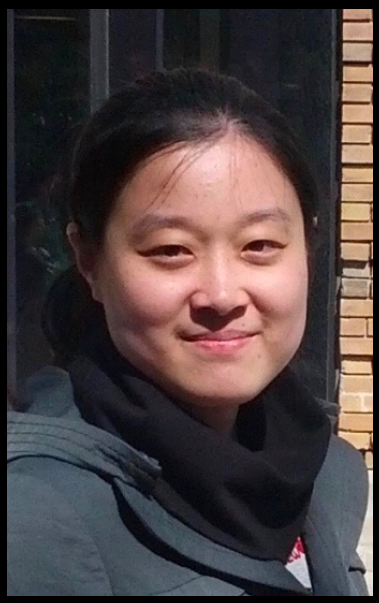
Biomathematics Seminar Series

Department of Mathematics and Statistics

Examining HIV Progression Mechanisms via Mathematical Approaches



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Virtual Zoom

https://zoom.us/j/95584204864

The progression of HIV infection to AIDS is unclear and under examined. Many mechanisms have been proposed, including a decline in immune response, increase in replication rate, involution of the thymus, syncytium inducing capacity, activation of the latently infected cell pool, chronic activation of the immune system, and the ability of the virus to infect other immune system cells. The significance of each mechanism in combination has not been studied. We develop a simple HIV viral dynamics model incorporating proposed mechanisms as parameters that are allowed to vary. In the entire parameter space, we derive two formulae for the basic reproduction number (R0) by considering the infection starting with a single infected CD4 T cell and a single virion, respectively. We show that both formulae are equivalent. We derive analytical conditions for the occurrence of backward and forward bifurcations. To investigate the influence of the proposed mechanisms to the HIV progression, we perform uncertainty and sensitivity analysis for all parameters and conduct a bifurcation analysis on all parameters that are shown to be significant, in combination, to explore various HIV/AIDS progression dynamics.

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