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Review Article

# Immune Systems in The Human Body Against COVID-19

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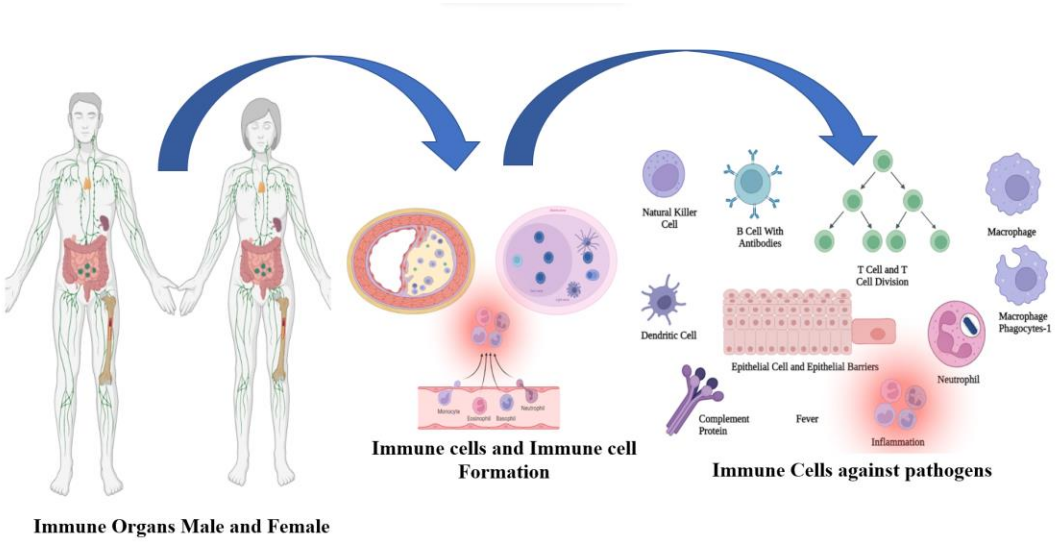
## Abstract

The immune system creates antibodies to destroy infections and defends against viruses and illnesses. This study provides a concise summary of the immune system's role in protecting against COVID-19 in humans, demonstrates the immune system's functioning and virus-fighting mechanisms, and provides information on the most recent COVID-19 treatments and experimental findings. There is also discussion of many potential obstacles the immune system may face. Foods to eat and steer clear of are recommended towards the article's conclusion, and exercise is promoted. This paper can serve as the state-of-the-art for promising alternate strategies to survive the coronavirus in this crucial time.

The continuing coronavirus disease 2019 pandemic is caused by the SARS-CoV-2 coronavirus, which is also known as SARS-CoV-2. Understanding the fundamental physiological and immunological mechanisms behind the clinical symptoms of COVID-19 is crucial for the identification and logical design of viable therapeutics, in addition to research into the virology of SARS-CoV-2. A summary of the pathophysiology of SARS-CoV-2 infection is given here. We discuss how SARS-CoV-2 affects the immune system and how faulty immune responses subsequently contribute to the development of the disease. We draw conclusions about SARS-CoV-2 from preliminary findings based on the similar pathophysiology and immunological characteristics of the other human coronaviruses that target the lower respiratory tract, including SARS-CoV and Middle-east respiratory illness coronavirus. We highlight the significance of these strategies for possible treatment methods that focus on viral infection and/or immunoregulation.

**Key words:** covid 19; immune system; sars-cov-2; covid 19 treatment

## Graphical Abstract



## Introduction

While the world is unwinding, people are dying. By April 18, 2020, the coronavirus had claimed the lives of more than 154,000 individuals, infected 2.2 million people, and spread to at least 185 different nations [1]. SARS, or severe acute respiratory syndrome, introduced the coronavirus to the globe in 2002–2003, and MERS, or Middle East respiratory illness, did it in 2011.SARS-CoV and MERS-CoV, two newly discovered coronaviruses of zoonotic origin of the genus Beta coronavirus, were the responsible culprits in both occurrences. By the end of 2019, the current coronavirus (SARS-CoV-2) COVID-19 made its debut in Wuhan, China. Due to close contact, human-to-human transmission affects people, and COVID-19 patients experience severe respiratory illnesses [2]. The most susceptible groups to COVID-19 are the elderly and those with numerous coexisting conditions. For this illness, neither a recognized medication nor vaccination exist. The United States Food and Drug Administration has approved the limited urgent use of chloroquine and hydroxychloroquine for the treatment of affected individuals. The National Medical Products Administration of China has authorized the use of the antiviral medication Failover as a coronavirus treatment [1-3]. In a clinical trial involving 70 patients, the medication demonstrated effectiveness in the treatment of the disease with relatively few side effects. The clinical trial has been running in the Guangdong province city of Shenzhen [4-5].

