

ATS 2016 Highlights

Respiratory Structure and Function Early Career Professionals

Get to know the members of the RSF Assembly



Charlotte K. Billington, PhD

Research Fellow

The University of Nottingham, UK

[Contact Charlotte](#)

Is your research clinical, basic science or translational?

All of the above!

Tell us about your research?

My research currently has three major themes; (1) The development of a mathematical model to describe the airway remodelling observed in asthma. (2) Determining the functional significance of genes found to be associated with lung function via GWAS. (3) Utilising hyperpolarised Xenon to image the lungs via MRI.

Where do you see yourself in 5 years?

Academia

What do you find is the major benefit of RSF Assembly Membership?

I have found the ATS RSF family to be incredibly inclusive, supportive and fun! The contacts I have made through RSF have enhanced my scientific knowledge, my career, my understanding of how the ATS works and I have made some amazing friends too.

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Mathematical Modelling of Airway Remodelling

Mathematical modelling is an important part of the 3Rs (replacement, reduction and refinement of animals in research).¹ We² seek to describe the airway remodelling observed in asthma by developing new predictive mathematical models³ that are informed by the best biological and clinical information we can obtain. To this end we are using information from previous and novel, specifically tailored, studies including *in vivo*, *in vitro* and *ex vivo* systems. Moreover, we have developed a new histomorphological analysis software tool with which to quantify remodelling in a large cohort of airways.

Our previous mathematical model suggested that speed of resolution of inflammation is critical in determining the severity of airway remodelling⁴. We therefore have a particular interest in the dynamics of inflammation resolution and how this could affect changes in airway smooth muscle mass and extracellular matrix deposition.

Using a previously described ovalbumin mouse model of asthma⁵ we studied markers of inflammation and remodelling for five weeks following the end of the challenge period, thereby tracking these changes throughout a resolution period. Preliminary data suggests a surprisingly rapid return to baseline in airway remodelling as assessed by amount of airway smooth muscle in the ovalbumin asthma model (Figure 1). A key advantage of our semi-automatic histomorphological technique to track inflammation and remodelling is that it allows us to analyse more airways per lung than is usually feasible, thereby providing a large, shared imaging database of remodelled airways. Measured data is used as mathematical modelling input and for validation. The aim will be to use the integrative mathematical model we are developing to identify the key factors responsible for both the remodelling and resolution observed.

- (1)<https://www.nc3rs.org.uk>, (2)Christopher J. Philp, Michael R. Hill, Reuben D. O’Dea, Amanda L. Tatler, Simon R. Johnson, Bindi S. Brook (all University of Nottingham, UK), (3)Hill et al., American Journal of Respiratory and Critical Care Medicine, 193:A7525, 2016, (4)PLoS One, 2014; 14:9(3), (5) J.Immunol, 2011; 1;187(11):6094-107

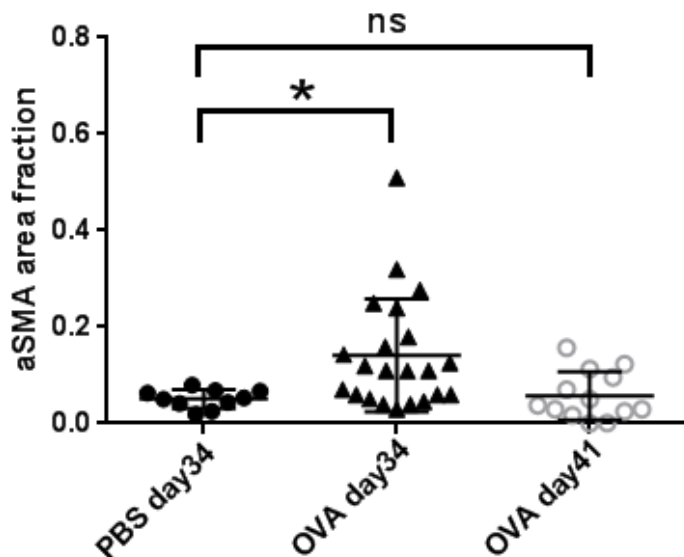


Figure 1. Changes in aSMA Area Fraction. Note the increase in both the mean and deviation from control to OVA at day 34 and the return to near control status at day 41.

aSMA: alpha Smooth Muscle Actin

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