INDIVIDUAL PARTICULATE MUCOCILIARY TRANSIT ANALYSIS USING SYNCHROTRON X-RAY IMAGING

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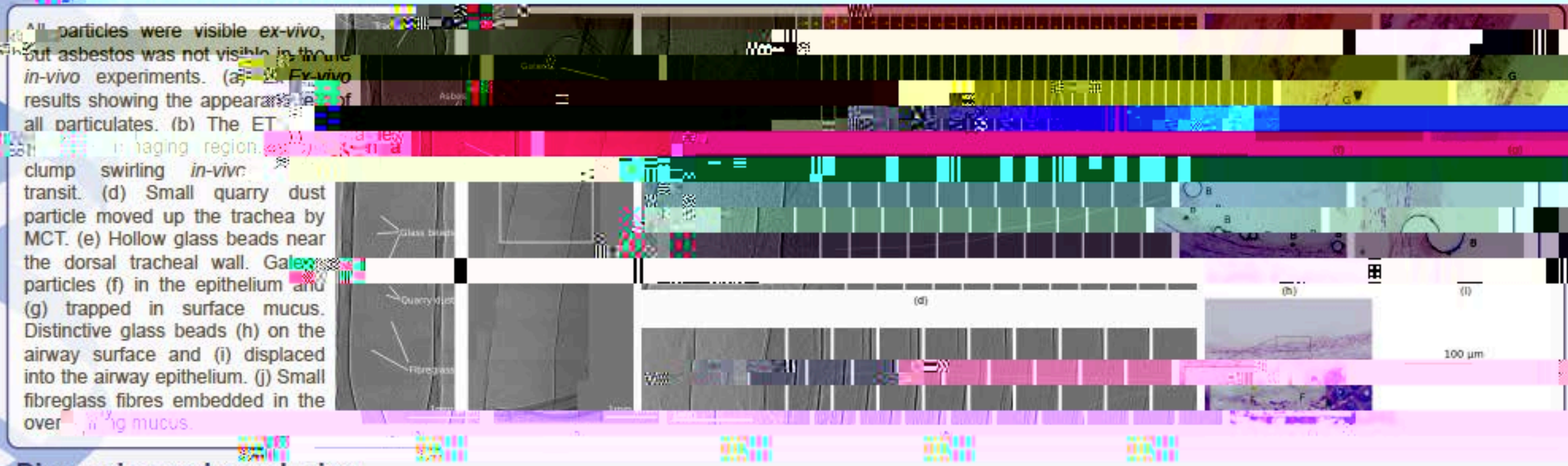
Background

The ability of the airways to move and clear deposited particles is a clear diagnostic indicator of airway health. Prior to the development of synchrotron phase contrast X-ray imaging (PCXI) ... non-invasive detection and tracking of individual particle... movements produced by m... ciliary transit (MCT) ... possible. Since MCT is affected in cystic fibrosis, the ability to quantify MCT in CF disease models could assist in examining airway surface dysfunction and responses to treatment. Using PCXI we have begun to dynamically and non-invasively examined the behaviour of individual pollutan... particle visibility and behaviour.

Materials and Methods

Experiments were performed on the BL20XU beamline at the SPring-8 synchrotron. Asbestos, fibreglass, quarry dust, galena lead ore, and reference hollow silver-coated glass beads were examined. One HOS:HR-1 mouse was humanely killed, the trachea excised, and particulate delivery was tested *ex-vivo*. *In-vivo* then examined in anaesthetised mice (n=15), which were secured head-high on an ... board before the X-ray beam was directed late... doses of 1% w/v particulates in saline were delivered to the trachea via an oral ET

Results



All particles were visible *ex-vivo*, but asbestos was not visible in the *in-vivo* experiments. (a) *Ex-vivo* results showing the appearance of all particulates. (b) The ET ... imaging region. (c) ... clump swirling *in-vivo* ... transit. (d) Small quarry dust particle moved up the trachea by MCT. (e) Hollow glass beads near the dorsal tracheal wall. Gal... particles (f) in the epithelium and (g) trapped in surface mucus. Distinctive glass beads (h) on the airway surface and (i) displaced into the airway epithelium. (j) Small fibreglass fibres embedded in the over... ...g mucus.

Discussion and conclusion

Particle behaviour was related to both the type and size of the particles. Sm... particles moved faster and for longer periods, and we speculate this was because they took longer to be captured on the epithelial surface or in mucus. The transit of all particles was consistently localised to the dorsal tracheal w... Histological ... particles and glass beads ... displaced cilia and surface liquid to lodge into the airway epithelium. This experiment demonstrates that PCXI can provide the ... ability to non-invasively detect and track individual particulates in live airways, and that PCXI techniques are now a valuable addition to the suite of imaging tools available for use in live airway models.