Abstract Submitted for the DFD17 Meeting of The American Physical Society

Hydrodynamic Impacts on Dissolution, Transport and Absorption from Thousands of Drug Particles Moving within the Intestines.<sup>1</sup> FARHAD BEHAFARID, JAMES G. BRASSEUR, University of Colorado at Boulder — Following tablet disintegration, clouds of drug particles 5-200  $\mu m$ in diameter pass through the intestines where drug molecules are absorbed into the blood. Release rate depends on particle size, drug solubility, local drug concentration and the hydrodynamic environment driven by patterned gut contractions. To analyze the dynamics underlying drug release and absorption, we use a 3D lattice Boltzmann model of the velocity and concentration fields driven by peristaltic contractions in vivo, combined with a mathematical model of dissolution-rate from each drug particle transported through the grid. The model is empirically extended for hydrodynamic enhancements to release rate by local convection and shear-rate, and incorporates heterogeneity in bulk concentration. Drug dosage and solubility are systematically varied along with peristaltic wave speed and volume. We predict large hydrodynamic enhancements (35-65%) from local shear-rate with minimal enhancement from convection. With high permeability boundary conditions, a quasiequilibrium balance between release and absorption is established with volume and wave-speed dependent transport time scale, after an initial transient and before a final period of dissolution/absorption.

<sup>1</sup>Supported by FDA.

Farhad Behafarid University of Colorado at Boulder

Date submitted: 01 Aug 2017

Electronic form version 1.4