A smart breathing alveolus on chip model: concept and applications

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AlveoliX
In-vitro models inspired by nature

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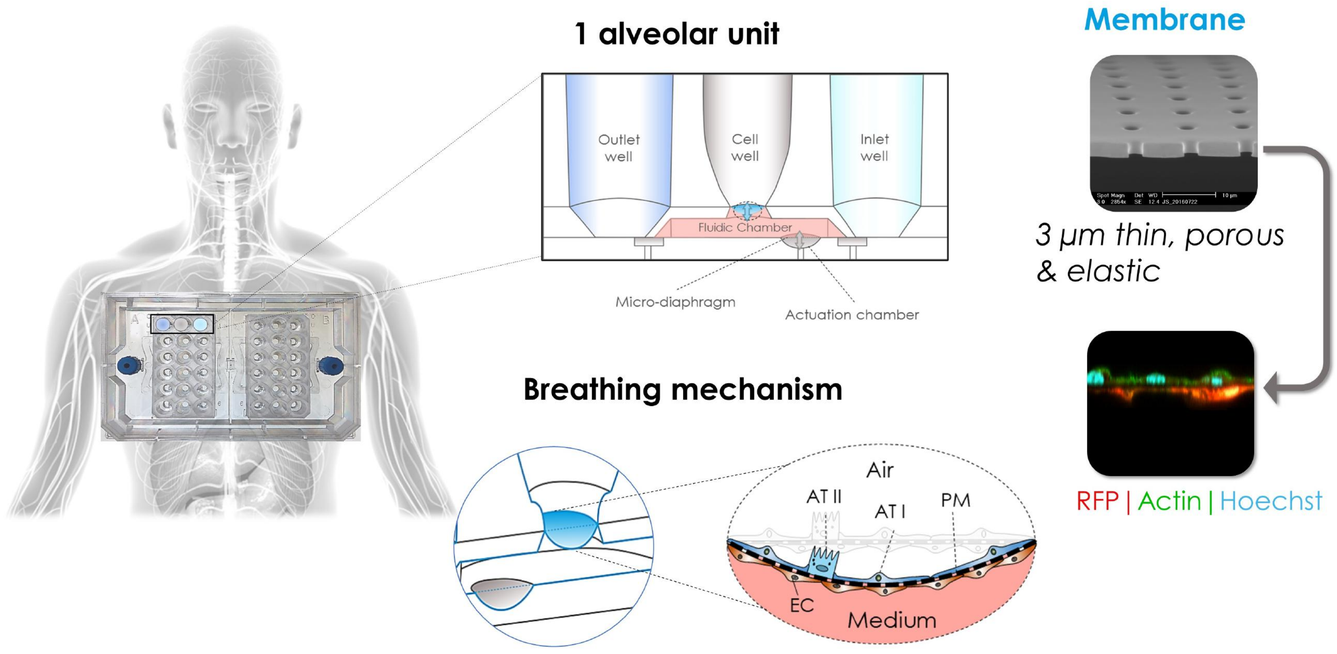
Introduction

Since the introduction of microphysiological systems (MPS), human-based in vitro models are gaining relevance as research instruments in the drug development pipeline and molecule toxicology. Balancing out model complexity, biological relevance and ease of use is key to produce models suited for different applications maximizing the benefit of in vitro systems. In this work we present the **[AX]Lung-on-Chip System**, a barrier model for the alveoli including breathing-like mechanics and an ultrathin, porous and elastic cell support to mimic the alveolar structure. We highlight the key aspects for the development of lung models using this platform and present different applications of this advanced technology.



How to build the model?

1. Cell selection
Primary cells, cell lines, organoids, iPSC:
Alveolar epithelial cells, endothelial cells, fibroblasts, immune cells, etc.

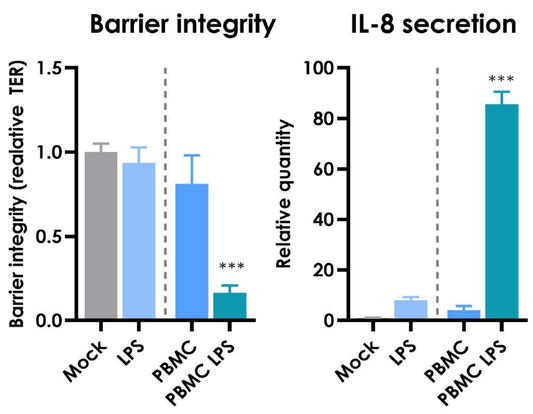
2. Selection of cell culture conditions
Co- vs mono-culture
Breathing dynamics, air-liquid interface

