

## Supporting Information

### **Naked Eye Detection of Lung Cancer Associated miRNA by Paper Based Platform**

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#### **QCM characterization of mir21-PNA hybridization**

Quartz crystal microbalance (QCM) studies were carried out to characterize mir21-PNA hybridization using a 5 MHz AT-cut piezoelectric quartz crystals on to which Au electrodes were deposited (Q-Sense, Sweden). The crystals were immersed in 2% sodium dodecyl sulfate (SDS) in deionized (DI) water for 30 min followed by an ozone treatment for 10 min. The cleaned crystals were then washed thoroughly with DI water, dried in nitrogen gas and used immediately. 10  $\mu$ M amine terminated PNA was then incubated onto the Au surface, via [SH—(CH<sub>2</sub>)<sub>15</sub>—COOH] linkers (Sigma Aldrich, upon EDC/NHS activation), for 1 h followed by rinsing with DI water. The PNA modified QCM electrodes were then mounted in the micro-fluidic chamber of the Q-sense instrument. Upon attaining a stable resonant frequency, 5  $\mu$ M of non-complementary and complementary mir21 strands were injected at flow rate of 100  $\mu$ l/min. Real time QCM measurements were then performed using a Q-Sense E4 (Q-Sense, Sweden) with 4-channels IPC pump (Ismatec SA, Switzerland). Phosphate buffer solution (PBS, Invitrogen) was used as the running buffer.

## Verification of PNA- mir21 hybridization

As shown in Fig. 1, hybridization of mir21 with immobilized PNA probes is reflected by a frequency shift of 2 Hz for a 5  $\mu\text{M}$  solution of complementary strands (in PBS) whereas the response to a 5  $\mu\text{M}$  solution of non-complementary strands occurs within the noise level. Although optimization of the immobilization protocol and experimental conditions are beyond the scope of this letter, the obtained QCM response for the complementary sequence illustrates that mir21 hybridizes with immobilized probe PNA (within  $\sim 20$  min), confirming that this model system could be utilized to demonstrate the sensing capabilities of the developed paper platform.

