COVID-19 keeps spreading and producing more variants; whether it is possible to stop COVID-19 from mutating. If people stop the mutation of COVID-19, people will have more chances to beat COVID-19. The paper will be divided into biology and society parts to discuss the possibility of stopping COVID-19 from making more variants.

2. The pathology aspect of the possibility of ceasing the mutation

2.1. The structure and feature of COVID-19, and its variants

The SARS-Cov2 virus is an RNA virus that integrates with an RNA sequence that is consisted of around 30 Kb of genome and protein shell. The complete genome of COVID-19 consists of two-thirds of 5' with open reading frames and one-third of 3' with structural protein. The remaining part of the gene does not have many functions, and the non-structure will replace them. (Figure 1) [5] In all genes, ORFs play significant roles in the activity of the COVID virus. ORF1a and ORF1ab are noteworthy for replication since they transmit in the host cell's rough endoplasmic reticulum to protein pp1a and pp1ab, which are cut into 16 kinds of non-structural proteins (nsp1-16). Some of the nsps can help to form polymerase with the help of nsp7 and 8. The polymerase helps the RNA virus to make copies of its hereditary substance. But this process has a higher rate of making mistakes in selecting bases from the host cell so that the base pairs cannot be as same as the original gene sequence. Here are four types of protein in SARS-Cov2: the surface Spike (S) protein, the envelope (E) protein, the matrix (M) protein, and the nucleocapsid (N) protein. The S protein helps viruses enter host cells through angiotensin-converting enzyme 2 (ACE2). And the other three types of proteins: the E, M, and N proteins consist of the basic structure of the COVID virus [6].

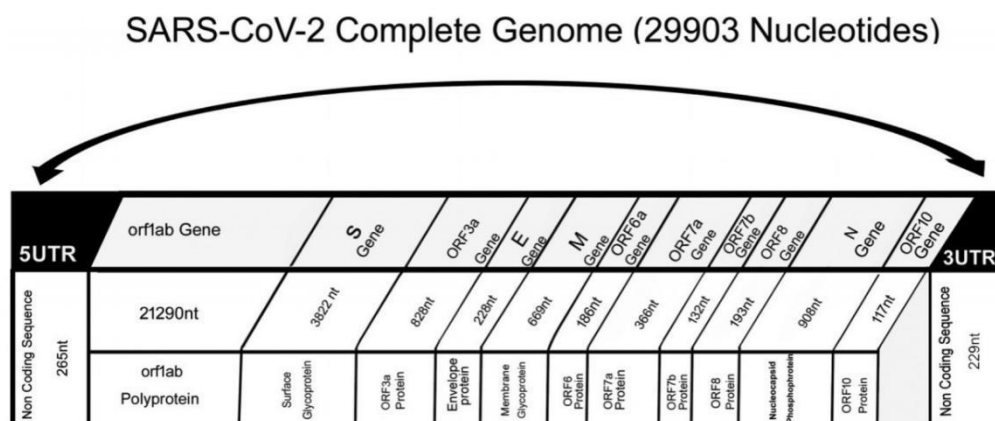


Fig. 1. Structure of the SARS-CoV-2 genome.

Figure 1. The complete genome sequence for SARS-Cov-2 [5].

2.2. Why the virus is easy to mutate?

mRNA plays a vital role in the transcript of the base to complete the replication of a virus. This process needs RNA polymerase to link RNA and mRNA together so that mRNA can bring RNA information to ribosome consist proteins, which express the virus's characteristics. However, the replication in RNA virus does not need a primer which causes an RNA virus mutates to reduce the possibility of the wrong rate compared to DNA virus. If a synonymous variation happens, even though the codon is changed, the protein is the same, and the function of the specific part and the characteristics would not change. However, if a missense variation takes place, the protein varies accordingly. Also, the expression of the virus changes a lot and makes a big difference in infectivity, mortality, and other abilities of a virus.

Another point is adaptability. The virus needs to vary its structure to escape from the human immune system to survive in the human body. Each virus has its way to develop specific parts, like spike protein increasing the combination ability of ACE2. But people cannot control the feature since the mutation processes every minute with the replication of the virus, as long as there are enough materials to form a virion. And undoubtedly, in this case, the existence of the virus cannot be detected, so there would not be any human limiting factor to interrupt the evolution of the virus.

