Mathematical Models on Checkpoint Blockade Therapies

Collin ZHENG [1] , Peter KIM [1] and Peter LEE [2]

1) *School of Mathematics and Statistics, University of Sydney, Sydney, AUSTRALIA*

2) *City of Hope Beckman Research Institute, Los Angeles, UNITED STATES*

Corresponding Author : Collin ZHENG, collin.zheng@sydney.edu.au

ABSTRACT

Cytotoxic T-lymphocytes, commonly called killer T cells, are among our immune system's most potent and highly-studied weapons against cancer. However checkpoint receptors such as CTLA-4 and PD-1 on the surfaces of T cells inhibit their activation and proliferation. These receptors can be blocked by antibody drugs, which pave the way for an anti-tumour immune response. We will present work-in-progress mathematical models on tumour-lymphocyte dynamics in the presence of checkpoint blockade therapies, discuss their clinical implications, and more broadly discuss the current modelling efforts in this area.

The first model, a set of ordinary differential differential equations, describes tumour-immune dynamics in the presence of anti-CTLA-4 blockades. The model suggest that known delay in the treatment efficacy is linked to a lack of co-stimulatory signals provided to the nave T-cells by dendritic cells. The second model, a hybrid agent-based model, focuses on tumour-immune dynamics in the presence of anti-PD-1 blockades. This model is a work-in-progress and aims to shed insight into a similar delay in treatment efficacy observed in anti-PD-1 treatments.