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Contraction-driven Mixing and Absorption in the Intestine with a 3D lattice-Boltzmann Model BANCO GINO, JAMES BRASSEUR, YANXING WANG, Penn State University — The primary purpose of the intestines is absorption of nutrient molecules and transport of chyme by specific motility patterns. These are broadly classified as *segmental* (for radial mixing) and *peristaltic* (for axial transport). Our AIM was to identify an optimal patterning of contractions. METHODS: Fluid motions were modeled in a tubular intestine with a 3D lattice Boltzmann algorithm with prescribed motions of the lumen wall, parameterized from MRI data. Nutrient concentration was modeled as a passive scalar. Scalar was zero at the lumen wall to model rapid nutrient uptake. Simulations were initialized with uniform concentration. RESULTS: The mechanics are more complex than commonly believed. Whereas absorption is maximal when fully occluded, there is little differentiation between segmentation and peristalsis at high occlusions. However at lower occlusions absorption is reduced 28% from maximum with segmentation, but as much as 56% with peristalsis. The power requirements are reduced nearly 90% from maximum in segmentation at the lower occlusions! Thus there is a great physiological advantage to choose segmentation at lower occlusion values to enhance mixing and absorption. The MRI measurements indicate that *in vivo* occlusion values are in the low range where the tradeoff between mechanics and energetics is functionally optimal. *Supported by NSF.*

James Brasseur
Penn State university

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