AAIR Charity
ASTHMA, ALLERGY & INFLAMMATION RESEARCH

Research Award:

Expansion of an ex vivo primary respiratory epithelial cell model to facilitate primary ciliary dyskinesia airway research

Awarded to: Dr Claire Jackson Amount: £8,574 (Feb 2018 – Jan 2022)

Lay summary

Patients are referred to our national primary ciliary dyskinesia (PCD) service for a series of specialist clinical and laboratory tests on their airway cilia. Airway cilia (moving hair-like structures) normally sweep away mucus and clean the airway of harmful microbes. In PCD patients' cilia are abnormal and a lack of airway 'clearance' causes progressive lung disease. In our laboratory we culture cells from nasal brushings to model the patient's airway. This model is important diagnostically to confirm PCD, decide difficult cases or replace low quality samples. It is also used for research to characterise the different types of PCD and investigate why patients are more prone to infection. We have also used this model to investigate how nasal cells respond during infection and drug treatments.

Culture success depends on the health and number of 'basal epithelial cells' retrieved from nasal brushing samples. In 2017, we were challenged by two main issues. Firstly, only 54% of cultured patient's cells were suitable for analysis with an average cilia coverage of 10%. Secondly, samples from PCD positive patients are infrequent creating a need for a reliable storage method to stock rare samples for research. AAIR funding supported us to developed a new method in order to improve success rates. We achieved a culture success rate of 96% with an average cilia coverage of 39%.

Surplus nasal brushing samples (n=181, up to November 2020) were frozen in liquid nitrogen; 39 samples were cultured after cryo-storage. All defrosted samples ciliated in culture and provided good quality and widespread ciliated samples fit for diagnostic processing and research.

An internal service audit of patient referral sample from January 2007- January 2020 (pre-pandemic) showed that culture success stably increased from 2018 (new protocol) with a simultaneous reduction in patient samples. We suggest that the improved culture protocol helped to reduce patient-recall for repeat brushing biopsies, because results from healthier culture-samples improved diagnostic certainty.

Coles JL, Thompson J, Horton KL, Hirst RA, Griffin P, Williams GM, Goggin P, Doherty R, Lackie PM, Harris A, Walker WT, O'Callaghan C, Hogg C, Lucas JS, Blume C, Jackson CL. A Revised Protocol for Culture of Airway Epithelial Cells as a Diagnostic Tool for Primary Ciliary Dyskinesia. J Clin Med. 2020 Nov 21;9(11):3753. doi: 10.3390/jcm9113753. PMID: 33233428; PMCID: PMC7700393. (10 citations, May 2022) AAIR grant support was acknowledged:

- "Expansion of an ex vivo primary respiratory epithelial cell model to facilitate primary ciliary dyskinesia airway research"/AAIR Charity
- 200470/Research for Patient Benefit Programme

Preliminary data from this project allowed us to secure further funding by the Research Management Committee (Faculty of Medicine) enabling us to establish a biobank of nasal epithelial cells from cystic fibrosis patients, a rare genetic disease. This biobank allowed us then to secure a further grant from the British Lung Foundation exploring

the impact of the lipid membrane profile on biofilm formation during Pseudomonas infections. Data from this study was presented at the FOM conference in 2020 acknowledging AAIR support.
'A BIO-RESOURCE OF AIRWAY EPITHELIAL CELLS FROM CYSTIC FIBROSIS PATIENTS; CHARACTERISATION OF STORED AND CULTURED CELLS'

This funding has supported the career development of both Drs Jackson (promotion to level 5) and Blume (permanent lectureship).
