Bio-functional surfaces for analysis and diagnostics

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The increasing demand for new technologies in health and personalized medicine requires the realization of low cost, flexible devices and new nanomaterials for analysis and diagnostics. A general requisite for the successful implementation of these tools is the development of suitable bio-functional materials and surfaces. The methods for the preparation of bio-functional surfaces as well as the tailoring of surface properties to improve their biocompatibility, is crucial for the successful development of these devices.
Several fields could benefit from bio-functional surfaces, for example in the oncological filed there is an increasing interest in circulating microRNAs (miRNAs) as potential non-invasive cancer biomarkers. In this context, we explored the surface properties of several materials by modifying both the surface charge and morphology. We set-up an optimal surface for miRNAs purification from biological samples [1] and succeeded in implementing this surface on a polymeric microdevice [2]. In this case, the purification and reverse transcription of miRNAs occurs in the same microdevice since the purified miRNAs are directly available for reverse transcription without any release step. The cDNA obtained with our system is completely compatible with the most used miRNA detection method, i.e. quantitative real-time PCR and ddPCR. In addition, we exploited new detection methods, such as fluorescence enhancement based on a photonic crystal, with promising results [3].
The purification and detection of specific classes of miRNAs, such as those bound to the Ago2 protein, is under investigation with satisfactory preliminary results.
Beside cancer biomarkers, an on-chip purification and detection of Hepatitis C virus genome in human plasma was also demontrated [4].

References

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