2.3. Relationship

Since COVID-19 is a kind of RNA virus, it does not have a trigger to correct the mistake while making replication to the gene. Also, recent data reports that the U content in the COVID-19 virus had increased, and the total genome size had decreased. If the number of U content goes down and the stability reduces spontaneously, the virus will replicate more quickly and secretly. For example, the main variants of COVID-19 have the trend of increasing U content (Figure 2), while A, G, and C content shows the tendency to remain the same or decrease, but the infectivity increase with the changing of contents. (Figure 3) [7]. Taking the Delta variant as an example, the predominant mutations are L452R, P681R, and T478K, G of which change to U. L452R plays the role of connecting with ACE2, also increasing the amount of replication of the virus and the virus load. P618R could increase the pathogenicity by promoting the cleavage of the S protein in the case that the S protein has made the COVID virus more contagious. T478K can increase the number of charged lysine(K) to link ACE2 easier. The R0 value for Delta is 3.2, which is much higher than the last data [8]. Also, the data from Ontario, Canada showed that Delta variants have higher pathogenicity. The hospitalization increases by 49% (41%-58%), the ICU admission rises to 86% (68%-109%), and mortality moves up 51%(32%-72%) from non-VOC to N501Y, and finally to Delta variants [9]. As a result, the mutation trend for the Delta variant is to make itself a more infectious one.

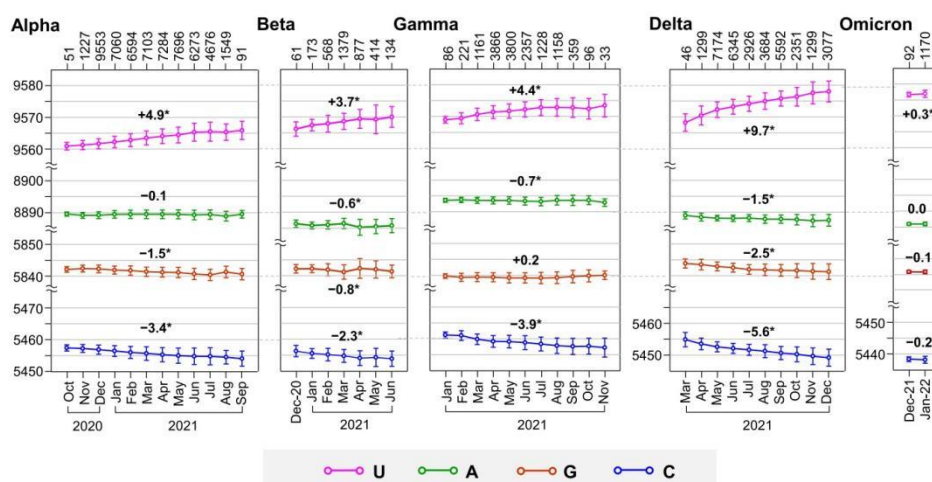


Figure 2. The variation of different contents in five kinds of variants of SARS-Cov2 [7].

