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Evidence of streaming-related irreversibility and mixing in low Reynolds number acinar flows[1] HARIBALAN KUMAR, CHING-LONG LIN, Department of Mechanical and Industrial Engineering, The University of Iowa, MERRYN H. TAWHAI, Auckland Bioengineering Institute, The University of Auckland, ERIC A. HOFFMAN, Department of Radiology, Internal Medicine and Biomedical Engineering, The University of Iowa — Understanding kinematic irreversibility and mixing deep in the lung helps improve particle retention estimates and hence provide better drug delivery strategies. The time-periodic low-Reynolds number flow in the tiny alveolar units can be computed using an open cavity configuration. Steady streaming is found to hold the key to the origin of irreversibility and dispersion in the duct, cavity mouth and within the cavity. The mechanism of steady streaming is hydrodynamic in nature. The results of tracer advection and mixing rates are used to quantify the irreversibility and mixing resulting from this streaming. The effect of varying Strouhal numbers, Reynolds numbers and geometrical parameters on the resulting mixing are also investigated. This streaming mechanism may provide a route to explaining dispersion observed in bolus experiments deep in the lung.

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Haribalan Kumar
Dept of Mechanical and Industrial Engineering, The University of Iowa

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