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| **Title** | **Programmed drug nanovehicles for enhanced site-selective anticancer therapy** |
| **PI** | STEFANO SALMASO |
| **Research Group** | Drug Delivery research Unit – DSF |
| **Curriculum** | Scienze Farmaceutiche |
| **Location** | DSF, Padova |
| **Contact** | **web:** https://www.dsfarm.unipd.it/stefano-salmaso-1 |
| | **email:** stefano.salmaso@unipd.it |

**Project description:**

Cancer is one of the major causes of death worldwide accounting for about 13% of all deaths in 2015 (source: WHO Fact, February 2017). However there is a lack of ultimate solution to this fatal disease. In the last decades, several new active and selective anticancer drugs have been developed. However, poor pharmacokinetic (PK) profiles, limited biodistribution in the tumor tissue and high off-target toxicity have often hampered the clinical development of new promising molecules. Drug delivery approaches based on the use of nanosized carriers encapsulating drugs have been developed to reduce drug side effects and ultimately provide suitable therapeutic efficacy.

We aim here to improve drug nanovehicle performances by programming their functions that will be activated where and when required, including, but not limited to, drug delivery and release. While passive accumulation can promote biodistribution of drug nanocarriers in the tumor, our delivery systems are instructed to be activated in contact with target tissue and cells or when external stimuli are applied resulting in enhanced nonvehicle tropism for the tumor and locally restricted therapeutic activity.

This project aims at developing organic/inorganic colloidal vehicles as a “nano-machines” for cancer therapy. We will develop carriers for very potent and selective new anticancer molecules with poor biopharmaceutical features not yet on the market, and for existing anticancer drugs whose activity can be enhanced by combination therapy or by exploiting their sensitizing properties. The carriers developed will be decorated with functional components that provide for: sensing of the tumor local environment, biorecognition of specific molecular targets, site-activated drug release and cancer tissue hypersensitization to externally applied physical stimuli. When possible, novel microfluidic approaches will be exploited for the assembly of the nanocarriers.

The PhD fellow involved in this project will acquired state-of-the-art skills in advanced drug delivery, nanotechnology, bioconjugation/polymer chemistry, in vitro and in vivo characterization of novel therapeutic systems. The student will learn the most updated physico-chemical and biophysical techniques for colloid characterization. He/she will be trained at the interface between material science / pharmacy / nanotechnology / biomedicine since the concepts behind the design of these systems stems from a background knowledge of the novel material features and of the physiology of either the tumor tissue and the whole body.

**Publications:**

1. M. Barattin, et al. (2018) *Appl. Mater. Interfaces* 10: 17646–17661
2. Ambrosio E., et al. (2016) *J. Control Release.* 226: 35-46.
3. Brazzale C., et al. (2016) *Nanomedicine (Lond.)*, 11: 3053-3070.

**Collaborations/Network:**

University La Sapienza (IT), University of Nottingham (UK), University of Turin (IT), Ben-Gurion University of the Negev (Israel).

**Research funding**

The project will be supported by “PRIN grant” from the Ministry of University and Reseacrh – MIUR (Italy).