Personalized nanomedicine for improved anticancer therapeutics

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The identification of druggable targets in metastasis is a promising strategy to improve the outcome and overall survival of metastatic cancer. Metastasis is indeed the major cause of death in cancer patients with solid tumors, and, as a matter of that, for Non-Small Cell Lung Cancer (NSCLC), the 5- year mean survival is lower than 5% in a metastatic setting. Following a patient-driven approach, we have identified TAS1R3, a novel and druggable oncology target that plays a role in the metastasis of NSCLC and has potential in other cancers (1). We have obtained solid evidence regarding the role of TAS1R3 in cancer progression and metastasis, using patient derived samples, in vitro 3D cultures, and in vivo animal models. This new biomarker has additionally the potential for patient stratification, providing a highly valuable tool for interpretable decision making and advancing towards the concept of personalized medicine.

We aim to develop nanomedicines targeted to TAS1R3, to specifically deliver anticancer drugs to early-stage metastasis, to interrupt progression to overt metastasis, and to ultimately improve survival.

In our research group, we have developed stable nanometric emulsions, with a simple composition based on natural lipids, which are non-toxic and can be tailored to accommodate different kind of molecules, such as miRNA, plasmids, peptides, proteins, and antibodies (2, 3). As summarized in Figure 1, we are now working on the surface-decoration of the nanosystems with targeted ligands, antibodies and/or aptamers against TAS1R3, on the loading of anticancer drugs to eliminate metastatic resistant cancer cells, and on their radiolabelling with ^{89}Zr for in vivo PET/CT diagnosis. These multifunctional nanosystems will be valuable tools for allowing early detection of TAS1R3 positive metastatic cells and simultaneous treatment, to ultimately interrupt metastasis progression in specific patient subpopulations.

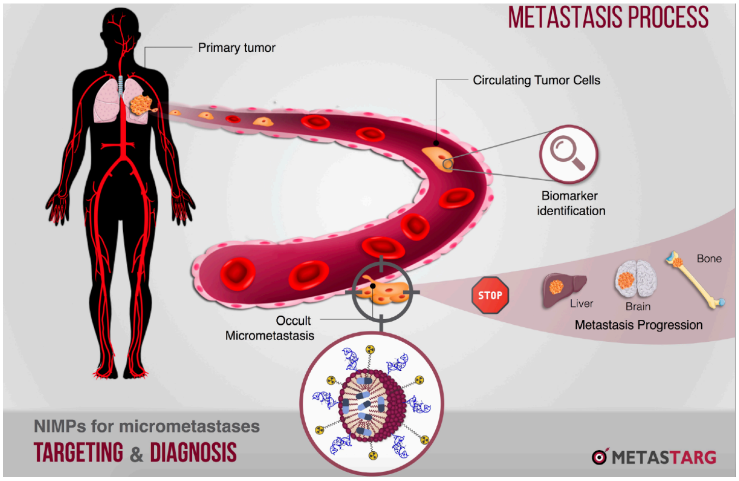

Figure 1: Following a patient-driven approach we aim to develop anticancer nanomedicines specifically targeted to metastasis.

REFERENCES

(1) WO2019138140, filed on January 15th, 2018 before the OEPM, and entitled “Use of the protein TAS1R3 as a therapeutic, diagnostic and/or prognostic biomarker, in tumors that express the protein thereof”; (2) WO2019138139, filed on January 15th, 2018 before the OEPM, and entitled “Nanosystems as selective vehicles”; (3) Bouzo BL, Calvelo M, Martín-Pastor M, Garcia-Fandiño R, de la Fuente M. In Vitro-in Silico Modelling Approach to Rationally Design Simple and Versatile Drug Delivery Systems, J. Phys. Chem. B 2020, 124, 28, 5788-5800.

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