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Dynamics of Individual cilia to external loading- A simple one dimensional picture VINAY SWAMINATHAN, Curriculum in Applied Sciences and Engineering, UNC- Chapel Hill, DAVID HILL, Cystic Fibrosis/Pulmonary Research and Treatment Center, UNC- Chapel Hill, R. SUPERFINE, Department of Physics and Astronomy, UNC- Chapel Hill, THE VIRTUAL LUNG PROJECT TEAM — From being called the cellular janitors to swinging debauchers, cilia have captured the fascinations of researchers for over 200 years. In cystic fibrosis and chronic obstructive pulmonary disease where the cilia loses it's function, the protective mucus layer in the lung thickens and mucociliary clearance breaks down, leading to inflammation along the airways and an increased rate of infection. The mechanistic understanding of mucus clearance depends on a quantitative assessment of the axoneme dynamics and the maximum force the cilia are capable of generating and imparting to the mucus layer. Similar to the situation in molecular motors, detailed quantitative measurements of dynamics under applied load conditions are expected to be essential in developing predictive models. Based on our measurements of the dynamics of individual ciliary motion in the human bronchial epithelial cell under the application of an applied load, we present a simple one dimensional model for the axoneme dynamics and quantify the axoneme stiffness, the internal force generated by the axoneme, the stall force and show how the dynamics sheds insight on the time dependence of the internal force generation. The internal force generated by the axoneme is related to the ability of cilia to propel fluids and to their potential role in force sensing.

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