Alexander Golberg

MATISSE

MoleculAr harvesTing with electroporation, microfluidics and nanoparticles for dIagnoSticS and thErapy of heterogeneous solid tumours

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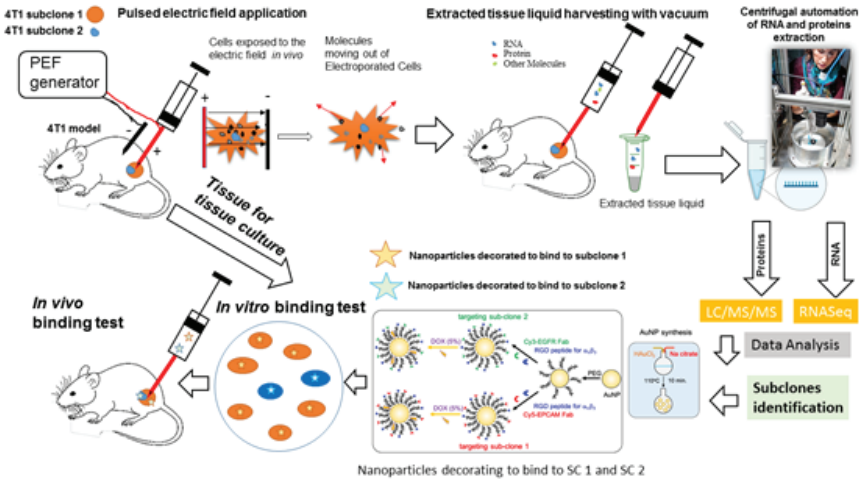

Nanoparticles decorating to bind to SC 1 and SC 2

Genomic variation inside a tumor presents a major challenge hindering application of a personalized medicine approach to cancer diagnostics and therapy. The main goal of the MATISSE project is to overcome this challenge by developing a set of nanotechnology-driven tools for the characterization of tumor genomic variations, and to combine these tools with nanoparticles-based therapies. For diagnostics, we will advance a method for molecular harvesting from tumors by using biological cell membrane permeabilization by electroporation, and integrate it with a centrifugal microfluidic device for rapid sample preparation. For the therapy of heterogeneous tumors, we will tailor gold and silica nanoparticles according to the genetic variations revealed by the diagnostics. Our most recent results show that liquid extraction from tumors with electroporation enables the diagnosis of both benign and cancerous tumors as well as allows to assess the processes of tumor protein production at various locations of the same tumor.

To sum up, in MATISSE we aim 1) to develop a novel device for biomarkers harvesting from solid tissues 2) to determine electric field parameters for proteins and genomic material extraction from solid tumors 3) to develop a microfluidic platform for the automation of sample preparation from electroporated samples (RNA and protein extraction) 4) to develop nanoparticles that will bind selectively to various tumor zones. Solving these challenges will allow for the translation of technological advances in the areas of electroporation, microfluidics, and nanoparticles into the novel, highly relevant for cancer research, method for characterization of heterogenous tumors.