Dipartimento Meccanica Matematica Management

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Research project

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Title: OUT Onco-**U**ltrasound-**T**ripsy: Exploiting cellular mechanical fatigue to develop innovative treatments for cancer cells

Description:

OUT research project aims to investigate, define, and implement an innovative therapeutic approach for addressing cancer. This approach leverages ultrasound potential to selectively target healthy and cancerous cells. The differential targeting is made possible by exploiting the inherent mechanical differences between tumoral cells and their healthy counterparts. These disparities in mechanical properties result in a shift in cell resonance frequencies, providing an opportunity to induce fatigue effects specifically in cancer cells.
A fundamental step towards developing this approach involves conducting a comprehensive mechanical characterization of selected cell lines. This process will not only contribute to build a comprehensive database of cellular mechanical properties but also aid in selecting the most promising cell lines for treatment based on the degree of separation in resonance excitation frequencies.
Using experimental data obtained from mechanical characterization, numerical models will be developed to understand the interaction of ultrasound with cellular and subcellular structures. This will help determine effects on cell viability, including self-healing mechanisms, and assess potential mechanisms of cell damage such as lysis or apoptosis. The sonication process will be optimized to selectively target cancer cells. Furthermore effects of sonication on 3D cell cultures and cell conglomerates, encompassing both healthy and cancer cells, to fully explore the selectivity potential of the proposed approach.
To efficiently conduct sonication procedures, specific ultrasound equipment will be developed. Following the in vitro experimental phase, selected cancer cells that exhibit a more responsive behavior will be identified. These cells will be the focus of the final in vivo testing campaign, marking a crucial step towards translating our innovative therapeutic approach into practical and effective skin cancer treatment.

The activities will be carried out in the laboratory of Experimental Mechanics and in the laboratory of cell cultures of Department of Mechanics, Mathematics and Management (DMMM) of Politecnico di Bari. DMMM has been recognized has Excellence Department from the Italian Ministry of Education and University. The laboratory of Experimental Mechanics is being active since many decades on the topics of cell mechanical characterization and cell sonications. Researcher involved in the research will have the full availability of the facilities in the laboratories including optical microscopes, scanning electron microscope and atomic force microscope. Moreover she/he will have the possibility to use equipment available in the cell culture laboratory including cell incubator, cell centrifugators, chemical hood, low temperature refrigerator (- 80 °C), cell counters, viability tests etc. The researcher will also collaborate within the research network involving medical and biological teams from Università degli Studi di Bari and Università di Foggia.

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Candidates should provide detailed CV

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