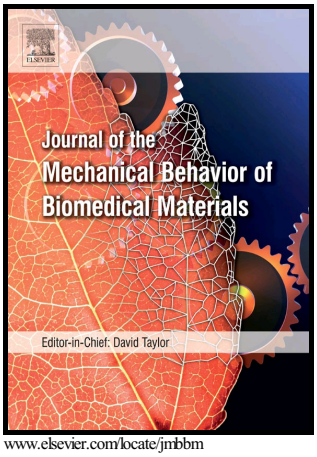
Growth and *in vivo* stresses traced through tumor mechanics enriched with *predator-prey* cells dynamics

A.R. Carotenuto, A. Cutolo, A. Petrillo, R. Fusco, C. Arra, M. Sansone, D. Larobina, L. Cardoso, M. Fraldi



www.elsevier.com/locate/jmbbm

PII: S1751-6161(18)30329-1
DOI: https://doi.org/10.1016/j.jmbbm.2018.06.011
Reference: JMBBM2832

To appear in: *Journal of the Mechanical Behavior of Biomedical Materials*

Received date: 14 March 2018
Revised date: 10 May 2018
Accepted date: 5 June 2018

Cite this article as: A.R. Carotenuto, A. Cutolo, A. Petrillo, R. Fusco, C. Arra, M. Sansone, D. Larobina, L. Cardoso and M. Fraldi, Growth and *in vivo* stresses traced through tumor mechanics enriched with *predator-prey* cells dynamics, *Journal of the Mechanical Behavior of Biomedical Materials,* https://doi.org/10.1016/j.jmbbm.2018.06.011

Growth and *in vivo* stresses traced through tumor mechanics enriched with *predator-prey* cells dynamics

A. R. Carotenuto[a], A. Cutolo[a], A. Petrillo[b], R. Fusco[b], C. Arra[c], M. Sansone[d], D. Larobina[e], L. Cardoso[f], M. Fraldi[a,g,*]

[a] *Department of Structures for Engineering and Architecture, University of Napoli Federico II - Italy*
[b] *Department of Diagnostic Imaging, Radiant and Metabolic Therapy, National Institute for Tumors "Fondazione Pascale - IRCCS" Napoli - Italy*
[c] *Animal Facility Unit, Radiant and Metabolic Therapy, National Institute for Tumors "Fondazione Pascale - IRCCS" Napoli - Italy*
[d] *Department of Electrical Engineering and Information Technologies, University of Napoli Federico II - Italy*
[e] *Institute for Polymers, Composites and Biomaterials - National Research Council, Napoli - Italy*
[f] *Department of Biomedical Engineering, The City College New York, The City University of New York, NY 10031 - USA*
[g] *Interdisciplinary Research Center for Biomaterials, University of Napoli Federico II - Italy*

Abstract

Mechanical stress accumulating during growth in solid tumors plays a crucial role in the tumor mechanobiology. Stresses arise as a consequence of the spatially inhomogeneous tissue growth due to the different activity of healthy and cancer cells inhabiting the various districts of the tissue, an additional piling up effect, induced by stress transferring across the scales, contributing to determine the total stress occurring at the macroscopic level. The spatially inhomogeneous growth rates accompany nonuniform and time-propagating stress profiles, which constitute mechanical barriers to nutrient transport and influence the intratumoral interstitial flow, in this way deciding the starved/feeded regions, with direct aftereffects on necrosis, angiogenesis, cancer aggressiveness and overall tumor mass size. Despite their ascertained role in tumor mechanobiology, stresses cannot be directly appraised neither from overall tumor size nor through standard non-invasive measurements. To date, the sole way for qualitatively revealing their presence within solid tumors is *ex vivo*, by engraving the excised masses and then observing opening between the cut edges. Therefore, to contribute

*Corresponding author
Email address: fraldi@unina.it (M. Fraldi)