Hamilton Institute Student Seminar Series

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**Title:** Quantitative model of cell population dynamics in immunology

**Abstract:** The immune system is mediated by two essential lymphocytes (white blood cells): B- and T- cells, protecting the human body against infections. Thus, by understanding the behaviour of B- and T- cells, it will benefit not only in therapeutic development such as immunotherapy but also in refining the diagnostic tools, for instance, for immunodeficient/autoimmune patients.

Lymphocytes must first receive a stimulatory signal that binds to their cell surface receptor. These signals activate the lymphocytes, like the “on switch”, to proliferate and differentiate into the effector cells – initiating an immune response. Conversely, inhibitory signals can inactivate the immune response like the “off switch”. To investigate the population dynamics of cells, it is vital to understand the cellular modules such as the time a lymphocyte takes to divide, to die, and to return to a quiescent state. Therefore, the current project aims to develop a mathematical model to quantitatively integrate the signals in terms of modulating the independent and competing cellular modules, which are depicted as timers.

For this presentation, the basic concepts of the immune response mentioned above will be introduced and how the mathematical model can contribute towards the cell population dynamics will be discussed with applications to the drug intervention and immunodeficient patients.