Abstract Submitted
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Multiscale Airflow Model and Aerosol Deposition in Healthy and Emphysematous Rat Lungs[1] JESSICA OAKES, ALISON MARSDEN, Dept. of Mechanical and Aerospace Eng., University of California, San Diego, USA, CELINE GRANDMONT, INRIA Paris-Rocquencourt, France, CHANTAL DARQUENNE, Dept. of Medicine, University of California, San Diego, USA, IRENE VIGNON-CLEMENTEL, INRIA Paris-Rocquencourt, France — The fate of aerosol particles in healthy and emphysematic lungs is needed to determine the toxic or therapeutic effects of inhalable particles. In this study we used a multiscale numerical model that couples a 0D resistance and capacitance model to 3D airways generated from MR images. Airflow simulations were performed using an in-house 3D finite element solver (SimVascular, simtk.org). Seven simulations were performed; 1 healthy, 1 uniform emphysema and 5 different cases of heterogeneous emphysema. In the heterogeneous emphysema cases the disease was confined to a single lobe. As a post processing step, 1 micron diameter particles were tracked in the flow field using Lagrangian particle tracking. The simulation results showed that the inhaled flow distribution was equal for the healthy and uniform emphysema cases. However, in the heterogeneous emphysema cases the delivery of inhaled air was larger in the diseased lobe. Additionally, there was an increase in delivery of aerosol particles to the diseased lobe. This suggests that as the therapeutic particles would reach the diseased areas of the lung, while toxic particles would increasingly harm the lung. The 3D-0D model described here is the first of its kind to be used to study healthy and emphysematic lungs.

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