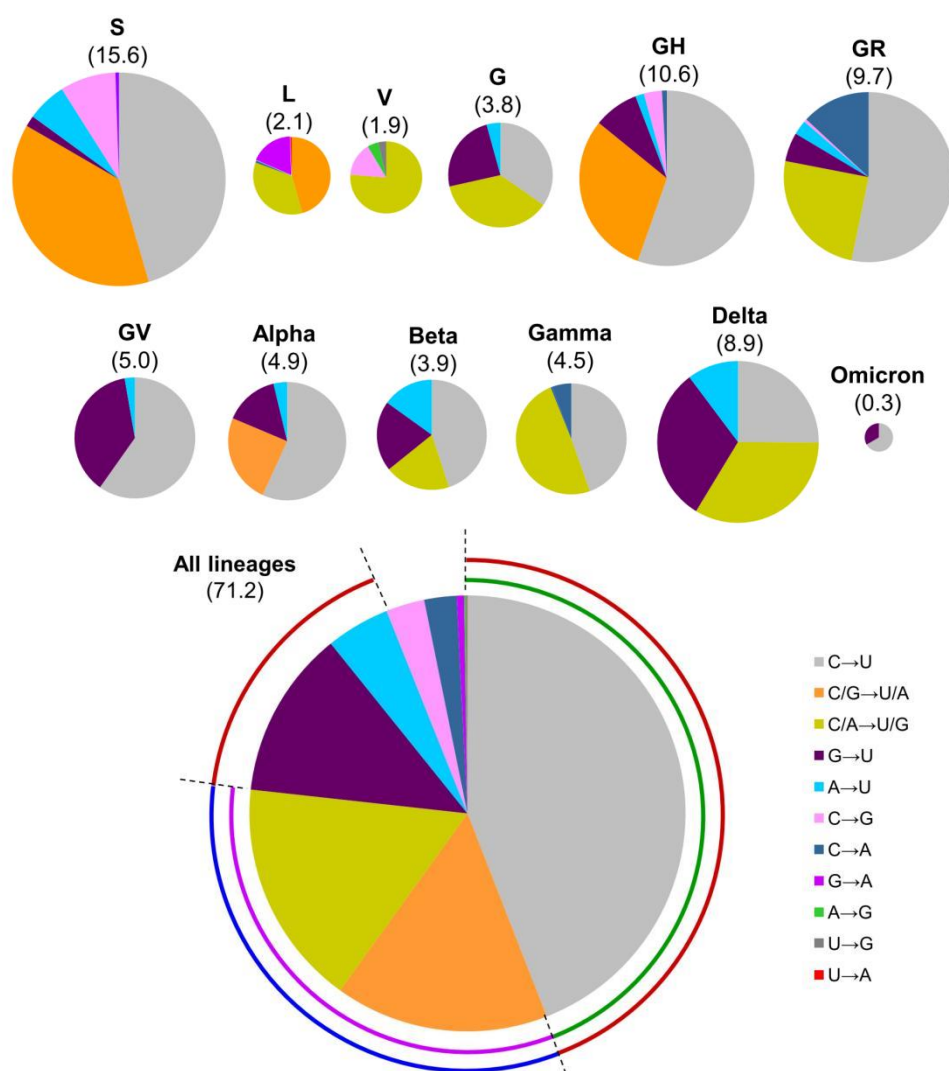


Figure 3. The mutation in content in different SARS-Cov2 variants [7].

2.4. Methods to stop the mutation of the COVID-19 virus

Unfortunately, people have not invented specific medical stuff. If it is possible to cease the nsps genes from forming polymerase, the rate of replication will decrease significantly. Since the change in base pairs causes most mutations of the COVID-19 virus, especially from A, C, and G to U, it might be possible to cease the variation of SARS-Cov2 if the replication of the virus can be stopped, which means the inhibition of RNA polymerase (RdRp). A study in 2021 mentioned that suramin enables the inhibition of the RdRp in SARS-Cov2 and the replication of the COVID-19 virus. This goal can be achieved by ceasing the binding of the RNA template–primer duplex to the active site and the entry of nucleotide triphosphate into the catalytic site [10]. Thus, the possibility that SARS-Cov2 mutates by natural selection decreases drastically.

3. Society

3.1. Economy

U.S. economy, strong rebound or recession? With unemployment at record lows and inflation at record highs, the Bank of America has come to a different conclusion, even warning of a recession.

Since 2020, covid-19 pneumonia has swept the world and has severely damaged the US economy. Two years later, the economy showed signs of improvement, the unemployment rate hit a new low, and labor prices rose, but no one won. Prices are also rising as if everything is moving in the right

direction because prices are rising, even inflation. To some extent, people can understand the enthusiasm of economic activities as the performance of economic overheating.

Britain was the first country to implement a nesting policy equivalent to 66 million people living in Britain [11]. Has Britain achieved economic growth after 170000 deaths and paying the price of more than 20 million infections? In 2020, the UK economy fell by 9% due to the impact of the epidemic, making it one of the countries most affected. In 2021, using the coronavirus break-off period, the British economy recovered by 7.5% and the economic aggregate did not return to pre-epidemic levels. In 2022, following the repeal of all epidemic prevention measures, the UK economy is still in flux. The latest UK economic data published by the Statistical Office of the United Kingdom show 11. According to local time, the United Kingdom's gross domestic product (GDP) grew only 0.1% in February, well below 0.8% in January. The facts proved that lying down cannot be replaced by economic growth, but gives the virus room for mutation.

