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Abstract

The cellular adaptive immune response plays a key role in resolving influenza infection. Experiments where individuals are successively infected with different strains within a short timeframe provide insight into the underlying viral dynamics and the role of a cross-reactive immune response in resolving an acute infection. We construct a mathematical model of within-host influenza viral dynamics including three possible factors which determine the strength of the cross-reactive cellular adaptive immune response: the initial naive T cell number, the avidity of the interaction between T cells and the epitopes presented by infected cells, and the epitope abundance per infected cell. Our model explains the experimentally observed shortening of a second infection when cross-reactivity is present, and shows that memory in the cellular adaptive immune response is necessary to protect against a second infection.

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