"Playing pinball with cells and plasmonics: optofluidic-based sensors for health applications"

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The capacity of microfluidic platforms as tiny labs transitioned from a potential to a reality as demonstrated in the past 20 years. The microfluidics community developed extremely advanced systems able to perform almost any chemical and/or biological lab protocol. However, in order to develop integrated lab-on-a-chip diagnostic platforms, it is crucial to couple microfluidic devices with detection strategies able to match the inherent properties of microfluidics: high-throughput, automation and miniaturisation. One of those detection techniques is surface-enhanced Raman scattering (SERS) spectroscopy, an ultrasensitive and highly selective analytical technique with multiplexing ability.[1] SERS is based on the use of plasmonic nanoparticles that act as nanoantennas and augment the very specific Raman signatures of molecules close to the nanostructured surfaces. We have shown how the integration of different SERS sensing substrates and strategies within microfluidics and microdroplets offers a great flexibility for the diagnosis of several biological species and/or events. In this talk, I will show examples in the context of single cell analysis and disease diagnosis based on the use of SERS-based optofluidic platforms.[2] For example, we have demonstrated the multiplex phenotyping of single cancer cells in microdroplets, we have isolated and analysed the mutational profile of leukemia blasts, or we demonstrated the use of bacterial sensors for the indirect metabolite monitoring in microreactors.[3,4] Proof-of-concepts for different diseases such as cancer or Alzheimers will be shown during the talk. Further, the streamlining of these innovations into automated platforms, combined with Raman-based flow cytometry have shown promising potential for the high-throughput and real time disease monitoring. These approaches have also the potential to be transferred to different analytical fields, such as the detection and discrimination of foodborne pathogens, bacteria or viruses in food or water samples.[5–7]

References

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Figures

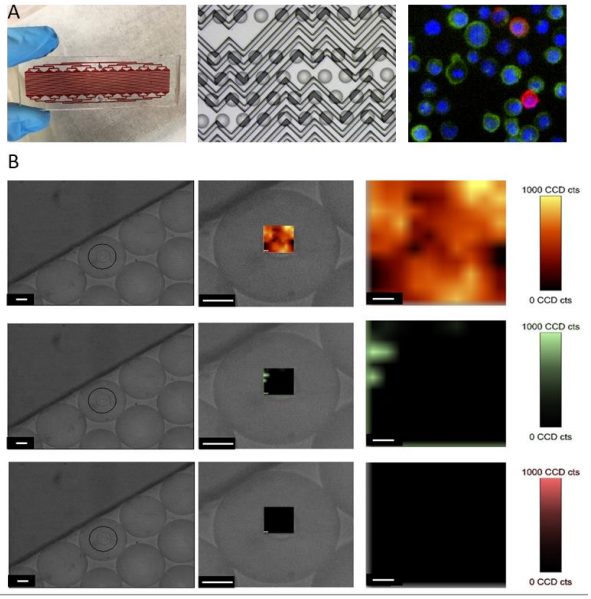

Figure 1. (A) Isolation of leukemic blasts in microfluidic systems; (B) single-cell SERS phenotyping in microdroples.