Parameter estimation and dynamic simulation of a mathematical model of breast cancer

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Dynamic mathematical models using ordinary differential equations (ODEs) have been widely employed to study biological systems. The parameter values for each parameter are not a single value but are often considered a distribution due to individual variability, environmental factors, or other influences. Therefore, modeling parameters as distributions can help develop more realistic models and provide more realistic predictions.

Immunoediting is a dynamic process through which the immune system interacts with tumor cells. The immune system recognizes tumor cells and destroys them, protecting against cancer development. The remaining tumor cells may coexist with the immune system, achieving an equilibrium between tumor cell proliferation and immune-driven elimination. During this phase, tumor dormancy occurs; the immune system controls tumor growth but does not completely destroy it. The tumor may finally evade the immune system and grow uncontrollably. Understanding immunoediting can help in designing strategies to prevent or delay tumor escape and effective immunotherapies.

In this talk, a mathematical model of breast cancer is considered. The parameter distributions of some important parameters will be estimated from experimental data using the MCMC method. The dynamics generated by the mathematical models will be compared with the phenomena, such as immunoediting, observed in experimental and clinical studies.