Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Effect of cell mechanics on instantaneous molecular bond force and measured kinetic parameters VIJAY GUPTA, CHARLES EGGLETON, UMBC — Receptor-ligand interactions that mediate cellular adhesion are subjected to forces that regulate their dissociation via modulating off-rates. One should be able to determine off-rates from either dissociation force measurements. The correct knowledge of the transient molecular force history is essential for accurate estimation of kinetics parameters through force spectroscopy. Currently, it is assumed that the molecular force is instantaneously equal to the externally applied force. In this work we predict via analytical models and simulation that cell mechanics and hydrodynamics modulates the externally applied force such that the instantaneous bond force is not equivalent. Various mechanical models (solid, elastic, viscoelastic) of cells and microvillus are considered over relevant ranges of loading rates (10^2-10^6pN/s). Specifically it is demonstrated that microvillus extension and tether formation decrease the pulling force imposed on the adhesive bonds leading to a prolonged bond lifetime. It is demonstrated that modulation of molecular force leads to inaccurate estimation of kinetic off-rate even when the cell and microvillus are modeled as solid materials.

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Date submitted: 23 Nov 2009 Electronic form version 1.4