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Sommario

MicroRNAs (miRNAs) are short non-coding RNAs, whose primary function consists in mRNA silencing. Mature miRNAs are found in the cytoplasm as single-stranded molecules but there is growing evidence that miRNAs can be excreted by cells, mainly encapsulated inside exosomes, in almost all body fluids. It has also been shown that the level of expression of some of these circulating miRNAs (e.g. miR-21) varies significantly under pathological conditions such as in the presence of cancer. Circulating miRNAs are therefore emerging as promising non-invasive diagnostic and prognostic tumour biomarkers. Nevertheless, current methods for the purification of circulating miRNAs are challenging, mainly due to low body fluid concentration, variability, and quantification limits. This thesis aimed at developing and studying an innovative miniaturised strategy for the purification and detection of cancer-related circulating miRNAs. The employment of microdevices could provide a faster, simpler and low-cost alternative to the current laboratory procedures for the analysis of extracellular miRNAs. The solid-state miRNA purification method shown here is based on the introduction of chemical and morphological modifications on the surface of an adequate substrate (silicon, PDMS). In particular, surface functionalisation with organic molecules carrying charged functional groups was employed to establish specific interactions with the electrical charged moieties of miRNAs. Modulation of the charge density and morphology will be

	allowed by the additional introduction of neutral organosilanes characterised by different chain length. In this thesis, a detailed chemical and morphological characterisation of the modified planar surfaces is presented and correlated with the capacity to selectively purify miRNAs from a complex biological sample. The most efficient condition was implemented on a PDMS microdevice and further coupled with a sensitive detection technique (RT-qPCR). The performances of our purification system will be eventually tested with both synthetic miRNAs and biological samples.
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