Multiscale Simulation of Tumor Growth and Angiogenesis: A Model for Pharmacotherapy Assessment and Drug Discovery

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Growth patterns and growth rates of tumors are irregular when compared to those of standard tissue, resulting in obstacles that affect anti-cancer chemotherapy. Consequently, both the expenditures and the time required for standard drug pharmacodynamic and pharmacokinetic studies are increased significantly. In order to aid anti-cancer drug discovery, I present a multiscale model that integrates tumor growth and angiogenesis into a simulation of tumor development for drug assessment. This model combines the complex processes of angiogenesis, mass transport, and blood vessel growth for the simulation of tumor development during the progression from initial avascular growth to malignant vascular growth. A variety of simulations and tests were performed to indicate the benefits of the presented model. When compared with purely physical models, my model is not only more computationally efficient, but also provides more accurate predictions and calculations for tumor growth. This combination of computational efficiency and greater accuracy allows my model to offer further insights into cancer therapy. As a result, this model can be used as a valuable simulation platform for drug discovery and optimization, as well as a prediction resource for tumor diagnosis and drug assessment.