

Life Sciences and Medicine

Special Topic: COVID-19: Virus, Immunity and Vaccines

The evolving immunity to SARS-CoV-2Chen Dong^{1,2,*}¹Shanghai Immune Therapy Institute, Shanghai Jiao Tong University School of Medicine-affiliated Renji Hospital, Shanghai 200127, China;²Institute of Immunology and Peking University-Tsinghua University Joint Center for Life Sciences, Tsinghua University, Beijing 100084, China*Corresponding author (email: chendong@tsinghua.edu.cn)

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COVID-19, since outbreak, has forever changed our lives as well as sciences.

In the past two years, there has been rapid progress in understanding the virus, and several variants that have spread the world, as well as the immune responses to it. Billions of people have been injected with different kinds of vaccines within 1–2 years, and protection efficacies have been reported, variable to different viral variants. Infection, immunization and investigation are real-time and ongoing. In this inaugural special topic of *National Science Open*, we have invited experts all over China to highlight their work and thoughts on this topic and to summarize the current knowledge.

Coronaviruses are known to exist widely in bats, and evolve to break interspecies barrier to enter humans. In infected individuals, the virus may cause pathology by a mechanism called “cell-in-cell”, as discussed by Sun and Chen [1] in their article “Cell-in-cell: an emerging player in COVID-19 and immune disorders”.

It has been known for two years that both humoral and cellular immunity are engaged to protect us and clear SARS-CoV-2 infection [2]. Zhang [3] discussed antibody responses and particularly touched on the issue of “Broadly neutralizing antibodies against SARS-CoV-2 variants”. On the other hand, Ni and her colleagues [4] reported that despite decline in antibody titers over months after infection, T cell immunity was maintained in a cohort of convalescent individuals. One person even showed strong virus-specific T cell memory in the absence of antibody responses. These pieces of knowledge certainly help to understand the interaction of the immune system, adaptive immune system in particular, with the virus.

There are quite a few articles discussing different aspects of vaccine development and usage in people. Cheng *et al.* [5] summarized the rapid development and implementation of SARS-CoV-2 vaccines in their article “One year of COVID-19 vaccination”. Considering multiple formats of vaccines available, Lin and Huang [6] wrote an article “Towards robust immune responses after heterologous COVID-19 vaccination and its application perspectives” and proposed combinatorial vaccination strategies. Lastly, Jia *et al.* [7] touched on a particular group of people with their review “Challenges of COVID-19 vaccination in patients with cancer”.

In a little more than two years of time, the virus has evolved after infecting a large portion of the world

population, giving rise to multiple variants. It is fair to say that the virus is significantly different from the old one surfaced at Wuhan city in 2019. Our knowledge on the immune responses to this virus has also evolved. We know that while antibodies protect us from infection, T cells may undermine the severity of symptoms in infected people. In addition, there has been quick evolution of vaccine technology, mRNA format worth mentioning, in response to this virus. Comparison of different formats is coming along.

SARS-CoV-2 is certainly not going away, and by infecting people worldwide, is quickly changing and evolving. The knowledge on the immune system that has evolved for millions of years to protect us against all microbes will have a giant leap forward, especially in human infectious immunology. It is well anticipated that our expertise in developing effective and long-lasting vaccines will greatly benefit from this quickly evolving immunology and receive a new boost!

Our immunity is evolving along with the virus.

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References

- 1 Sun Q, Chen W. Cell-in-cell: an emerging player in COVID-19 and immune disorders. *Natl Sci Open* 2022; **1**: 20220001.
- 2 Ni L, Ye F, Cheng ML, *et al.* Detection of SARS-CoV-2-specific humoral and cellular immunity in COVID-19 convalescent individuals. *Immunity* 2020; **52**: 971–977.e3.
- 3 Zhang L. Broadly neutralizing antibodies against SARS-CoV-2 variants. *Natl Sci Open* 2022; **1**: 20220005.
- 4 Ni L, Ye F, Qiao Q, *et al.* Anti-viral memory T cell responses in the absence of IGG production in a COVID-19 convalescent individual. *Natl Sci Open* 2022; **1**: 20220009.
- 5 Cheng ML, Zhao H, Qin CF. One year of COVID-19 vaccination. *Natl Sci Open* 2022; **1**: 20220007.
- 6 Lin Y, Huang A. Towards robust immune responses after heterologous COVID-19 vaccination and its application perspectives. *Natl Sci Open* 2022; **1**: 20220008.
- 7 Jia S, Zhu W, Jiang H, *et al.* Challenges of COVID-19 vaccination in patients with cancer. *Natl Sci Open* 2022; **1**: 20220004.