The development of the human immune system's capacity to fend off the coronavirus was discussed in this review article as a potential alternative to the development of medications and immunizations.

### Process of the immune system in the human body

The immune system's organs, which guard against illnesses, are found in the body as per shown in figure 1 [6]. It is essential for maintaining both pathogenesis and health. Moreover, it shields the body from pathogens, bacteria, and malignant cell growth (neoplasm) as per shown in figure 2 [7-8]. White blood cells, which may move through the blood arteries to travel throughout the body, are the main component of the immune system. The body circulates cells and fluids between blood and lymphatic vessels and activates the lymphatic system to keep an eye out for invasive microorganisms [2-9]. Lymph is transported through lymphatic vessels. Each lymph node has particular spaces where antigens may be encountered. Immune cells and foreign substances reach the lymph nodes through the entering lymphatic veins [10].

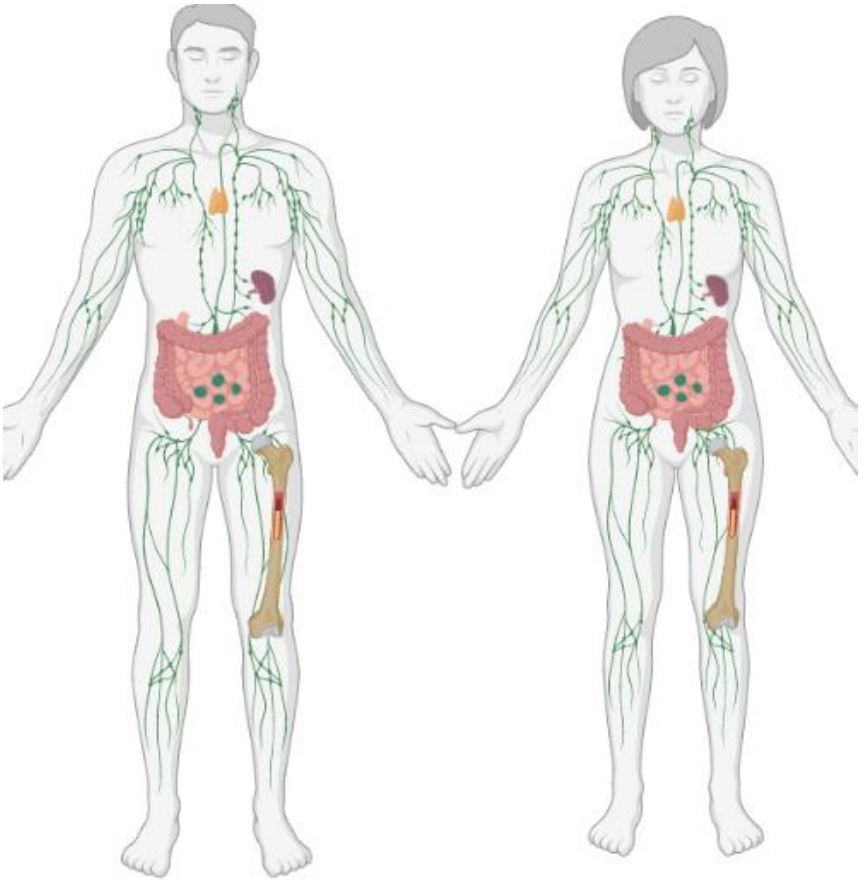


**Figure 1.** Immune Organs Male and Female

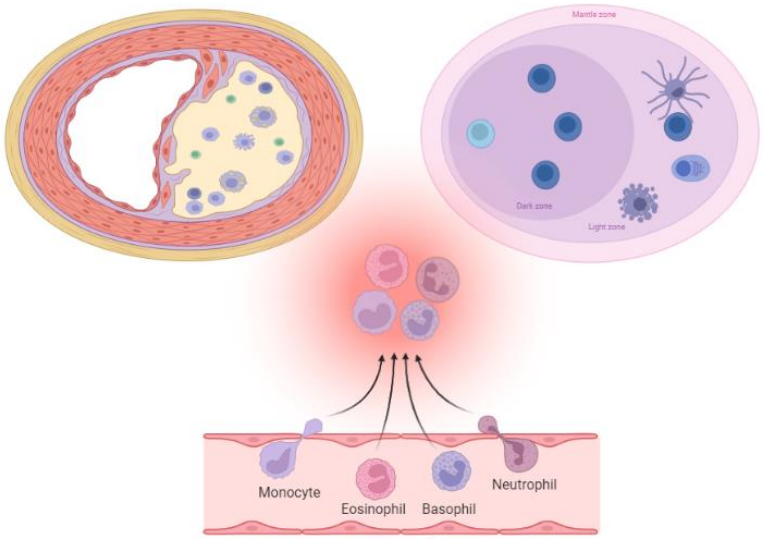



**Figure 2.** Immune cells and Immune cell recruitment

### 1.1.1Mechanism of immune systems in the human body against COVID-19

The immune system is the body's strongest line of protection against pathogens (such as viruses, bacteria, fungi, protozoan, and worms and infections because there is no approved drug or vaccination against COVID-19 [8-11]. Infections like COVID-19 go undiscovered as long as the immune system is functioning correctly. Innate immunity (quick response), adaptive immunity (delayed response), and passive immunity are the three forms of immunity. There are two types of passive immunity: natural immunity, acquired from the mother's side, and artificial immunity, acquired from medication [12-13]. When the body is impacted, skin and inflammatory reactions start. The immune system, however, is compromised when the body comes into contact with germs or viruses for the first time, and disease may result as per shown in figure 3 [14].

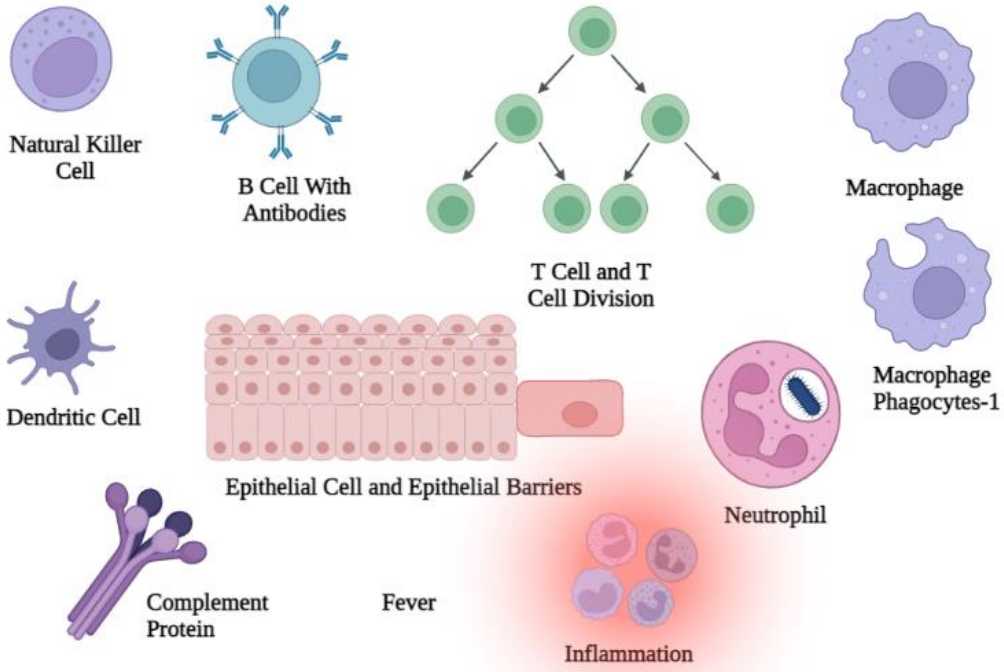



