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Modelling Immunomodulation of Tumor Growth

The physical presence and activities of cancer cells elicit an immune response in the host. In turn, this immune response has been shown to be both stimulatory and inhibitory to tumor growth. This interplay therefore has complex implications for tumor development. To explore these, we have developed a system of differential equations to investigate the role of the immune response in tumor growth. The two-compartment model consists of both cancer and immune cells: the cancer cells proliferate on their own and their growth can either be inhibited or stimulated by immune cells in a manner dependent on the states of each, while the immune cells are recruited to the tumor site by either the cancer cells or by the interaction of the cancer cells with the immune cells. Cancer cells, innate immune cells (such as platelets, dendritic cells, macrophages, and natural killer cells) and adaptive immune cells (such as T and B lymphocytes) communicate with each other through cytokine and chemokine production which controls and shapes tumor growth. The cummulative result of the interactions of these diverse cells determines whether tumor-promoting inflammation or antitumor immunity occurs, and it is this wholistic response that we attempt to capture in our model. Most mathematical models of the immune response to cancer focus on single immune cells and their specific function in cancer cell killing. One of the main advantages of this model is that it combines the effects of all immune cell types and the physical process of inflammation into one quantitative model setting. Thus, it is better positioned to predict immunomodulation of tumor growth, and to assist in the design of novel treatment approaches that exploit immune response to improve tumor suppression.

References

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