Organs-on chips as smart in vitro tools for dissecting heterogeneous cancer models

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In the age of immunotherapy and single-cell genomic profiling, cancer biology requires novel *in vitro* and computational tools for investigating the tumor-immune interface in a proper spatiotemporal context. The tumor microenvironment is a complex tissue where cancer cells continuously interact and dynamically co-evolve with the other cellular components (immune, stromal, and endothelial cells) and a chemical/physical landscape (i.e, the extracellular matrix constituents, released soluble factors). In this context immune cells may play as friends or foes of malignant cells, thus strongly affecting both disease progression and response to therapy.

Bridging the gap between animal studies and traditional *in vitro* methods, advances in microfluidics and co-culturing techniques give access to different classes of micro-engineered cellular models such as organoids, micro-physiological systems (MPS), and organs-on-chip (OOC). They share the common trait to expand the *in vitro* potential to control microenvironmental factors while exploiting high-content microscopy and advanced image processing approaches.

State-of-art of microfluidic models for onco-immunology applications will be presented as observation windows for understanding the role of immune contexture in cancer progression and resistance mechanisms, compatible with dynamic, multiparametric monitoring and visualization of cellular functions.