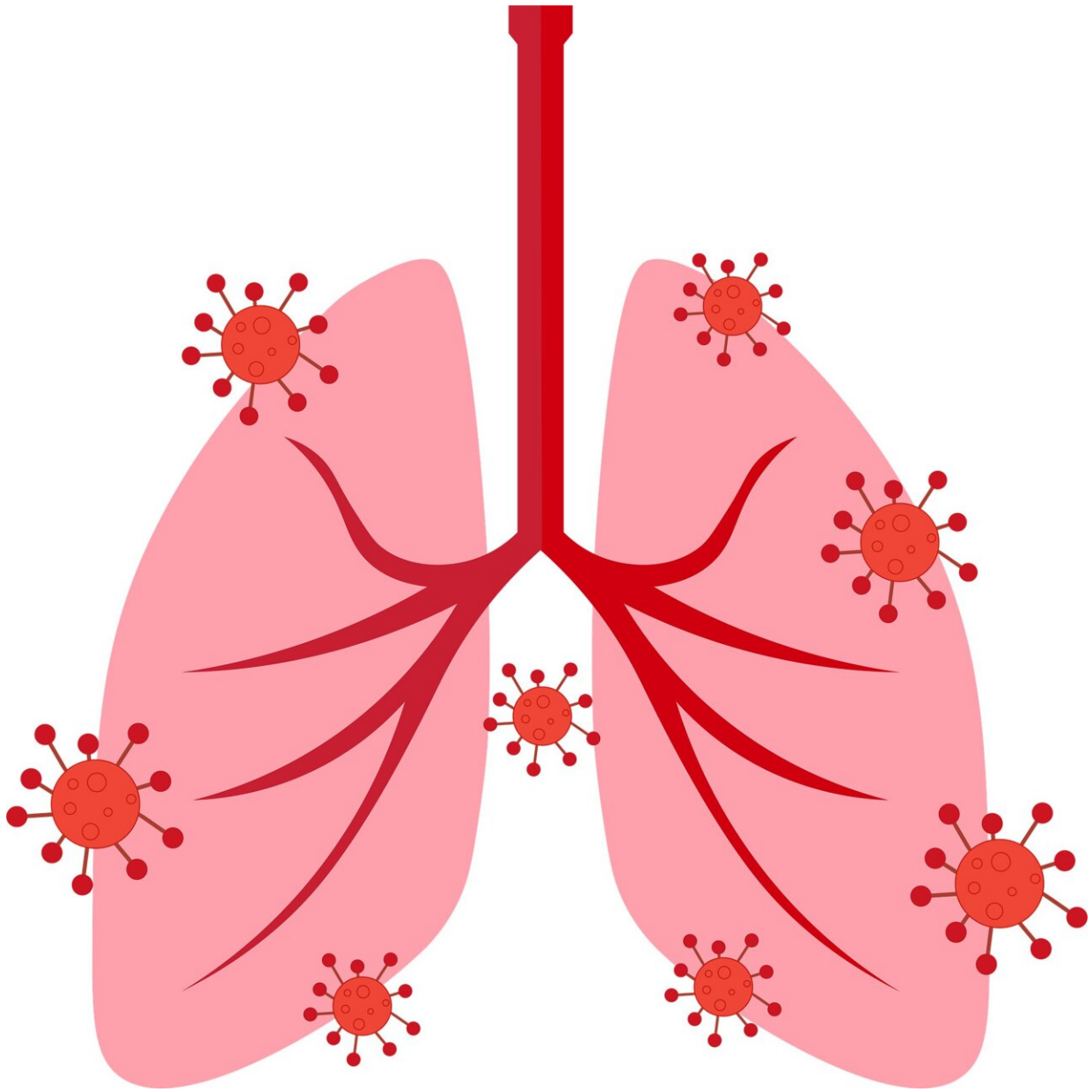
Long COVID-19 may stem from an overactive immune response in the lungs

August 5 2022, by Harish Narasimhan



Credit: Pixabay/CC0 Public Domain

Viruses that cause respiratory diseases like the flu and COVID-19 can lead to mild to severe symptoms within the first few weeks of infection. These symptoms typically resolve within a few more weeks, sometimes with the help of treatment if severe. However, some people go on to experience persistent symptoms that last several months to years. Why and how respiratory diseases can develop into chronic conditions like long COVID-19 are still unclear.

