Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Measurement of flow and dispersion in an in-vitro model of a single human alveolus[1] SUDHAKER CHHABRA, AJAY PRASAD, University of Delaware — The acinar region of the lung consists of alveoli and respiratory bronchioles. Alveoli are the smallest units which participate in gas exchange with the blood. Alveoli can also be exploited as a delivery site for inhaled therapeutic aerosols. While gas transport is governed primarily by diffusion due to the small length scales associated with the acinar region (of the order of 500 microns), the transport and deposition of inhaled aerosol particles is influenced by convective airflow patterns. The current work focuses on measuring the airflow patterns in the acinar region using an in-vitro model of a single alveolus located on a bronchiole. The model consists of a single transparent $5/6^{th}$ hemispherical oscillating alveolus attached to a rigid circular tube. The alveolus, fabricated from an elastic latex film, is capable of expanding and contracting in phase with the oscillatory flow through the rigid tube. Realistic breathing conditions were achieved by matching Reynolds and Womersley numbers. Particle image velocimetry was used to measure the resulting flow patterns. Data will be presented to show the effect of oscillatory flow in the bronchiole and alveolar wall motion on the flow and dispersion within the alveolus. In particular, measurement of the recirculating flow within the alveolus, and the fluid exchange between the bronchiole and the alveolus provide insights for the transport, mixing and deposition of inhaled aerosols.

[1]Funded by Philip Morris USA Inc. and Philip Morris International.

Ajay Prasad
University of Delaware

Date submitted: 26 Jul 2006 Electronic form version 1.4