Chairman Yi Gang introduced China's economic situation and monetary policy and said that the main goal of China's monetary policy is to stabilize prices and employment. In terms of monetary policy, the people's Bank of China has always believed that the growth rate of money supply and social financing is basically consistent with economic growth, and the market interest rate is kept within a reasonable range. As far as the real economy is concerned, grain production and energy supply are very important for price stability this year. As long as food production and energy supply are guaranteed, prices will remain stable within a reasonable range.

3.2. Policy

According to the Washington Post 23. According to 2008 data, the confirmed cases of Covid-19 in the United States have significantly increased pressure on hospitals and many hospitals have sent people infected with Covid-19 back to work. This has led to dissatisfaction among some medical staff. People in the healthcare industry in the United States believe that quarantine standards can threaten the morale of medical professionals and patients, especially those who are more vulnerable to the virus. Others believe that after more than a fifth of US hospitals last week reported "serious staff shortages", deregulation is needed for the normal functioning of medical services.

British health policy has three points: 1. Allow patients to wait for treatment for no more than 2 years before July 2022 (currently, UK patients may have to wait more than 2 years to get treatment) 2. Allow patients to wait for treatment no longer than 18 months before April 2023. 3. Allow the patient to wait for treatment no more than 1 year before March 2024. By March 2025, 95% of patients will be diagnosed within 6 weeks (basically, they can withstand the diagnosis and have recovered from minor diseases)

In the case of China, many have recently discussed when to lie flat, when China is treating a Covid-19 epidemic. 1. The objective of national vaccination should be achieved. Vaccine resistance of vaccinated personnel may be resistant to the latest variant of coronavirus. The Chinese medical system should be able to cope with the patients in the country after lying flat. China should have Covid-19-specific medicines, such as Covid-19-specific medicines. Even generics. China must build a psychological system to deal with the panic caused by the epidemic after lying flat [12].

3.3. Medical condition

Taking as a condition for the selection of the non-vaccination of the Covid-19 vaccine, 1066 qualified employees were selected, and the reasons for their non-vaccination were recorded and analyzed. Among them, about 35% say that their religious belief can be used as a reason to refuse vaccination. If the unit forces vaccination, they will explicitly refuse it as a reason. In addition, 42% said they do not want to receive the Covid-19 vaccine, even if they resign [13].

According to covid-19 (Broadcasting British Corporation) 21, British Prime Minister Johnson announced that the new plan to co-exist a " Covid-19" in the House of Commons announced it would remove all existing restrictions on preventing and controlling new pneumonia in the crown in England from the date 24 and that the Covid-19 tests positive individuals should no longer be isolated [14].

The government would no longer monitor close contacts and those who had not been fully vaccinated did not have to be isolated again, so far, the BBC said. Since 1st. April will no longer be delivered free of charge to the general public, except for the elderly and vulnerable populations.

Public health security is a common challenge facing humanity and requires countries to cooperate. Foreign experts and researchers strongly confirmed China's active international cooperation in epidemic prevention and control and expressed their willingness to strengthen cooperation with China.

3.4. About the relationship

According to the current situation, positive measures for epidemic control can reduce the incidence of novel Coronavirus mutation to a greater extent. For China, aggressive protection and quarantine policies have significantly reduced the number of infections and the risk of mutation. Of course, if the government considers economic development and personal safety, it is understandable that the government has decided to relax its control over Covid-19.

4. Conclusion

COVID-19 virus is spreading at an incredible speed and making people's lives harder than before, and it is essential to think that whether the mutation of the COVID virus could be stopped. It is discussed that the mutation of the SARS-Cov2 virus can be stopped by suramin, medical stuff, in order to cease the replication of this virus. In this case, this COVID virus has no chance to mutate anymore. However, most countries show negative attitudes toward the policies to COVID pandemic. These countries put their economic situation at the top of the priority to recover their economy and give up to continue fighting against with pandemic. This negative policy provides the SARS-Cov2 virus more opportunities to get evolved in the human body. Hope human society could overcome this catastrophe.

