Physics Colloquium

سخنرانی عمومی فیزیک

پژوهشکده فیزیک
پژوهشگاه دانش‌های بنیادی (مرکز تحقیقات فیزیک نظری و ریاضیات)
IPM
Institute for Research in Fundamental Sciences
School of Physics

Modeling Humoral Immune Response to SARS-CoV-2 and Machine Learning for Discriminating COVID-19 and Influenza Infection: An Application Approach

Speaker

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Affiliation

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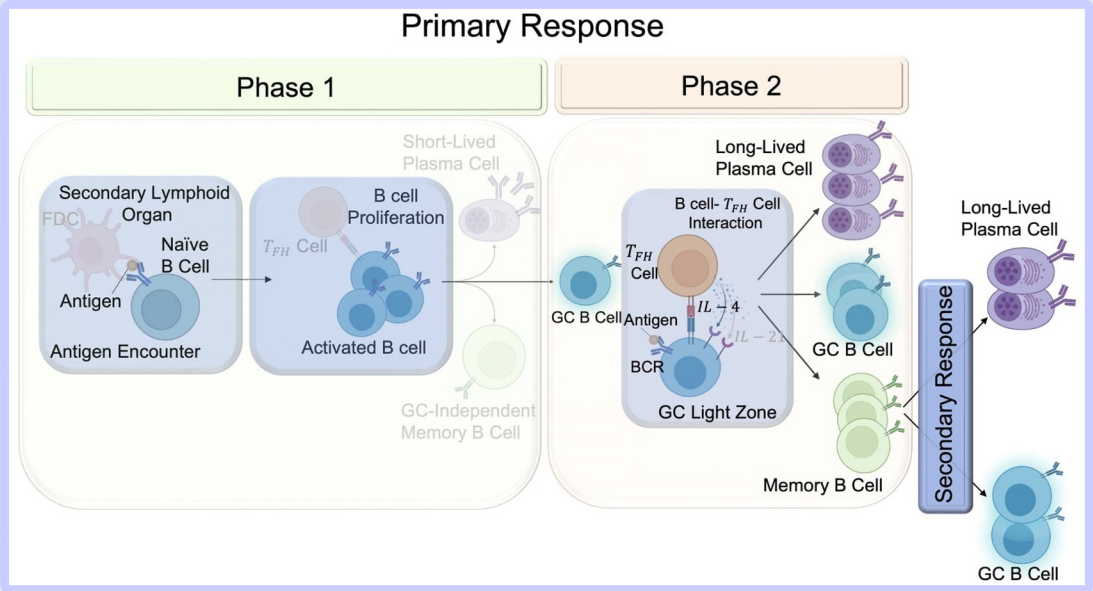
Date and time

Monday, 13 Shahrivar 1402 (4 Sept., 2023), 6 pm (Note the unusual day)



Abstract

In this colloquium, I will first present our mathematical model to investigate humoral (antibody-mediated) immunity. B cells and their antibodies play a crucial role in protecting against COVID-19. However, the decline of antibodies following natural infection or vaccination results in reduced defence against subsequent SARS-CoV-2 infections. To comprehend the dynamics of antibody production from B cells, we constructed a computational biology model that incorporates B cells, IgG-neutralizing antibodies, and host-pathogen interactions. This model provides insights into the kinetic processes and mechanisms that drive the humoral response to SARS-CoV-2, including the initiation of B cell responses, differentiation into germinal center cells, long-lived plasma cells, and memory cells. It enhances our understanding of antibody production in primary and secondary reactions. Next, I will present our recent work that centers around applying mathematical modelling to generate synthetic data of influenza and COVID-19 patients, enabling differentiation between the two infections. Here, we developed and validated a supervised machine-learning model utilizing mechanistic models of viral infection. Our investigation showcases the effl has the potential to serve as a cost-effective classification system, eliminating the need for expensive virus typing procedures and relying solely on viral load and interferon measurements.

Link

https://www.skyroom.online/ch/schoolofphysics/colloquium