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The Relation between Peristaltic and Segmental Contraction, Mixing, and Absorption in the Small Intestine GINO BANCO, JAMES BRASSEUR, YANXING WANG, AMIT AILIANI, THOMAS NEUBERGER, ANDREW WEBB, Penn State Univ — The physiology and mechanics of the small intestine originates with lumen-scale fluid motions generated by enterically controlled muscle wall contractions. Although complex in appearance, we have shown with principle component decomposition of gut motion from a rat model that simpler component structure may integrate to produce basic peristaltic and segmental motions. To couple these measured modes with fluid mixing and nutrient absorption we have developed 2-D and axisymmetric models of the gut using the lattice-Boltzmann framework with scalar and second order moving boundary conditions. Previous models indicated that peristalsis is detrimental to absorption and therefore that gut motility is likely bimodal, transitioning between peristalsis and segmental modes to optimize the transport of chyme vs. nutrient absorption. However we have since discovered that more complex control is possible due to potential transitions between "trapped" vs. "nontrapped" peristaltic fluid motions, depending on occlusion ratio. These transitions lead to an important distinction between 2-D and axisymmetric models and indicate that gut motility may be more finely controlled than previously thought. [Supported by NSF]

James Brasseur
Penn State Univ

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