Abstract Submitted
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Long-range self-organization of ciliary activity and flow patterns in reconstituted bronchial epithelium[1] ANNIE VIALLAT, Aix Marseille University, CNRS, ETIENNE LOISEAU, SIMON GSELL, UMBERTO D'ORTONA, JULIEN FAVIER, aix marseille university, CINAM TEAM, M2P2 TEAM — Mucociliary clearance is the active transport of a complex fluid, mucus, along the airway epithelial surface. Mucus is propelled over tens of centimeters by the beating of billions of active cilia carried by the epithelial ciliated cells. How the necessary coordination of beat directions emerges during ciliogenesis and is maintained is still an open debate. Would the collective motions of ciliary beats involve the dynamics interaction between cilia as observed in long range interaction in active matter systems ? The direction of ciliary beats is constrained by the long-range hydrodynamic forces created by distant cilia and mediated by mucus, and by the planar polarity of the tissue. Here, after highlighting the spontaneous emergence and growth of mucus swirls during ciliogenesis, we show that mucus is necessary to generate and maintain a global swirl, associated with a strong circular directional order of ciliary beats, spanning the whole culture. By showing that large-scale swirl and ciliary order are lost and then recovered by successively removing and adding mucus to the epithelial surface, we demonstrate that the hydrodynamic force exerted locally on each cilium by the mucus flow, itself resulting from the beats of all the cilia of the epithelium, induces its active reorientation. These results are discussed in light of a hydrodynamic model which captures the observed mucus flow patterns.

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