**Figure 3.** Immune Cells against pathogens

When immune cells are trained, they carry out their tasks by moving from injury sites via blood and recirculating between central and peripheral lymphoid organs[15]. When blood circulates throughout the body, it serves as a pipeline for the immune system, transporting both immature and experienced immune cells from one location to another.

### 1.1.3. Treatment for patients with COVID-19

A COVID-19 vaccine is currently being developed and is being studied globally.115 vaccine candidates are being developed, claims a report. Of them, 78 are confirmed as ongoing initiatives and 37 are unconfirmed; 73 of the 78 confirmed active projects are in the exploratory stage [16-19]. The most qualified candidates have been advanced to the clinical stage. The COVID-19 clinical phase vaccine candidates are listed in Table 1.

| Candidate | Vaccine characteristic | Lead developer | status |
|---|---|---|---|
| **mRNA-1273** | LNP-encapsulated mRNA vaccine encoding S protein | Moderna | Phase I (NCT04283461) |
| | | | |
| **Ad5-nCoV** | Adenovirus type 5 vector that expresses S protein | CanSino Biologicals | Phase I (NCT04313127) |
| **INO-4800** | DNA plasmid encoding S protein delivered by electroporation | Inovio Pharmaceuticals | Phase I (NCT04336410) |
| **LV-SMENP-DC** | DCs modified with the lentiviral vector | Shenzhen Geno-Immune | Phase I (NCT04276896) |
| **Empty Cell** | expressing synthetic minigene based on domains of selected viral proteins; administered with antigen-specific CTLs | Medical Institute | |
| **Pathogen-specific aAPC** | aAPCs modified with the lentiviral vector expressing synthetic minigene based on domains of selected viral proteins | Shenzhen Geno-Immune Medical Institute | Phase I (NCT04299724) |

**Table 1:** Clinical phase vaccine candidates for COVID-19

Another research states that 108 adults have received an intramuscular injection of the vaccine at a low, moderate, or high dose. These adults ranged in age from 18 to 90 years old and were all unaffected by SARS-CoV-2 [19]. They were studied for 28 days, with a mean age of 36.3, and a male preponderance of 51%.In addition to binding antibodies detected by ELISA at around 14 days, neutralizing antibodies can also be found using live viral or pseudo virus neutralization assays [20].

