Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Influence of muscle activation and mucosal material property on esophageal transport: study based on a fully-resolved computational model[1] WENJUN KOU, Theoretical and Applied Mechanics Program, Northwestern University, JOHN PANDOLFINO, PETER KAHRILAS, Feinberg School of Medicine, Northwestern University, NEELESH PATANKAR, Department of Mechanical Engineering, Northwestern University — Esophageal transport involves interactions between food (bolus), the esophageal walls (composed of mucosal, circular muscle (CM) and longitudinal muscle (LM) layers), and neurally coordinated muscle activation including CM contraction and LM shortening. Due to the complexity of these interactions, few studies have been conducted on the mechanical role of the mucosal layer in esophageal transport. Also poorly understood are the collaborative roles of CM contraction and LM shortening and the influence of their synchronization. Here, based on a fully-resolved computational model that we developed, we investigated the individual roles of CM contraction and LM shortening, compared bolus transport with various levels of discoordination between CM and LM activation, and studied the role of the mucosa and how its stiffening influenced transport. These preliminary findings should help understand the synergy between LM, CM, and the mucosal layer in facilitating bolus transport, thereby providing insight into related physiology and pathophysiology.

[1]The support of grant R01 DK56033 and R01 DK079902 from NIH is gratefully acknowledged

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Date submitted: 31 Jul 2014 Electronic form version 1.4