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Computational Modeling of Cancer Treatment Using Carbon Nanotubes FENG GONG, HONGYAN ZHANG, JIN WEN TAN, National University of Singapore, DIMITRIOS V. PAPAVASSILLIOU, University of Oklahoma, USA, VINCENT B.C. TAN, SWEE HIN TEOH, HAI MINH DUONG, National University of Singapore — Laser thermal therapy selectively kills cancer cells without harming surrounding cells due to the high-energy absorbance of the functionalized carbon nanotubes (CNTs). However, the technique application is still very limited due to lack of experimental and computational works to understand how to kill cancer cells effectively and how the CNTs are heated by the external laser. The goal of this work is to present integrated computer models to capture changes in CNT heat transfer characteristics due to variations in the properties of CNTs and tissues during laser surgery. Numerical results show that the models are able to characterize variations of tissue properties for laser surgical procedures (by three dimensional finite element models) and predict anisotropic temperature fields within the CNTs (by finite different models). The current model is made more realistic and accurate than previous models by taking into account the anisotropic properties of CNTs and the energy loss from the CNT surface. The effects of the CNT concentration, morphology, orientations, and the power and heating duration of the laser are also investigated. The developed models help experimentalists to understand cancer treatment mechanisms and optimize operating conditions of the laser thermal therapy.

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