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Surfactants and the Mechanics of Respiration. ABDULRAHMAN JBAILY, ANDREW J. SZERI, University of California, Berkeley — Alveoli are small sacs found at the end of terminal bronchioles in human lungs with a mean diameter of 200 μm. A thin layer of fluid (hypophase) coats the inner face of an alveolus and is in contact with the air in the lungs. The thickness of this layer varies among alveoli, but is in the range of 0.1 to 0.5 μm for many portions of the alveolar network. The interfacial tension σ at the air-hypophase interface tends to favor collapse of the alveolus, and resists its expansion during inhalation. Type II alveolar cells synthesize and secrete a mixture of phospholipids and proteins called pulmonary surfactant. These surfactant molecules adsorb to the interface causing σ to decrease. For example, σ of water at body temperature is $\approx$70 mN/m and falls to an equilibrium value of $\approx$25 mN/m when surfactants are present. Also, in a dynamic sense, it is known that σ is reduced to near 0 during exhalation when the surfactant film compresses. In this work, the authors develop a mechanical and transport model of the alveolus to study the effect of surfactants on various aspects of respiration. The model is composed of three principal parts: (i) air movement into and out of the alveolus; (ii) a balance of linear momentum across the two-layered membrane of the alveolus (hypophase and elastic wall); and (iii) a pulmonary surfactant transport problem in the hypophase. The goal is to evaluate the influence of pulmonary surfactant on respiratory mechanics.

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