



## **Tissue Engineered In Vitro Human Airway Models (EpiAirway™) of Asthma and COPD**

PJ Hayden, GR Jackson, J Bolmarcich and M Klausner. MatTek Corporation, Ashland, MA, USA.

**INTRODUCTION:** Asthma and chronic obstructive pulmonary disease (COPD) are the two leading chronic respiratory diseases in the US. However, reliable in vitro human models are not widely available to researchers attempting to understand asthma and COPD pathogenesis and develop therapeutic interventions for these diseases. Here we report on a program to create and maintain a human cell bank derived from airway epithelium of diseased individuals, and production of tissue engineered in vitro human models of asthma and COPD from the cells.

**METHODS:** Tracheal and bronchial tissues are obtained from non-transplantable organs donated from normal, asthmatic or COPD individuals with IRB approval and informed consent. Epithelial and mesenchymal cells are isolated from the tissues, cryopreserved and maintained in a cell bank. As needed, cell are recovered and utilized to produce in vitro tissue engineered models.

**RESULTS:** Tissue engineered models are cultured at the air-liquid interface and consist of well-differentiated human tracheal/bronchial epithelium (EpiAirway™) as well as human airway epithelium co-cultured with donor-matched human airway mesenchymal cells (EpiAirway-FT™). Twelve donor-specific models were produced (4 each from normal, asthma and COPD donors). H&E stained paraffin sections show development of pseudostratified epithelium with mucociliary phenotype similar to in vivo proximal airway epithelium. Transmission electron microscopy shows development of tight junctions and transepithelial electrical resistance measurements demonstrate barrier function.

**CONCLUSIONS:** These in vitro human models of asthma and COPD provide important unique attributes that animal models cannot provide, including the ability to address human individual variability and genetic factors and a means to determine mechanisms of human virus elicitation of asthma and COPD exacerbations. These models will provide researchers important new tools for investigating the role of airway epithelium and mesenchymal cells in asthma and COPD pathogenesis and development and testing of new therapeutic treatments for these diseases.

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