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*The Impact of Dynamical System Nondimensionalization on Sensitivity Analysis when Modeling the Epithelial Mesenchymal Transition*

The epithelial mesenchymal transition (EMT) is a process that allows carcinoma cells to lose their adhesivity and migrate away from a tumor. Further, cells can maintain this invasiveness after they leave their original microenvironment, suggesting that there is an underlying bistable switch. We developed a mathematical model that examined the relationships between E-cadherin and Slug and their responses to tumor-level factors, such as cell-cell contact and TGF- $\beta$ . Phenomenological model behavior was derived from biological experiments and, ultimately, this model showed how cells at different positions within a tumor can use exogenous factors to undergo EMT. However, the nonlinear dynamics and estimated model parameters make it challenging to analyze and understand what parameters contribute to the observed E-cadherin and Slug changes. Thus, we turn to sensitivity analysis. This work seeks to understand the true impact of commonly used mathematical techniques on dynamical systems, such as nondimensionalization, on sensitivity analysis results. The global sensitivity analysis Latin Hypercube Sampling (LHS) and Partial Rank Correlation Coefficient (PRCC) was used on the original E-cadherin-Slug model, as well as seven different possible nondimensionalized versions. By comparing these eight different iterations against each other, this work shows that the issues from performing sensitivity analysis following nondimensionalization are two-fold: (1) nondimensionalization can obscure or exclude important parameters from in-depth analysis and (2) how a model is nondimensionalized can, potentially, change analysis results. Ultimately, this work cautions against using model nondimensionalization prior to sensitivity analysis if the subsequent results are meant to guide future experiments.