

Delay equations for disease and immunity dynamics

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We consider an epidemiological model that includes waning and boosting of immunity. Assuming that repeated exposure to the pathogen fully restores immunity, we derive an SIRS-type model with discrete and distributed delays. Interesting features due to immune boosts appear with respect to the endemic equilibrium, which can go through multiple stability switches by changing the key model parameters. We construct two-parameter stability charts, showing that increasing the delay can stabilize the positive equilibrium. Increasing the basic reproduction number the endemic equilibrium can cross two distinct regions of instability, separated by Hopf-bifurcations. Our results show that the dynamics of infectious diseases with boosting of immunity can be more complex than most epidemiological models. This is a joint work with Gergely Röst (Oxford/Szeged) and Monika Polner (Szeged).