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Modeling of Humoral Immune Response to Repeated Influenza A Virus Infections

Abbiana Arenas
Nova Southeastern University, aa1318@nova.edu

Safiyah Muhammad
Nova Southeastern University

Ly Nguyen
Nova Southeastern University

Samita Andreansky
University of Miami

Evan Haskell
Nova Southeastern University, haskell@nova.edu

Modeling of Humoral Immune Response to Repeated Influenza A Virus Infections

Abbiana R. Arenas[1], Safiyah Muhammad[1], Ly Nguyen[1], Samita Andreansky[2], Evan C. Haskell[1]

[1] Division of Math, Science, & Technology, Farquhar College of Arts and Sciences, Nova Southeastern University, haskell@nova.edu

[2] Department of Pediatrics, Microbiology, Immunology, and Medicine, Miller School of Medicine, University of Miami

Keywords: Humoral Immunity, Influenza A Virus, Mathematical Modeling. Seasonal infections by Influenza A virus (IAV) causes hundreds of thousands of deaths worldwide each year, with most individuals being infected multiple times throughout their lifetimes. The relative impact of the components of the host immune system in controlling the severity and duration of repeated challenges from an IAV infection remains unclear. In particular, the differential contribution of the humoral immune response in primary and secondary challenges from IAV are relatively little explored. We develop a parsimonious mathematical model of the humoral immune response to IAV infection with biologically meaningful and identifiable parameters. We show the relative sensitivity of the viral load and antibody response to dynamics of B cell proliferation and antibody production. We relate immunoglobin class switching to a $CD4^+$ T-cell driven process for the formation of humoral memory. Results of this study help to illuminate the relative contribution of $CD4^+$ T-cells, B-cells, and antibody in the control of IAV infection and formation of humoral memory.

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