Interaction of cancer cells with particles depended on cell deformability

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Growing evidence shows correlation between cancer aggressiveness and the mechanical properties of tumor cells. For many cancer diseases it was found that the deformability of the cells is higher in cancer compared to normal cells, and further raises with the degree of cell malignancy. The talk will discuss the effects of physical properties of particles on their interaction with cells and their capacity to penetrate non-cancer and cancer cells of varying malignancy potential.
Methods - The method(s) of study or data collection employed. .
A wide range of biological and physical models are presented and mechanistic insights provided theoretically and experimentally will be discussed. Moreover, a microfluidic based methodology to produce highly controlled nanoparticles is presented for the development of tunable drug delivery.

In a comprehensive study, we found a Triangular Correlation (TrC) between cell deformability, phagocytic like capacity, and cancer aggressiveness. We found that the uptake of inert sub-micron and micro-beads was massively higher in cancer cells compared with normal originated cells. Moreover, cells with a higher malignancy potential had greater uptake capacity. Importantly, in a reciprocal approach, we sorted either human bladder cancer cells or melanoma cells into subpopulations, solely based on their phagocytic capacity. The more phagocytic subpopulations showed elevated phenotypes of cancer aggressiveness ex vivo and in vivo. The uptake potential was found to be an imprinted feature preserved genetically and enriched over the sorting cycles. A gene expression profile revealed differences in gene sets associated with regulation of cell-cell and extracellular matrix adhesions and epithelial-to-mesenchymal transition. In all cases, enhanced phagocytic and aggressiveness phenotypes were correlated with greater cell deformability.

Our multidisciplinary approach provides the proof of concept that phagocytic measurements can be applied can be a surrogate marker for detecting malignancy of cancer cells based on mechanical properties and be used for rational design of drug delivery systems.

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FIGURES

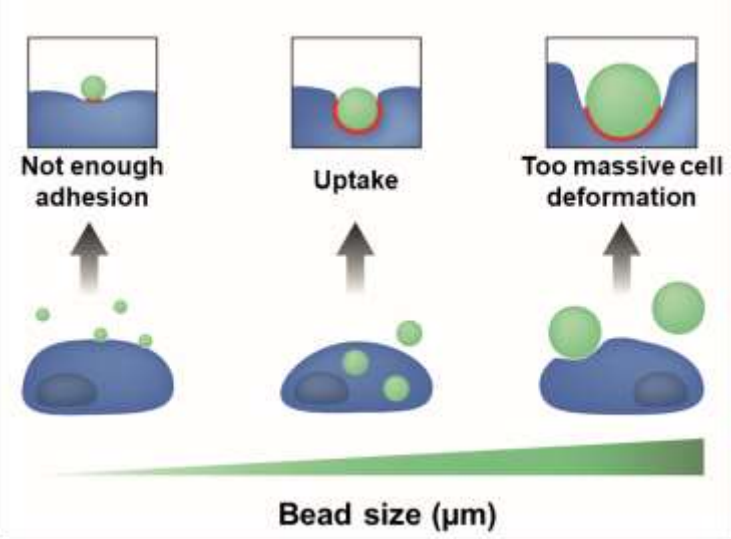

Figure 1: Illustration showing cell deformation effect on cell uptake