Miniaturized microfluidic platforms (Lab-on-chip/Organ-on-chip) for medical diagnostics, monitoring and drug screening

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Microphysiological systems, organ-on-chip and multiorgans microdevices attracted considerable attention as novel tools for high-throughput and high-content research to achieve an improved understanding of diseases and to accelerate the drug development process towards more precise and personalized standards. An organ-on-chip is a miniaturized device that can mimic the functional unit of an organ and simulate human pathophysiology by also incorporating mechanical and chemical stimuli[1, 2]. Here we report the development of an Intestine-on-chip model, made in polydimethylsiloxane (PDMS), to recreate the intestinal epithelium-endothelium interface so as to have a tool for screening drugs used in the treatment of chronic gastrointestinal diseases and colorectal cancer [3]. Moreover, to take full advantage of capabilities of these microfluidic devices, they should be combined with efficient analytical methods. A recent trend is to make a device that integrates several functions that usually take place in the laboratory. These devices are named Lab-on-chip and offer great opportunities to enable continuous, automated data collection and in situ monitoring of functional indicators and biological responses, attracting great interest for medical diagnostics and drug screening. Such biochips were demonstrated to be suitable for ultrasensitive detection of biomarkers in flow immunoassays providing tools useful to achieve a diagnosis of tumours (or other diseases) and monitor their evolution by liquid biopsy approaches [4-7]. Electrochemical impedance spectroscopy, coupled with the chip, enables proliferation, viability, and migration assays to be performed on a cell population, thus making the platform suitable for conducting pharmacological studies and learning more about the disease.[8] [9-12]

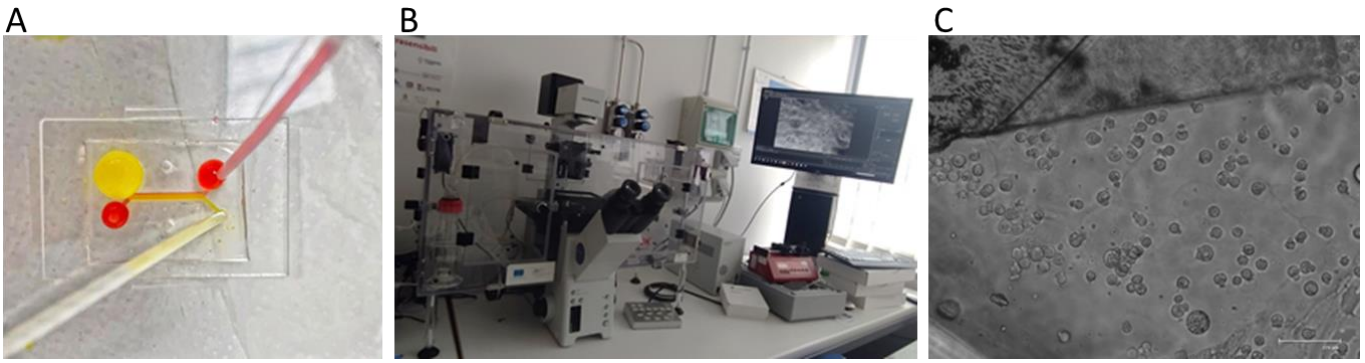

Fig.1. A) Foto del dispositivo sottoposto a test di flusso con Elve flow OB1MK3 con coloranti alimentari (rosso e giallo). B) Foto del sistema incubatore (Okolab)+ microscopio dove è stato tenuto in coltura per 3 giorni il dispositivo con all'interno cellule umane di adenocarcinoma al colon-retto (Caco-2). C) Immagine presa dal microscopio Evos Floid Invitrogen delle cellule Caco-2 appena seminate nel chip (scale bar:125 µm)

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