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Spatial Modeling of in-vivo Viral Infection with Interferon Response

Gary M. Lavigne Jr
North Carolina State University at Raleigh, gmlavign@ncsu.edu

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G. Michael Lavigne

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The innate immune response, particularly interferon signaling, represents the body's first line of defense against viral invasions. Previously, in-host viral dynamics and the innate immune response have been studied largely as a spatially homogeneous system via ODE models. This assumption neglects the biological reality of spatial distribution of cells and diffusion of viruses and interferons in an organ or epithelium for many diseases. Here, we propose a partial differential equation (PDE) model and a related cellular automata (CA) model to study the impact of spatial spread of viruses and interferon molecules. We find the spatial arrangement of cells and signaling particles to be crucial to the efficacy of innate immune signaling in combating infection