**SARS-CoV-2 variants, vaccines, and immunity**

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**Abstract**

The current pandemic disease, coronavirus disease 2019 (COVID-19) is caused by infection with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Since its emergence in late December 2019, SARS-CoV-2 has been spreading rapidly worldwide. In response to the rapid spread of COVID-19, vaccines have been developed at an unprecedented pace. In particular, novel platform technologies such as mRNA and viral vectors were adopted for rapid development of COVID-19 vaccines. However, variant viruses have been emerging, and neutralizing antibodies elicited by vaccination have reduced activity against variants. In the present lecture, I will talk about ‘what we learned from the COVID-19 pandemic’ in various aspects, including antibody and T cell responses elicited by natural infection or vaccination. In addition, I will discuss T cell responses among patients with breakthrough infection.