OPTICAL FIBER NANOTIPS COATED WITH MOLECULAR BEACONS FOR mRNA DETECTION IN CELLS

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Molecular beacons (MB) are single-stranded DNA molecules that possess a stem-and-loop structure. The loop portion of the molecule can form a double-stranded DNA in the presence of a complementary sequence. A MB is labeled with a fluorophore and a quencher on the two ends of the stem. The stem keeps these two moieties in close proximity to each other, causing the fluorescence of the fluorophore to be quenched by energy transfer. The fluorophore fluorescence is restored when the MB hybridizes to the target sequence. In this paper we present a molecular beacon used as bioreceptor for mRNA detection immobilized at the distal end of a tapered fiber [1]. The attention was focused on the mRNA for survivin, a protein highly expressed in most types of cancer. Survivin-MB was characterized by hybridization studies with a complementary sequence to prove its functionality both free in solution and once immobilized onto the fiber tip. The nanotips were fabricated by chemical etching, starting from 500 micron diameter multimode optical fiber and tapering it down to about 100 nm at the tip. Next, the MB was attached to the nanotips via covalent binding and the fluorescence of the MB fluorophore was externally collected after direct excitation through the optical fiber ending with the tip. The MB coated nanotips are proposed as innovative tool for entering the cytoplasm of living cells, and directly measure the intracellular RNA.

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[1] T. Vo-Dinh, Y. Zhang, "Single-cell monitoring using fiberoptic nanosensors", Wiley Interdisciplinary Reviews: Nanomed. Nanobiotech. 3, 79-85 (2011).