Integration of single-cell microfluidic cell culture with mass spectrometry

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Microfluidic systems can be constructed on the same scale as single cells, with features in the range of 1-100 µm, and with high spatial and temporal control of culture conditions. [1] High-resolution mass spectrometry is the premier tool for the study of proteomics and metabolomics. [2] Integrating the two will enable the evaluation of the physiology of single cells in prescribed culture conditions, leading to advances in research on single cell variability, and the effect of culture conditions, localised environment and perturbations. Toward this end, we have developed integrated microfluidic systems capable of capturing and housing the culture of a single cell using polydimethysiloxane (PDMS) based microfluidics (*Figure 1A)* and integrated them with novel monolithic PDMS electrospray ionisation (ESI) emitters (*Figure 1B*). [3] We have characterised the fully integrated cell traps/ESI emitters using both test solutions and in trial runs on cells using a Thermo LTQ-FT (hybrid ion trap / Fourier transform ion cyclotron resonance) mass spectrometer (*Figure 1C)*. Initial results on the microfluidic cell traps, microfluidic-ESI characteristics, and performance of the integrated cell traps/ESI system will be presented along with a comparison with conventional nanospray-ESI with the integrated microfluidic system with emphasis placed on detection sensitivity and interference effects from PDMS.

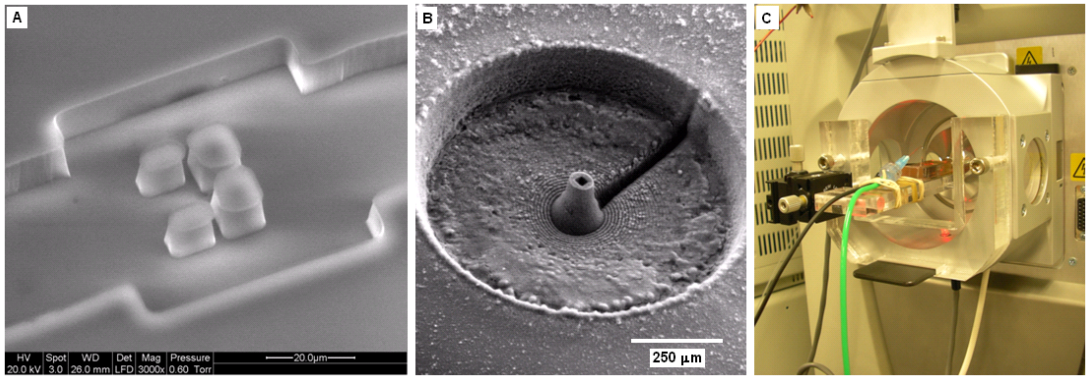

Figure 1. Single cell traps (A), PDMS ESI Emitters (B), and MS Interface (C)

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