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Development of Novel Fluorescence Nanoprobes for Early Cancer Diagnosis

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The urgent need for a certified and credible tool for an early cancer diagnosis is one of the most formidable impediments to reducing global cancer mortality. Herein we describe the development of a novel cancer mRNA-targeting DNA hairpin-based fluorescent nanoprobe (DHFNP) for early cancer diagnosis. These have several advantages: high uptake into cells, and biocompatibility without cytotoxicity. DHFNPs are composed of gold nanorods (GNRs) functionalized with a thiol-modified ssDNA oligonucleotide hairpin (DNAhp) linked with a fluorophore label at the 5' end and a thiol group label at the 3'-end. We have created recognition loops of DNAhp to be complementary to either (MYC) or (TP63) mRNAs. In the absence of targeted mRNA, the fluorescence of the probe is quenched by the fluorophore's proximity to the gold surface. When the targeted mRNA is expressed in a tumour, it hybridizes to the complementary ssDNA sequence within the DNAhp, and this double-stranded conformation opens the hairpin structures. Subsequently, the fluorophore moves away from the GNR surface and fluorescence is enhanced. Our results indicate great hybridization performance of DHFNPs (MYC-Cy5 and TP63-AF488 nanoprobes) in solution with complementary sequences of DNA, and in flow cytometry using a variety of different cell lines. Notably, prostate PC-3 cancer cells and A549 lung cancer cells were shown to express the MYC gene 51-fold, and TP63 gene by 26-fold higher than HEK293 cells, chosen as a negative control. The sensitivity and selectivity of DHFNPs were demonstrated to detect even 1 cell among 103 cells in a heterogeneous population of mixed PC3 and HEK293 cells or mixed A549 and HEK293 cells. Our data indicate that DHFNPs are a sensitive cancer diagnostic tool with potential to detect circulating tumour cells in blood samples that would improve diagnosis efficiency, monitoring of metastasis and determine the effectiveness of chemotherapy.

Biography

Intisar Albandar has completed her master from Basrah University, she is now the PhD student at Strathclyde Institute of pharmacy and biomedical science, University of Strathclyde. She is the lecturer at University f Basrah, a college of sciences, was a member of genetic engenering and head of central laboratories of biology department in a college of sciences. She has published one paper in Basrah sciences journal.

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