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Baby Spinach-based minimal modified sensor (BSMS) for miRNA sensing

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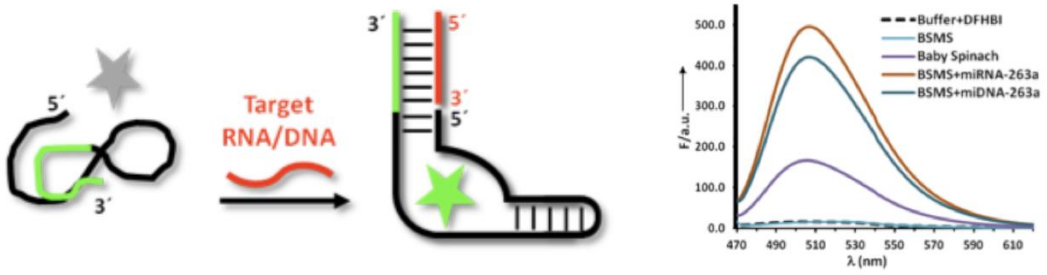
Nucleic acid sensing holds great potential in disease diagnosis, gene expression profiling and personalized therapeutic approaches. Several fluorescence based hybridization probes for the detection of nucleic acid has been reported in literature. Most of them, for instance, molecule beacons require chemical labelling followed by purification, and are also not cost effective. Light-up aptamer based sensors have recently shown great potential and has emerged as a promising platform for designing biosensors for small molecule as well as nucleic acid detection. Many of these sensors takes the advantage of a RNA mimic of green fluorescent protein often termed as spinach aptamer that has been shown to activate the fluorescence of otherwise non-fluorescent small-molecule DFHBI (3,5-difluoro-4-hydroxybenzylidene imidazolidinone)[1]. Using a miniature variant of spinach aptamer, termed as baby spinach, we have demonstrated a surprisingly simple, cost effective and label free baby spinach based minimal-modified sensor (BSMS) for fluorescent detection of miRNA. A single BSMS probe can detect either of DNA or RNA analytes including miRNA. The BSMS destabilizes in the absence of analyte by disrupting small molecule dye binding pocket of baby spinach leading to no fluorescence. However, sequence specific binding of target DNA/RNA analyte acts as a turn on switch leading to fluorescence enhancement by several folds. The sensitivity of the BSMS lies in the low nanomolar range for both DNA as well as RNA and also exhibits high specificity towards its target sequence. The sensor design is quite general in nature and can be easily modified to detect varied length nucleic acid sequence. Since the sensor consists of single, short and chemically unmodified ssRNA, it can be genetically encoded, thus holds potential for in vivo applications.



References and Notes:

1. Paige, J. S.; Wu, K. Y.; Jaffrey S. R. *Science*, **2011**, *333*, 642
2. Soni, R.; Sharma, D.; Krishna, A. M.; Sathiri, J.; Sharma, A. *Org. Biomol. Chem.* **2019**, *17*, 7222

Bio-Sketch of the speaker

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Dr. Ashwani Sharma completed his PhD in 2011 from National Chemical Laboratory (NCL), Pune, India. After PhD, he moved to United States for his first post-doc from University of Utah from 2011 – 2013 and second postdoc from Markey Cancer Centre, University of Kentucky from 2013–2015. After coming back to India, he joined as DST young scientist in Indian Institute of Chemical Technology (IICT), Hyderabad for a short span of one year. He joined IISER Tirupati in January 2017 and currently is an Assistant Professor in Chemistry and Biology at IISER Tirupati. His field of interest is development of novel strategies utilizing nucleic acid based nanoparticles for targeted drug delivery to different cancers, and to develop DNA/RNA based biosensors for detection.