

Università degli Studi di Pavia Computational Mechanics & Advanced Materials Group - DICAr



CELLS MECHANICS AND COMPETITION IN TUMOR GROWTH

Within the framework of Continuum Mechanics, growth of biological tissues is analyzed through poroelastic models in which the interaction between soft matrix and interstitial fluid flow is coupled with inelastic effects accounting for macroscopic volumetric growth. However, as these strategies are employed to study solid tumors, mass growth is uploaded as a datum, on the basis of in vitro measured intrinsic growth rates of the cell species, thereby neglecting important cell-cell dynamics and feedback mechanisms across the scales. To solve this biophysical inconsistency, we propose a poroelastic model undergoing large deformations and embodying inelastic growth terms whose net balance results from the "interspecific" predator-prey competition occurring at the micro-scale level between healthy and cancer cell species to grab the available common resources. Stresses, pressure gradients, interstitial fluid flows driving nutrients and inhomogeneous growth are in this way found all simultaneously interacting to decide the tumor fate. Motivated by some first in-vivo experiments which seem to confirm the effectiveness of the proposed approach, some viscoleastic and tensegrity paradigms to model the mechanics of single cells and cells clusters, including adhesion and migration, are also under study, with the aim of both enriching the interplay across the scales and exploiting ascertained stiffness discrepancies between cancer and healthy cells for targeting and selectively attacking tumour cells at different scales, for instance by using ultrasound at frequencies tuned to induce mechanical resonance in the cytoskeleton of abnormal cells.

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Department of Structures for Engineering and Architecture University of Naples "Federico II" March 15th, 10:00am (sharp) DICAr MS1 Meeting Room Via Ferrata, 3 – Pavia