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Development of a 3D to 1D Particle Transport Model to Predict Deposition in the Lungs[1] JESSICA M. OAKES, INRIA Paris-Rocquncourt, UC Berkeley, CELINE GRANDMONT, INRIA Paris-Rocquncourt, UPMC Universite Paris 6, SHAWN C. SHADDEN, UC Berkeley, IRENE E. VIGNON-CLEMENTEL, INRIA Paris-Rocquncourt, UPMC Universite Paris 6 — Aerosolized particles are commonly used for therapeutic drug delivery as they can be delivered to the body systemically or be used to treat lung diseases. Recent advances in computational resources have allowed for sophisticated pulmonary simulations, however it is currently impossible to solve for airflow and particle transport for all length and time scales of the lung. Instead, multi-scale methods must be used. In our recent work, where computational methods were employed to solve for airflow and particle transport in the rat airways (Oakes et al. (2014), Annals of Biomedical Engineering, 42: 899-914), the number of particles to exit downstream of the 3D domain was determined. In this current work, the time-dependent Lagrangian description of particles was used to numerically solve a 1D convection-diffusion model (trumpet model, Taulbee and Yu (1975), Journal of Applied Physiology, 38: 77-85) parameterized specifically for the lung. The expansion of the airway dimensions was determined based on data collected from our aerosol exposure experiments (Oakes et al. (2014), Journal of Applied Physiology, 116: 1561-8). This 3D-1D framework enables us to predict the fate of particles in the whole lung.

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