In the middle- and high-dose groups, seroconversion was observed in 50%–75% of patients at 28 days, when dose-dependent antibody responses peaked. Additionally, interferon enzyme-linked immunospot and flow cytometry demonstrated distinct T cell responses to the spike glycoprotein. Dose-dependent responses might be seen between 83% and 97% of subjects after 14 days [21]. Frequent side effects were fever, exhaustion, headaches, and muscle soreness. Convalescent plasma therapy for the treatment of COVID-19 has been shown to be effective by one trial. With this therapy, the survival rate of SARS patients with viral etiology has increased. The convalescent donors are those between the ages of 18 and 65 who have recovered and haven't had COVID-19 for the past 14 days [22]. The locations with tropical diseases were likewise off limits to people. Each donor's plasma, weighing between 400 and 800 mL, was taken, divided into units of 200 or 250 mL, and immediately frozen for use in subsequent transfusions. Another concern is the safety of using convalescent plasma. The influenza, SARS-CoV, and MARS-CoV epidemics did not have any adverse events, but Ebola did. According to reports, convalescent plasma therapy for COVID-19 patients is safe and devoid of serious adverse effects [23].

Other medications with a long therapeutic history and comparable chemical structures include hydroxychloroquine and chloroquine. These medications are frequently used to treat rheumatoid arthritis and malaria erythematosus [24]. Another medication, lopinavir, was used and commercialized by Abbott in 2000 under the name Kaletra in combination with ritonavir. A protease inhibitor with a high level of selectivity for HIV-1 protease is lopinavir [25]. Another medication, umifenovir, was created in Russia and is still used there and in China to treat prevention, infections brought on by influenza A and B, as well as other arboviruses .The Japanese company Fujifilm Toyama Chemical created favipiravir in 2014 to treat avian influenza that was resistant to neuraminidase inhibitory [26-27]. The treatment for influenza A and B is oseltamivir [28]. This To prevent the influenza virus from spreading throughout the human body, this medication targets the neuraminidase enzyme that is present on the surface of the virus [29]. The off-label medications for COVID-19 and SARS-CoV-2 are shown in Table 2.

| Drug | Class | Target | Treatment/ Dose |
|---|---|---|---|
| **Camostat mesilate** | Serine protease inhibitor | TMPRSS2 | 200 mg three times daily, for 2 weeks, per oral |
| **Nafamostat mesilate** | Serine protease inhibitor | TMPRSS2 | 240 mg daily, for 5 days, per oral |
| **Chloroquine phosphate** | Antimalarial drug | ACE2 | 250 mg daily until clinical convalescence, per oral |
| **Hydroxy-chloroquine** | Antimalarial drug | Endosome, pH elevation | 400 mg loading dose twice daily at day 1, 200 mg twice daily for 4 days, or 600 mg for 6 days, or 400 mg for 5 days, per oral |
| **Remdesivir** | Antiviral drug | RdRp | 200 mg loading dose at day 1, 100 mg for 9–13 days, per oral or intravenous |
| **Lopinavir/ ritonavir** | Antiviral drug | Viral proteases | 400 mg lopinavir and 100 mg ritonavir twice daily, for 14 days, per oral |
| **Umifenovir** | Antiviral drug | Membrane fusion, clathrin-mediated endocytosis | 400 mg three times daily, for 9 days, per oral |
| **Favipiravir** | Antiviral drug | RdRp | 6000 mg loading dose at day 1, 2, 400 mg for days 2–10, per oral |

**Table 2:** Off-label drugs against SARS-CoV-2 and COVID-19 disease

## Conclusion

This analysis of immune system stimulation offers prospective therapeutic options for COVID-Immune system development can benefit from understanding the workings of the immune system. The most recent findings about the therapy of COVID-19 could be the subject of future study. This would represent a significant accomplishment if the probable obstacles could be removed. Finally, since there is no approved medication for the treatment of COVID-19, nutrition (such as dietary advice) to strengthen the immune system should be investigated and advised.

## Declarations

## Consent for publication

Nil

## Availability of data and material

Not Applicatble

## Authors' contributions

All the authors have contributed to the research work and preparation of the final manuscript.

## Conflict of interests

The authors declare no conflict of interests.

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