Microfluidic device-based electrical sensing of Nucleic acid

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The naturally occurring biological phenomena such as hybridization of DNA/miRNA molecules and its successful detection can bring new ideas in genetic diagnostics. Molecules like miRNA - short, single stranded, non-protein coding RNAs, has already been proved to be acting as excellent biomarker since their expression level correlates to specific diseases. Until now, researchers have been facing many difficulties to successfully electrically separate the close sequences of such molecules due to their shorter lengths and high background noise. Creating a platform that can facilitate different kind of molecular interactions still remains a big challenge.

Current most frequently used techniques in molecular biosensing include attachment of fluorescence label to target molecules which is expensive and time consuming. There are several alternative attempts such as CMOS based devices [1], SiNW field effect based biosensor [2] and microelectrode array [3] all presented different techniques for electrical detection of miRNA. But one might wonder that, there could be plenty of scope for looking beyond the detection technique and device type, or to speak precisely, study of surface modification strategy in the molecular level and target capture technique might influence greatly on the results that can help in high level sequencing. Investigation of different kind of probes and smaller but significant molecular binding effects such as coaxial stacking effect [3,4] resulted in a sandwich hybridization technique need to be well explored in order to take the present molecular sensing to the next level.

We recently demonstrated [5] our palm sized microfluidic platform integrated with analog sensing for label free, portable, fast and low volume sensing. Here, we attempted exploring our work on biomolecular sensing for the detection and separation of target miRNA (Fig. 1). We intend to study different types of capture probe used for sensing surface preparation and observe their effect on high sensitive and selective sequencing. Figure 1 represents one such result where two different structures of capture probe have been used in order to detect different concentration of miRNA (miR16).

[1] D. Gonc et al: Biosensors and Bioelectronics **24** (2008) 545–551

[2] Guo-Jun Zhang et al: Biosensors and Bioelectronics **24** (2009) 2504–2508

[3] Jeong Min Lee and Yongwon Jung, Angew. Chem. Int. Ed. **50** (2011) 12487 –12490

[4] H. Arata,et al Analyst, **137** (2012), 3234-2237

[5] Tanzilur Rahman, Takanori Ichiki, 23rd Annual Meeting of MRS-J, Yokohama, Japan

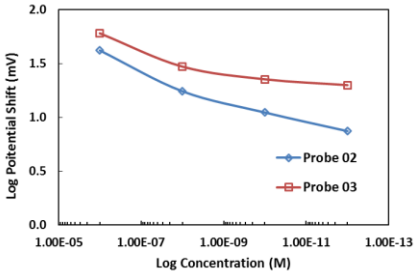

Fig 1: Potential shift vs Target concentration (Log) detected using two different capture probes02 & probe03. The probes differ in length and structures, therefore providing different target binding affinity