Generation of Fluid Flows On The Skin of *Xenopus* Embryo

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Multiciliated cells(MCC) are ubiquitous in living systems. They support physiological functions ranging from the locomotion of marine organisms to the transport of fluid in brain and respiratory tracts [1]. Such ciliated epithelia is also found on the skin of the embryo of amphibian frog, *Xenopus laevis,* when its immune system is not yet functional and then disappears during development [2]. This suggests that the ciliated epithelium supports the function of pathogen clearance by generating fluid flows at the surface of the embryo. In *Xenopus* epithelium, MCCs are regularly distributed and the implication of this precise distribution on the flow pattern is unknown. By combining an experimental setup using cultured explant and numerical simulations, we show how the organization of MCC is affecting the fluid flow. We use a 2D numerical model based on the Lattice Boltzmann method to predict the flow fields generated by the beating ciliated cells and then validate the model using experimental data [3]. We also show how the spatial coverage of MCC within an epithelium is optimized for the emergence of fluid flow and its associated biological function.

[1] Mitchell D.R, Advances in Experimental Medicine and Biology, vol 607, Springer (2007)

[2] Boutin, C., Kojabachian, L., CURR Opin Genet Dev; 56. 1-7 (2019)

[3] Gsell, S., Loiseau, E., D'Ortona, U. *et al.* Hydrodynamic model of directional ciliary-beat organization in human airways. *Sci Rep* 10, 8405 (2020)