

An air-liquid interface asthma model for drug discovery and development

An *in vitro* human airway model for mechanistic studies and pharmacological evaluation of cytokine driven asthma biology

The problem:

Asthma is a heterogeneous disease affecting approximately 300 million people worldwide. Distinct endotypes, including Th2-driven forms, require targeted therapeutic approaches. Preclinical models that reflect human airway biology remain limited, restricting mechanistic insight and translational drug evaluation.

The Solution

RoukenBio has developed an air-liquid interface (ALI) culture system using primary human airway epithelial cells to model Th2-driven asthma biology.

Under ALI conditions, epithelial cells differentiate into a pseudostratified mucociliary epithelium, including mucus-producing goblet cells. Stimulation with IL-4 and IL-13 enables controlled induction of asthma-like phenotypes (Fig 1). Models can be generated using cells from healthy donors or asthmatic patients.

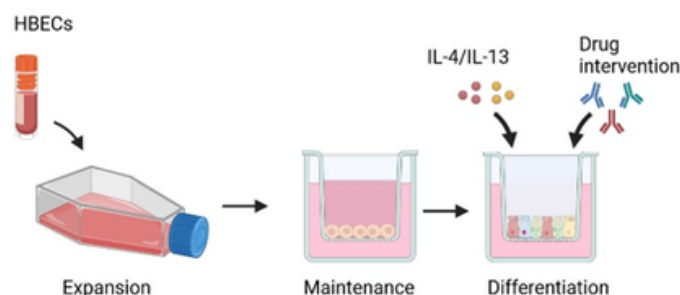
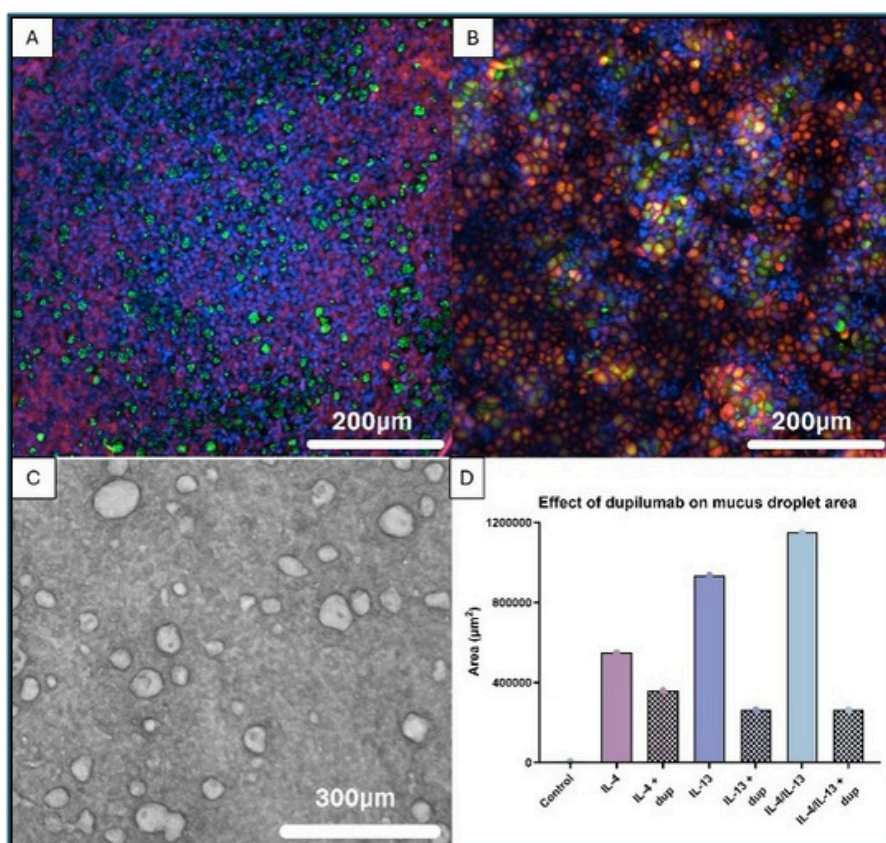


Fig 1. Schematic showing how starting with human bronchiolar epithelial cells (HBECs), followed by expansion and a maintenance phase, asthma-like conditions can be recreated using IL-4 and IL-13. Drug interventions can then be used to assess the model and their specific effect on this Th2-like induced asthma model.

Example Data

- Increased MUC5AC expression and epithelial remodelling observed following IL-13 stimulation in ALI cultures (Fig 2A & B)
- Induction of mucus droplet formation provides a quantifiable functional readout (Fig 2C)
- Reduction in mucus-associated readouts following IL-4 and IL-13 pathway inhibition, for example with dupilumab, supports model responsiveness (Fig 2D)

Fig 2. Immunofluorescent staining of MUC5AC (green) and CK5 (red) in normal (A) and IL-13-stimulated (B) ALI cultures, showing increased MUC5AC expression and epithelial remodelling following stimulation. DAPI nuclear counterstain. Scale bar 200 μ m. Mucus droplet formation in ALI cultures following IL-13 stimulation (C, scale bar 300 μ m) and effect of dupilumab (dup, 150 ng/ml) on mucus droplet area (D, day 21).



Applications

- Evaluation of IL-4 and IL-13 pathway inhibitors, including receptor-targeting biologics and small molecules
- Functional assessment of compound activity on airway epithelial responses, including mucus production and secreted mediators
- Comparative profiling of compound effects in healthy versus disease-derived airway cells
- Early assessment of epithelial responses to inform safety and tolerability

Key Benefits

Physiologically relevant

⊕ Differentiated mucociliary epithelium reflects airway structure more closely than submerged cultures.

Pharmacological responsiveness

⊕ The model responds to inhibition of IL-4 and IL-13 signalling, enabling functional evaluation of targeted therapies.

Controlled disease induction

⊕ Cytokine stimulation enables reproducible modelling of Th2-associated biology.

Configurable system

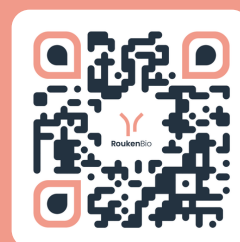
⊕ Donor source and stimulation conditions allow modelling across different disease contexts.

Quantifiable outputs

⊕ Includes mucus production and analysis of secreted factors from apical and basal compartments.

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To explore how this model could support your programme.



RoukenBio - The CRO redefined

Backed by our brilliant minds, we have turned the traditional CRO model on its head, by fostering a collaborative and personalised approach. Our mission is simple:

Solve problems. Deliver quality data. Propel your drug discovery breakthroughs.

United by a passion to make sense of complexities and overcome challenges, we apply our specialised knowledge to big-picture thinking. We will explore every option to deliver over and above for your project.

We are thought leaders with a deep understanding of immunology, bioassays, molecular biology and a track record of groundbreaking discoveries and novel cell-based tools.

Contact hello@rouken.bio for more information, or visit www.rouken.bio