I am a doctoral student working in the Sun Lab at the University of Virginia. We study how the immune system sometimes goes awry after fighting off viral infections. We also develop ways to target the immune system to prevent further complications without weakening its ability to protect against future infections. Our recently published review of the research in this area found that it is becoming clearer that it might not be an active viral infection causing long COVID-19 and similar conditions, but an overactive immune system.

The lungs in health and disease

Keeping your immune system dormant when there isn't an active infection is essential for your lungs to be able to function optimally.

Your respiratory tract is in constant contact with your external environment, sampling around 5 to 8 liters (1.3 to 2 gallons) of air—and the toxins and microorganisms in it—every minute. Despite continuous exposure to potential pathogens and harmful substances, your body has evolved to keep the immune system dormant in the lungs. In fact, allergies and conditions such as asthma are byproducts of an overactive immune system. These excessive immune responses can cause your

airways to constrict and make it difficult to breathe. Some severe cases may require treatment to suppress the immune system.

During an active infection, however, the immune system is absolutely essential. When viruses infect your respiratory tract, immune cells are recruited to your lungs to fight off the infection. Although these cells are crucial to eliminate the virus from your body, their activity often results in collateral damage to your lung tissue. After the virus is removed, your body dampens your immune system to give your lungs a chance to recover.

Over the past decade, researchers have identified a variety of specialized stem cells in the lungs that can help regenerate damaged tissue. These stem cells can turn into almost all the different types of cells in the lungs depending on the signals they receive from their surrounding environment. Recent studies have highlighted the prominent role the immune system plays in providing signals that facilitate lung recovery. But these signals can produce more than one effect. They can not only activate stem cells, but also perpetuate damaging inflammatory processes in the lung. Therefore, your body tightly regulates when, where and how strongly these signals are made in order to prevent further damage.

While the reasons are still unclear, some people are unable to turn off their immune system after infection and continue to produce tissue-damaging molecules long after the virus has been flushed out. This not only further damages the lungs, but also interferes with regeneration via the lung's resident stem cells. This phenomenon can result in chronic disease, as seen in several respiratory viral infections including COVID-19, Middle East Respiratory Syndrome (MERS), respiratory syncytial virus (RSV) and the common cold.

The immune system's role in chronic disease

In our review, my colleagues and I found that many different types of immune cells are involved in the development of chronic disease after respiratory viral infections, including long COVID-19.

Scientists so far have identified one particular type of immune cells, killer T cells, as potential contributors to chronic disease. Also known as cytotoxic or CD8+ T cells, they specialize in killing infected cells either by interacting directly with them or by producing damaging molecules called cytokines.

Killer T cells are essential to curbing the virus from spreading in the body during an active infection. But their persistence in the lungs after the infection has resolved is linked to extended reduced respiratory function. Moreover, animal studies have shown that removing killer T cells from the lungs after infection may improve lung function and tissue repair.

Another type of immune cells called monocytes are also involved in fighting respiratory infections, serving among the first responders by producing virus- and tissue-damaging cytokines. Research has found that these cells also continue to accumulate in the lungs of long COVID-19 patients and promote a pro-inflammatory environment that can cause further damage.

Understanding the immunological mechanisms underlying long COVID-19 is the first step to addressing a quickly worsening public health problem. Identifying the subtle differences in how the same immune cells that protect you during an active infection can later become harmful could lead to earlier diagnosis of long COVID-19. Moreover, based on our findings, my team and I believe treatments that target the immune system could be an effective approach to manage long COVID-19 symptoms. We believe that this strategy may turn out to be useful not only for COVID-19, but also for other respiratory viral

infections that lead to chronic disease as well.

Provided by The Conversation

Citation: Long COVID-19 may stem from an overactive immune response in the lungs (2022, August 5) retrieved 15 December 2022 from https://medicalxpress.com/news/2022-08-covid-stem-overactive-immune-response.html