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Title: **Biomimetic *In Vitro* Lung Models: Current Challenges and Future Perspective**

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Abstract

As post-COVID complications, chronic respiratory diseases are one of the foremost causes of mortality. The quest for a cure for this recent global challenge underlines that the lack of predictive *in vitro* lung models is one of the main bottlenecks in pulmonary preclinical drug development. Despite rigorous efforts to develop biomimetic *in vitro* lung models, the current cutting-edge models represent a compromise in numerous technological and biological aspects. Most advanced *in vitro* models are still in the “proof-of-concept” phase with a low clinical translation of the findings. On the other hand, advances in cellular and molecular studies are mainly based on relatively simple and unrealistic *in vitro* models. This perspective discusses the current challenges and potential strategies toward not only bioinspired but truly biomimetic lung models.

Keywords: *In vitro* lung model; lung-on-chip; scaffold design; basement membrane, additive manufacturing