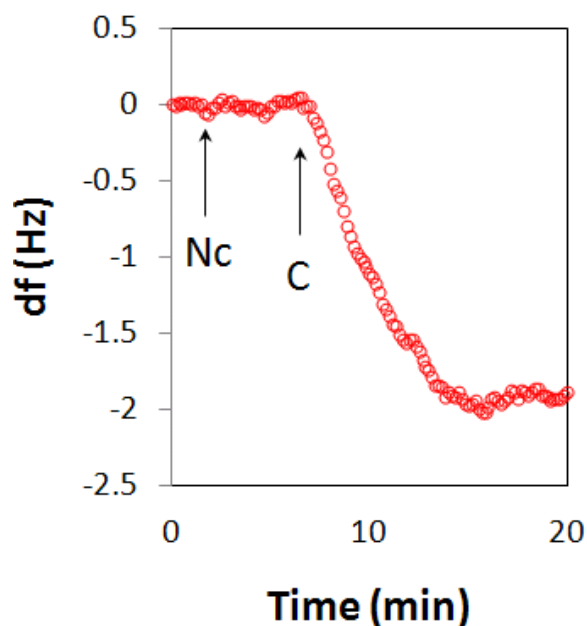
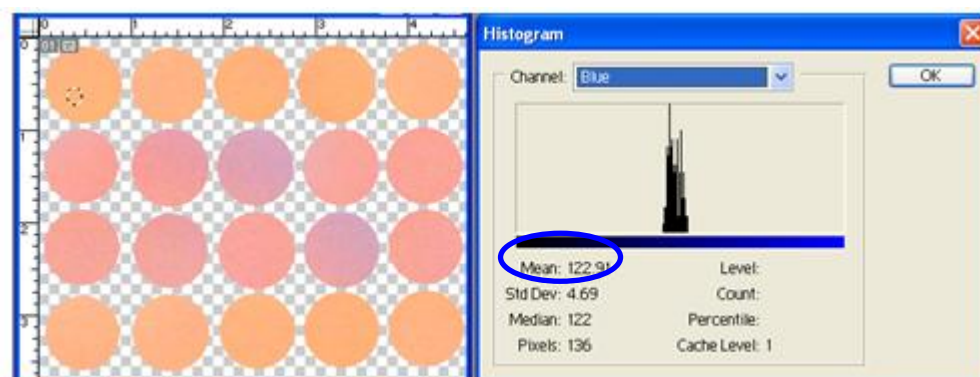
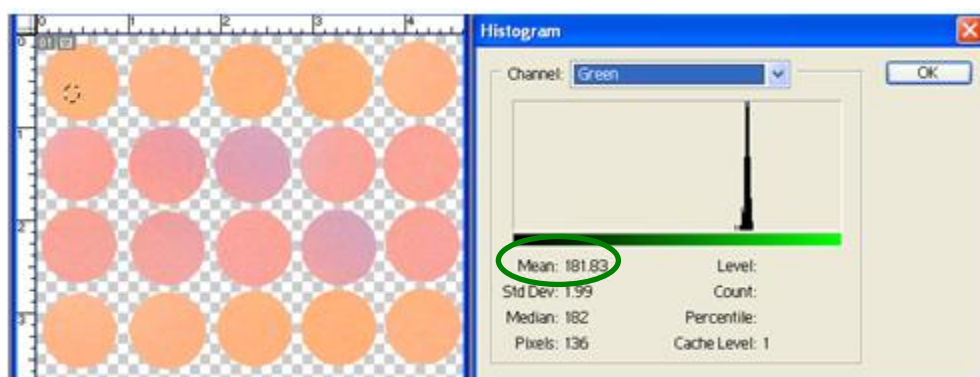
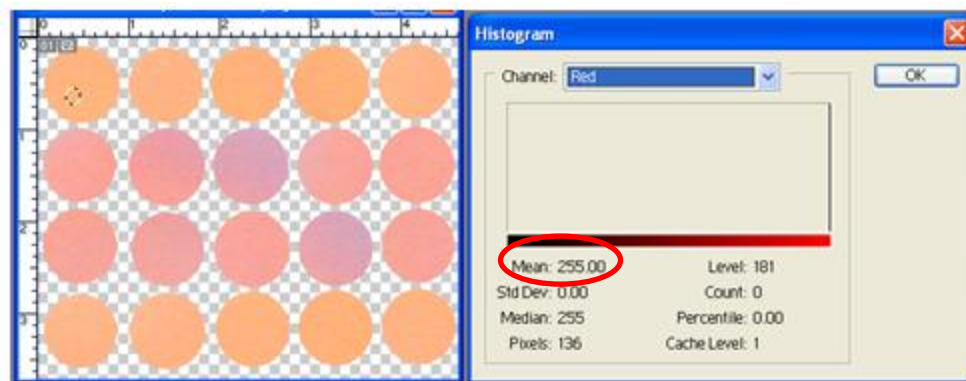


Fig 1: QCM response of PNA mir21 hybridization (C: complementary Nc: non-complementary)

