Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

AC Electrokinetic Cell Separation on a Microfluidic Device
ZACHARY GAGNON, University of Notre Dame, Dept. Chemical and Biomolecular Engineering, HSUEH-CHIA CHANG, University of Notre Dame, Department of Chemical and Biomolecular Engineering — Rapid cell separation and collection is demonstrated through the integration of electrokinetic pumps, dielectrophoretic (DEP) traps and field driven valves into a well designed microfluidic channel loop. We present the ground-up design and analysis of this fully functional microfluidic device for the rapid separation and collection of live and dead yeast cells and malaria red blood cells (RBCs) at low concentrations. DEP cell sorting and concentration schemes are based on the exploitation of cell specific DEP crossover frequencies (cof's). A rigorous DEP study of yeast and RBCs is presented and used to determine optimal conditions for cell separation. By utilizing a glutaraldehyde crosslinking cell fixation reaction that is sensitive to cell membrane protein concentration, we demonstrate the ability to further amplify these differences between healthy and unhealthy cells as well as stabilize their DEP cof's. Pumping is achieved with a new type of electrokinetic flow, AC electrothermal electro-osmosis (ETEO) and is shown to scale inversely with the field induced debye length and drive fluid velocities in excess of 6 mm/sec. The well characterized electrokinetic phenomena are integrated into a microchannel loop with a specifically designed electrode field penetration length for low concentration cell separation and concentration.

Zachary Gagnon
University of Notre Dame, Dept. Chemical and Biomolecular Engineering

Date submitted: 21 Nov 2008 Electronic form version 1.4