Biofabrication techniques to guide the cellular organization in tissues

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Abstract

Epithelial tissues contain three-dimensional (3D) microstructures that guide cell self-organization at the tissue level. In the small intestine, crypts and finger-like villi microstructures improve its absorbance function, provides specific microenvironments and compartmentalizes cell types [1–3]. Despite its physiological relevance, tissue architecture and multicellular population are neglected in the standard in vitro models, thus compromising their predictive capabilities [4]. Our efforts in addressing these shortcomings by including key elements to mimic the native tissue in vitro will be discussed in this talk. First, this will include strategies to promote cell's self-organization capabilities giving rise to crypt-villus domains on 2D monolayers [5], and strategies to engineer cell spatial positioning through micropatterning. Then, our approach to include the 3D architecture of the tissue will be addressed. In here, light-based biofabrication techniques to produce 3D villus-like structures [6,7] will be discussed. Finally, I will introduce our biofabrication proposal to produce tissue engineered models that include the epithelial and the stromal compartments [8]. Improving the prediction capabilities of cell-based assays is a growing strategy to lead to more efficient drug development processes. As 2D-based systems are showing their limits, new 3D strategies are gaining acceptance among the scientific community [9]. Our approaches aim to further accelerate this trend by providing feasible strategies to routinely incorporate 3D multicellular structures at the tissue level in cell culture systems.

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