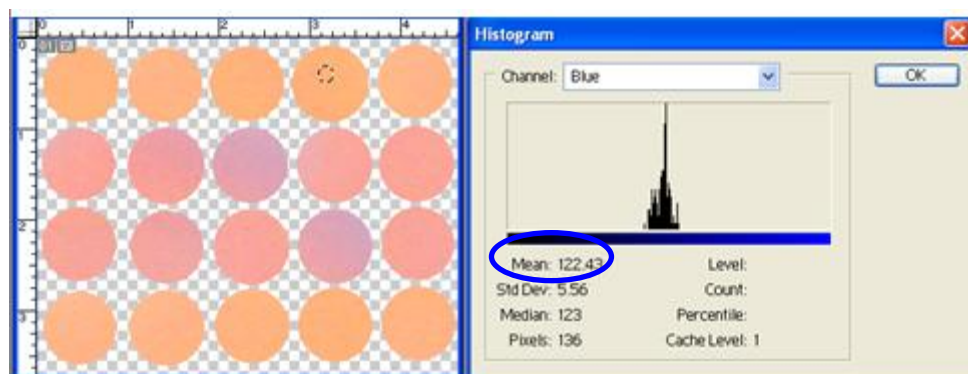
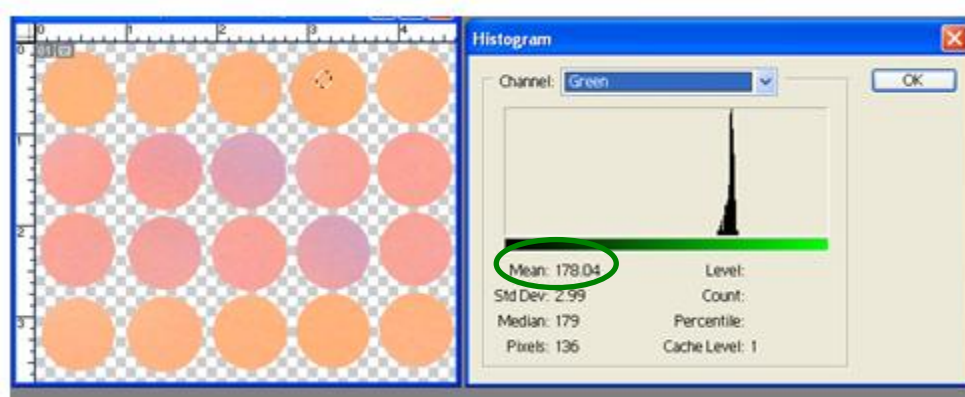
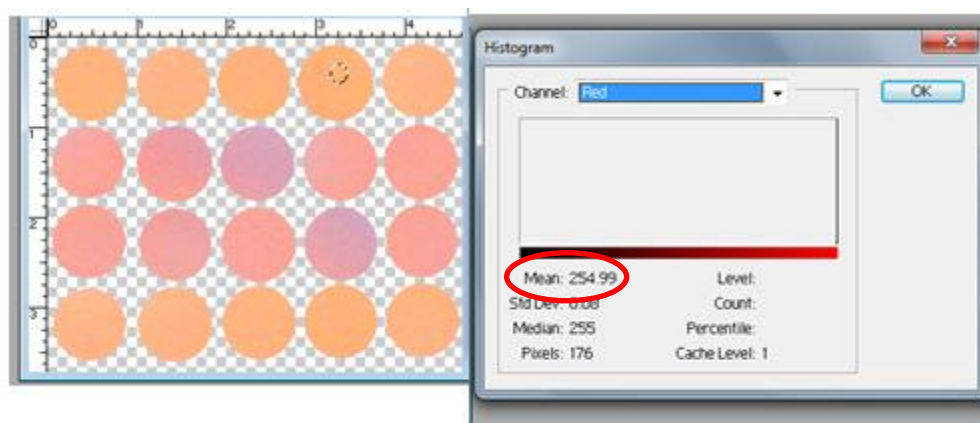
## RGB Analysis:



Supporting Figure2: Histogram of RGB (Red,Green,Blue) channels for the marked area (dashed circle) on the PVDF platform. The mean intensity of individual channels are indicated by red, green and blue ellipses.



Supporting Figure2cont.: Histogram of RGB (Red,Green,Blue) channels for the marked area (dashed circle) on the PVDF platform. The mean intensity of individual channels are indicated by red, green and blue ellipses.



Supporting Figure2 cont.: Histogram of RGB (Red,Green,Blue) channels for the marked area (dashed circle) on the PVDF platform. The mean intensity of individual channels are indicated by red, green and blue ellipses.

## Real-time video



Supporting Figure3: Real time movie that shows the response of two different paper chip upon addition of non-complementary miRNA. (note that this is a screen shot) The real time movie can be viewed as the additional Supporting Information file.