Alveoleye – an alveoli-on-a-chip model

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Alveolar tissue displays a highly complex multiscale morphology, composed by a thin epithelial layer organized in a 3D architecture surrounded by a branched capillary network, which nowadays remains difficult to reproduce *in vitro*[1].
Most platforms still rely on flat membranes that poorly recapitulate lung anatomy and physiology, limiting biomimicry of alveolar structure and vascular topology[2].
Here we introduce an alveoli-on-a-chip that integrates a digital light processing (DLP) printed Voronoi-based patterned scaffold (3Dresyn, Bioflex A10 MF), placed directly on a gelatin methacryloyl (GelMA) hydrogel co-laden with human umbilical cord endothelial cells (HUVECs) and lung fibroblasts (MRC-5) to promote capillary morphogenesis. The Voronoi scaffold provides a patterned substrate that recapitulates the alveolar packing inside the lung tissue with physiological pores dimension, generating an alveolar array whithin a circular area for epithelial cell seeding. The GelMA hydrogel is laterally confined by micropillars of the microfluidic chip, while culture medium flows in the adjacent channels. The bottomless chip is DLP-fabricated in Liqcreate BioMed Clear resin and bonded to a cover glass using polydimethylsiloxane (PDMS), enabling easy optical evaluation during cell culture. A removable lid integrates tubing anchors and allows air flow to perform an air-liquid interface cell culture.

This study was carried out within the BREATH project (a Bioprinted alveolaR lung-on-chip devicE to assess The role of inHaled pollutants towards pulmonary fibrosis onset) – funded by European Union – Next Generation EU within the PRIN 2022- PNRR program (D.D. 104 - 02/02/2022 Ministero dell'Università e della Ricerca).

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