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Periciliary Layer as a Protective Barrier of Human Airways¹ LI-HENG CAI, BRIAN BUTTON, RICHARD BOUCHER, MICHAEL RUBINSTEIN, University of North Carolina at Chapel Hill — The human airway surface layer consists of an overlaying gel-like mucus layer and a lower periciliary layer (PCL) protecting epithelial surface from mucus and the pathogens it contains. We investigated the permeability of the PCL using polymers that can readily penetrate through mucus. We found that in dilute solutions dextran larger than ~ 30 nm are excluded from the PCL, whereas dextran smaller than that can penetrate the PCL. The penetration depth increases (distance of dextran from epithelial surface decreases) as the dextran size decreases. We also found that the PCL can be compressed by semidilute solutions of dextran larger than 50 nm with concentration above a certain value, at which the solution correlation length (osmotic pressure) is about 30 nm (300 Pa). Above this concentration the height of the PCL decreases with the increasing concentration (osmotic pressure). The dependence of the PCL height on correlation length for semidilute solutions that compresses it is similar to the dependence of distance from cell surface on dextran size for the case of the PCL penetration by smaller polymers from dilute solutions. Our results suggest that the PCL protects the airways by limiting the penetration of inhaled infectious particles.

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