Abstract Submitted
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Surfactant Delivery into the Lung JAMES GROTBERG, University of Michigan, MARCEL FILOCHE, Ecole Polytechnique — We have developed a multiscale, compartmentalized model of surfactant and liquid delivery into the lung. Assuming liquid plug propagation, the airway compartment accounts for the plug's volume deposition (coating) on the airway wall, while the bifurcation compartment accounts for plug splitting from the parent airway to the two daughter airways. Generally the split is unequal due to gravity and geometry effects. Both the deposition ratio R_D (deposition volume/airway volume), and the splitting ratio, R_S, of the daughters volumes are solved independently from one another. Then they are used in a 3D airway network geometry to achieve the distribution of delivery into the lung. The airway geometry is selected for neonatal as well as adult applications, and can be advanced from symmetric, to stochastically asymmetric, to personalized. R_D depends primarily on the capillary number, Ca, while R_S depends on Ca, the Reynolds number, Re, the Bond number, Bo, the dose volume, V_D, and the branch angles. The model predicts the distribution of coating on the airway walls and the remaining plug volume delivered to the alveolar region at the end of the tree. Using this model, we are able to simulate and test various delivery protocols, in order to optimize delivery and improve the respiratory function.

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