Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Model Cilia - Experiments with Biomimetic Actuable Structures and Surfaces R. LLOYD CARROLL, DAN BLUM, BEN EVANS, RICH SUPERFINE, University of North Carolina at Chapel Hill — The use of cilia to drive fluid flow is a common motif in living organisms, and in the tissues of higher organisms. By understanding the ways that cilia function (or do not function), potential therapies to treat human diseases (such as cystic fibrosis) may be devised. The complex hydrodynamics of flow in beating ciliary tissues (such as lung epithelial tissues) are challenging to study in cultured tissues, suggesting the need for model systems that will mimic the morphology and beat patterns of living systems. To reach this goal, we have fabricated high aspect ratio cilia-like structures with dimensions similar to those of a lung epithelial cilium (0.2 to 2.0 μm diameter by $\sim$6 to 10 μm long). The structures and surfaces are composed of a magneto-elastomeric nanocomposite, allowing the actuation of artificial cilia by magnetic fields. We have studied the flexibility of the materials under conditions of flow (in microfluidics channels), and will present theoretical and experimental data from various efforts at actuation. We will discuss details of the fabrication of the ciliated structures and present results of mechanical characterization. The impact of this work on the understanding of fluid flow above ciliated cells and tissues and potential applications of such model systems will also be described.

R. Lloyd Carroll
University of North Carolina at Chapel Hill

Date submitted: 01 Dec 2004 Electronic form version 1.4