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Fluid-Structure Interactions and Microparticle Transport in Pulmonary Alveoli SAMIR GHADIALI, HANNAH DAILEY, Lehigh University, Dept of Mechanical Engineering, Bioengineering Program — The transport of micron-size particles in the lung has important implications for both respiratory disorders and drug delivery systems. During breathing, the expansion of pulmonary alveoli produces sub-ambient pressures that draw airflow into the lung. The fate of inhaled microparticles during breathing will depend on both particle properties and the complex transient flow fields generated by alveolar wall motion. In this study, fluid-structure interaction (FSI) models are used to evaluate the effects of breathing rates, particle size, tissue viscoelasticity and surface tension forces on microparticle transport. In addition to fluid and solid dynamic equations, these models solve a particle equation of motion that includes both Brownian diffusion and gravitational terms. Our results indicate that Brownian diffusion is the dominant mechanism of transport for particles smaller than one micron and that the elastic properties of alveolar tissues can significantly affect particle deposition. Particles larger than 0.5 microns also experience significant gravitational sedimentation, while convection forces become increasingly dominant for larger particles and faster breathing rates. These results may be useful in designing improved drug delivery systems and in establishing new threshold levels for exposure to viral agents. Supported by the NSF and Parker B. Francis Foundation.

Prefer Oral Session
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