

UniSR	PROPOSAL AS DIRECTOR OF STUDIES & RESEARCH PROJECT	MO-PHDMM-1 Rev. 02 del 26/01/2018
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PROJECT 1

DoS: MASSIMO ALFANO

Title: **Novel precision technological platforms to promote non-invasive early diagnosis, eradication and prevention of cancer relapse: proof of concept in the bladder carcinoma.**

Curriculum: Experimental and Clinical Medicine

Link to OSR/UniSR personal page: <http://research.hsr.it/en/institutes/urological-research-institute/massimo-alfano.html>

Project description (Number of characters, including spaces: 2.000 - 3.000):

Despite years of awareness, as of today, there is no screening program for the early detection of bladder cancer (BCa). The unmet clinical needs in the management of BCa are the prevention of tumor onset, relapse and progression, and therapy of the aggressive bladder carcinoma in situ (Cis), requiring frequent and endless follow-up and weekly treatments, with a consequent poor quality of life and the highest cost per patient among all cancers. Therefore public health programs crave for early BCa detection protocols, to improve performance in the management of this devastating disease. This study propose an advanced transformative technology combining a novel high-resolution ultrasound elastography and photoacoustic imaging on the bladder instilled with targeted plasmonic gold sensors.

The approach of this study exploits the structural and mechanical properties of the bladder extracellular matrix (ECM) as a unique biomarker of the early onset/progression/relapse of carcinoma, through engineered novel gold nanorods (GNRs) used as intravesical photoacoustic antennas targeted at the ECM within the cellular microenvironments and consequently generating an *ad hoc* visualization platform. GNRs will be further utilized as heat-releasing effectors at nanoscale for targeted cancer photo-thermal therapy. This study is designed to detect pre-neoplastic area and eradication of local areas at few cells resolution with high sensitivity and specificity. Pre-clinical models will be used to induce and monitor i) the structural and mechanical modifications of the bladder ECM, ii) the formation of a spontaneous bladder tumor, and iii) to thermos-ablate the neoplastic area in an orthotopic mice model.

Outcomes of EDIT will revolutionize the management of BCa with the introduction of sensing and effector nanotechnologies combined with non-invasive organ imaging with high resolution/definition 3D ultrasound and photoacoustic imaging. Structural and mechanical modification of the collagen rich extracellular matrix is a common denominator for invasive breast, colorectal, prostate and bladder cancers. The platforms delivered in this study will also pave the ways for the earlier management of other bladder-related pathologies and solid tumors, with a profound impact on the quality of life and well-being of millions of people.

Skills to be acquired by the student:

Management of preclinical models (mice and rat)
Cell culture under sterile conditions
Histological analysis
Ultrasound and photoacoustic techniques
Data visualization, analysis and interpretation

References (max. 3)

1.

<http://www.cancer.gov/cancertopics/pdq/treatment/bladder/HealthProfessional/page7#section7.20>. **2.** [10.1007/s40273-014-0194-2](https://doi.org/10.1007/s40273-014-0194-2) **3.** [10.2174/1389200218666170427092421](https://doi.org/10.2174/1389200218666170427092421)