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Assessing Colorectal Cancer in vitro through Smart Bioelectronics

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The generation of in vitro platforms capable of mimicking the in vivo situation as an alternative to animal models and/or monitoring cellular processes is necessary for medicine and drug discovery (1). In this sense, Smart Bioelectronics arise from the combination of smart functional materials, bioelectronics and microfluidics, making a powerful tool to control cellular microenvironments.

Smart functional materials such as poly(N-isopropylacrylamide) (pNIPAAm) can undergo structural changes due to their inherent lower critical solution temperature (LCST) phase transition in water at 32 ºC. On its side, poly(3,4-ethylenedioxythiopene):poly(styrene sulfonate) (PEDOT:PSS) is a widely used conducting polymer in the bioelectronics field, due to its mixed ionic and electronic conduction properties. When mixing both polymers, the developed PEDOT:PSS/pNIPAAm co-polymer modulates cellular adhesion/detachment of cancer cells and the electrochemical monitoring of the process (2,3).

Moreover, PEDOT can be tailored biochemically and mechanically to replicate a specific tissue. PEDOT polymers made in combination with biopolymers and glycosaminoglycans such as collagen and hyaluronic acid can be used in the generation of 3D bioelectronic interfaces with physiologically relevant conditions (4). On the other hand, microfluidic devices offer optical transparency, miniaturization, and controlled media perfusion required in organ-on-a-chip models. The interface between 3D bioelectronics and microfluidic devices enables the real-time electrical and optical monitoring of cellular processes in a controlled microenvironment.

Here, we present an overview of different 2D and 3D Smart Bioelectronic interfaces for the simultaneous electrical and optical monitoring of cancer cell migration.

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