Abstract Submitted
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Circular flow patterns induced by ciliary activity in reconstituted human bronchial epithelium.[1] ANNIE VIALLAT, CNRS, KAMEL KHELLOUFI, PlatOd, DELPHINE GRAS, PASCAL CHANEZ, Aix Marseille univ, AIX MARSEILLE UNIV., CNRS, CINAM, MARSEILLE, FRANCE TEAM, AIX MARSEILLE UNIV., CNRS, INSERM, LAI, MARSEILLE, FRANCE TEAM — Mucociliary clearance is the transport at the surface of airways of a complex fluid layer, the mucus, moved by the beats of microscopic cilia present on epithelial ciliated cells. We explored the coupling between the spatial organisation and the activity of cilia and the transport of surface fluids on reconstituted cultures of human bronchial epithelium at air-liquid interface, obtained by human biopsies. We reveal the existence of stable local circular surface flow patterns of mucus or Newtonian fluid at the epithelium surface. We find a power law over more than 3 orders of magnitude showing that the average ciliated cell density controls the size of these flow patterns, and, therefore the distance over which mucus can be transported. We show that these circular flow patterns result from the radial linear increase of the local propelling forces (due to ciliary beats) on each flow domain. This linear increase of local forces is induced by a fine self-regulation of both cilia density and orientation of ciliary beats. Local flow domains grow and merge during ciliogenesis to provide macroscopic mucus transport. This is possible only when the viscoelastic mucus continuously exerts a shear stress on beating cilia, revealing a mechanosensitive function of cilia.

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