Bladder cancer: growth and treatment

Svetlana Bunimovich-Mendrazitsky, Tel Aviv University, Israel,
SvetlanaBu@tauex.tau.ac.il

Bladder cancer (BC) is the most frequently occurring urological cancer and the fifth most common cancer among men, accounting for approximately 200,000 new cases world-wide annually. We developed a multi scale cellular automata (CA) model to study the growth of BC. The model includes nutrient and oxygen variables with dynamics described by 2D-spatial partial differential equations.

For the treatment, we present a modeling study of bladder cancer via pulsed immunotherapy with Bacillus Calmette-Gue´rin (BCG) - an attenuated strain of Mycobacterium bovis (M. bovis). Impulsive differential equations are used for studying periodic BCG instillations (pulsed BCG therapy). The mathematical relationships between schedule (pulsing frequency) and dose (therapy strength) are determined through appropriate mathematical analysis.

We examine the expression of interleukin-2 (IL-2) with a course of treatment with BCG. IL-2 causes inflammation, which is the reason that it has been tried as a therapeutic to augment the function of the immune system. The mathematical analysis of the seven ODE equations explains the conditions for successful bladder cancer treatment.