Label-Free Cell Screening

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Numerous methods have been developed to characterize cells for size, shape, and specific cell-surface markers. However, most of these methods rely upon exogenous labeling of the cells and are better suited for large cell populations (>10,000). In this talk, I will describe a label-free method of cell screening my research group has developed. Our method is based on measuring a current pulse when a cell transits a microchannel. The pulse magnitude corresponds to cell size and the pulse width, to the cell's transit time across the channel. When the channel is functionalized with antibodies corresponding to specific epitopes on the surface of a cell, specific interactions between the antibody and the epitope cause the cell to slow down, leading to a longer pulse duration. Thus, cell-surface markers can be identified. I will show how we have used this method to quantify the surface-marker expression of functional organ stem cells directly isolated from their micro-anatomical niche—something of which standard technologies cannot presently do. In particular, I will show how we have screened single quiescent muscle stem cells derived from single myofibers and have uncovered an important heterogeneity in the surface-marker expression of these cells. By sorting the screened cells with our microfluidic device, we have determined what this heterogeneity means in terms of muscle stem-cell functionality. Overall, our label-free cell screening method could be extended to other systems involving rare-cell subsets, and I will discuss our current efforts in screening and sorting circulating tumor cells using our device's multi-marker screening capability.