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Abstract

A 3D-printed deposition chamber narrows the gap between *in vitro* and *in vivo* respiratory tissue research

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The induction and maintenance of physiological conditions in advanced 3D cell culture models is a prerequisite for mimicking *in-vivo* exposure to environmental particles in *in-vitro* settings. Respiratory tissue models such as air-liquid interface (ALI) cultures have the unique property of an air-exposed apical side that anatomically resembles human and animal airways. When ALI cultures are tested for their immunological response to airborne particles derived from allergens or pathogens, these cultures are usually submerged in a solution containing such airborne particles. This approach has many disadvantages as submerged ALI cultures lose some of their properties such as ciliated cells and their response to airborne particles is drastically altered [1,2].

We aimed to design a 3D printable deposition chamber that would allow the deposition of airborne particles without submerging the ALI cultures, thus mimicking the physiological conditions of particle exposure and coming closer to *in-vivo* conditions.

Firstly, the deposition chamber was designed to be compatible with commercially available nebulizers used to stimulate ALI cultures grown in 24-well culture plates. As the chamber fits exactly into one well, this approach avoids inadvertent particle exposure of the operator or other 24-well insert ALI cultures grown in the same plate. Secondly, the deposition chamber can be printed using commercially available SLA printers. Thirdly, a biocompatible resin can be used which can be autoclaved for multiple uses.

The deposition chamber successfully delivered nebulized particles to the surface of ALI cultures as evidenced by several innate immune responses of airway epithelial cells while maintaining the ALI culture properties.

AUTHOR'S STATEMENT

Conflict of interest: Authors state no conflict of interest. Informed consent has been obtained from all individuals included in this study.
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