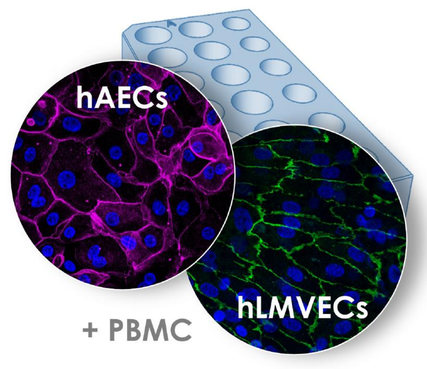
3. Selection of treatment application & read-outs
Application site (air vs blood side)
In liquid vs nebulized
Single vs multiple dose

Lung-on-Chip applications & [AX]Biomodels

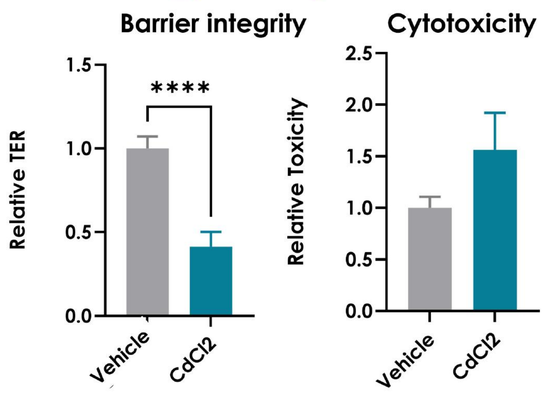
Inflammation, toxicology & safety

Inflammation - LPS

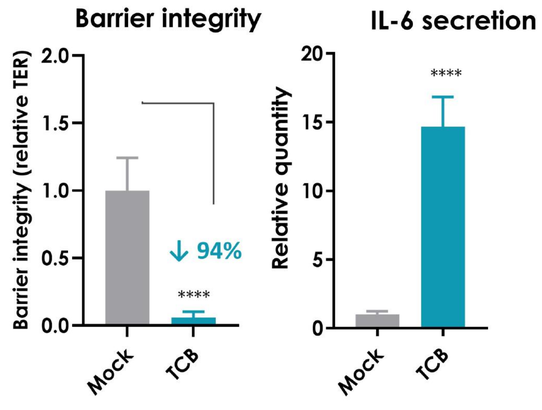




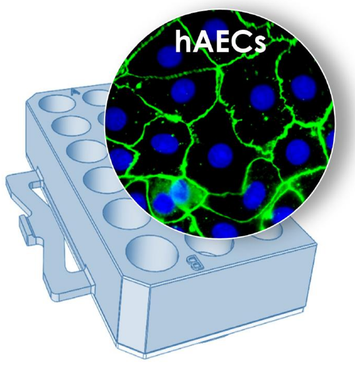
Toxicology - $CdCl_2$



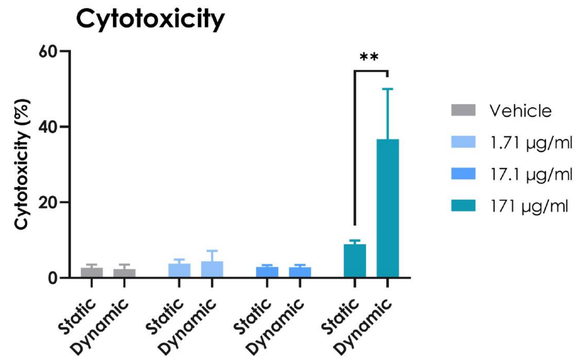
Drug safety – Immunotherapy



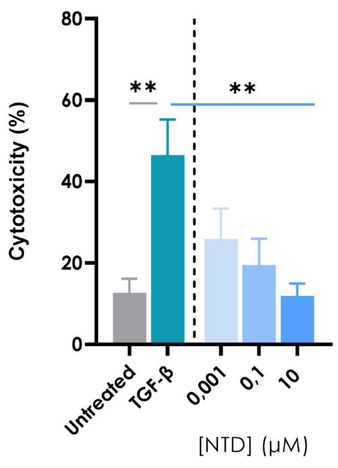
Inhalation, disease modeling & efficacy

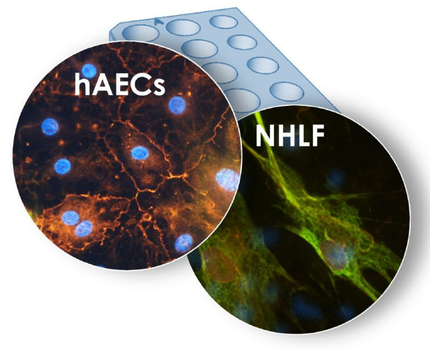


Inhalation toxicology – Nanoparticle Exposure



Disease modeling & efficacy – Pulmonary fibrosis





Conclusions

- Lung MPS such as the **[AX]Lung-on-Chip System** are bringing increasing value to in vitro research with enhanced versatility for different applications.
- By including relevant cell types, physiological cues and clinically relevant endpoints (read-outs), our models allow to gather human-relevant data for more efficient and cost-effective molecule development – toxicity, safety and efficacy testing - as shown by our results in the **inflammation and toxicity** and **lung fibrosis model**