Exploiting Microfluidic chips to investigate cancer and immune cells crosstalk

Fabrizio Mattei
Department of Oncology and Molecular Medicine - Istituto Superiore di Sanità

Cancer cells interact with immune system at multiple levels and in different spatio-temporal scenarios. In order to efficiently develop anti-tumor therapeutic strategies, a deep knowledge of the crosstalk between cancer cells and immune cells is pivotal. In this context, nanotechnology-based microfluidic platforms represent an innovative tool for modeling cancer-immune communications allowing tight control of the microenvironment and real-time monitoring of multiple cell type interactions with minimum amount of cells and drugs required. By using liquid-based and gel-based microfluidic chips, we show here the on-chip crosstalk between immune cells and cancer cells in three distinct therapeutic settings: i) the response of a single patient to a defined chemotherapy, ii) the anti-cancer efficacy of a combined regimen of treatments in comparison to single agents, and iii) the behavior of a defined immune cell subset following immunotherapy. Together, our studies demonstrate that combining the versatility of microfluidic chips with the potential of cellular imaging enable to collect quantitative data from complex biological systems at a single-cell level. In a medical context, microfluidic chips may be view as a bridge connecting conventional *in vitro* and *in vivo* studies with clinical applications for the development of novel immunotherapeutic protocols and for personalized medicine.