Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Hydrodynamics of inhalant flow at intermediate Reynolds numbers: implications for feeding, sensing, and respiration[1] JOHN CRIMALDI, University of Colorado — Many organisms inhale ambient fluid through an orifice for purposes of feeding, sensing, or respiration. Surprisingly, the dynamics of these fundamental flows, as well as implications for associated ecological processes, are not well understood. I will describe experimental and numerical investigations of idealized inhalant flows through a round tube in the intermediate Reynolds number (Re) range of 1-100. The flow depends strongly on Re due to enhanced viscous effects at lower Re. The ecological function of the flow can be quantified in terms of two simple metrics: the region of influence (ROI), which describes the spatial extent of the active flow field, and the inhalation volume, which describe the original distribution of fluid that is subsequently inhaled. At lower Re, diffusion entrains an increasing volume of fluid over time, enlarging the ROI indefinitely. In some cases, the flow spatially bifurcates, with some fluid being inhaled through the orifice and some bypassing into recirculation. At higher Re, inward advection dominates outward viscous diffusion and the flow remains in an inviscid state. The ROI and inhalation volume are strongly dependent on Re and the height of the orifice above the substratum, suggesting that organisms could alter these parameters to achieve specific inhalation criteria.

[1]This work was supported by the NSF, under Grant No. OCE 1260199.

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Date submitted: 31 Jul 2017 Electronic form version 1.4