References

- [1] Tracking SARS-CoV-2 Variants [EB/OL]. WHO, 2021, [2022-05-01]. [https://www.who.int/en/activities/tracking-SARS-CoV-2-variants/\(WHO, 2021\).](https://www.who.int/en/activities/tracking-SARS-CoV-2-variants/(WHO, 2021).)
- [2] Bian L, Gao Q, Gao F, et al. Impact of the Delta variant on vaccine efficacy and response strategies [J]. Expert Review of Vaccines, 2021, 20(10): 1201-1209.
- [3] Saito A, Irie T, Suzuki R, et al. Enhanced fusogenicity and pathogenicity of SARS-CoV-2 Delta P681R mutation [J]. Nature, 2021, 602(7896): 300-306.
- [4] Araf Y, Akter F, Tang Y, et al. Omicron variant of SARS - CoV - 2: Genomics, transmissibility, and responses to current COVID - 19 vaccines [J]. Journal of Medical Virology, 2022, 94(5): 1825-1832.
- [5] Khailany R, Safdar M, and Ozaslan M. Genomic characterization of a novel SARS-CoV-2 [J]. Gene Reports, 2020, 19: 100682.
- [6] Giovanetti M, Benedetti F, Campisi G, et al. Evolution patterns of SARS-CoV-2: Snapshot on its genome variants [J]. Biochemical and Biophysical Research Communications, 2021, 538: 88-91.
- [7] Wang Y, Chen X, Yang L, et al. Human SARS-CoV-2 has evolved to increase U content and reduce genome size [J]. International Journal of Biological Macromolecules, 2022, 204: 356-363.
- [8] Bian L, Gao Q, Gao F, et al. Impact of the Delta variant on vaccine efficacy and response strategies [J]. Expert Review of Vaccines, 2021, 20(10): 1201-1209.
- [9] Fisman D and Tuite A. Evaluation of the relative virulence of novel SARS-CoV-2 variants: a retrospective cohort study in Ontario, Canada [J]. Canadian Medical Association Journal, 2021, 193(42): E1619-E1625.

- [10] Yin W, Luan X, Li Z, et al. Structural basis for inhibition of the SARS-CoV-2 RNA polymerase by suramin [J]. *Nature Structural & Molecular Biology*, 2021, 28(3): 319-325.
- [11] Bank of England raises interest rates four times in a row to warn economy is heading for contraction [EB/OL]. [2022-05-01].
https://mr.baidu.com/r/FKYs4jk2Ri?f=cp&rs=1578889415&ruk=DqtpCdNnx-WQcaQCKNJ9YA&u=039370c4f169f931&urlex=%7B%22cuid%22%3A%22_8vz8g8w28jCi-aNli2M8g8wvu_ouvualuv_8giWvaj3uBiN0PSNt_80QMrGt1u9F8VmA%22%7D
- [12] The Chinese Foreign Ministry has made clear its position on the source of COVID-19, and Academician Zhong Nanshan has made a strong statement. [EB/OL]. [2022-05-01].
https://mr.baidu.com/r/FKYvb9cy3K?f=cp&rs=2509043526&ruk=DqtpCdNnx-WQcaQCKNJ9YA&u=075af5779d0e545b&urlex=%7B%22cuid%22%3A%22_a20flOqSij_a2iO0uvka_uEvi_5aBiOluHc80a6vfKo0qqSB%22%7D
- [13] What are the treatment and medical treatment methods for mild COVID-19 in the United States? [EB/OL]. [2022-05-01]. <https://mbd.baidu.com/ma/s/o7cBLQ9s>
- [14] Britain's overburdened health system suggests government rethink 'living with coronavirus' plan [EB/OL]. [2022-05-01].
https://ml.mbd.baidu.com/r/FKYlAYMVtm?f=cp&rs=2480281493&ruk=DqtpCdNnx-WQcaQCKNJ9YA&u=fe5576592cca57e5&urlex=%7B%22cuid%22%3A%220iSaa_aPB8lO8Su6ja29iluqBil7aB8ulaHN8gu62aKm0qqSB%22%7D