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A Model of Dendric Cell Therapy

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In this talk we will describe modifications made to a model of the immune response to a cancer vaccine. The paper *A Model of Dendritic Cell Therapy for Melanoma* in Frontiers in Oncology (2013) by A. Radunskaya et al. [1] introduces a system of nine differential equations, including one equation with a time delay. The time delay represents time needed for a type of antigen-presenting immune cell (APC) called a dendritic cell (DC) to initiate an immune response within a lymph organ, such as the spleen. This delay is due to the "synaptic connection time", which is the time that a DC must be in contact with an unactivated T-cell in order to activate that cell. The time delay term in [1] is problematic in several ways. From the modeling perspective, it inaccurately describes the evolution of the system as a function of the state of the system a fixed time in the past. A more accurate description would describe the Dendritic-T cell complex as it evolves through time. The delay also introduces an unwanted layer of mathematical complexity, since it produces an infinite dimensional system of equations that must be solved. This layer of complexity causes difficulties in the analysis of the system, as well as in the numerical solution. We eliminate the delay by introducing new state variables (and in turn differential equations and parameters) into the system based on our interpretation of the biological literature. The aim of the modification was to make the model more realistic and more mathematically tractable. We will introduce the new system and explain the parameter fitting process required to have a model representative of the current data.

References

[1] Lisette DePillis, Angela Gallegos, and Ami Radunskaya. A model of dendritic cell therapy for melanoma. *Frontiers in Oncology*, 3(56):1–14, March 2013.