## Supporting Information for

## DNA Microarray Analysis Using Smartphone to Detect BRCA-1 Gene

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**Fig. S-1** Degree of spreading of wax in paper. (a) Optical micrographs showing changes "before" and "after" baking lines with nominal widths from  $100 - 450 \ \mu\text{m}$ . (b) Quantitative assessment showing the linear relationship of spreading of molten wax in Whatman paper. The values represent an average (n = 3) of measured line widths, and a linear fit yielded  $W_b$  =  $1.01 W_p + 120$ , R<sup>2</sup> = 0.99. Scale bar:100 \ \mum. (W\_b = Barrier width,  $W_p$  = Printed Width)



**Fig. S-2** Evaluating the minimum space that can be created using two channels. (a) Optical micrographs showing the space between the channels "before" and "after" baking lines with nominal widths from  $20 - 350 \ \mu\text{m}$ . (b) Quantitative assessment showing the linear relationship of spreading of molten wax to create a desired minimum space. The values represent an average (n = 3) of measured line widths, and a linear fit yielded  $S_b = 0.95S_p \cdot 65$ ,  $R^2 = 0.99$ . Scale bar:100  $\mu$ m. ( $S_b$  = Barrier space,  $S_p$  = Printed space).



**Fig. S-3** Evaluating the minimum space that can be created using two lines. (a) Optical micrographs showing the space between the lines "before" and "after" baking lines with nominal widths from  $100 - 600 \ \mu m$ . (b) Quantitative assessment showing the linear relationship of spreading of molten wax to create a desired minimum space. The values represent an average (n = 3) of measured line widths, and a linear fit yielded  $S_{b(black BG)} = 0.92 S_{p(black BG)} - 77$ , R<sup>2</sup> = 0.99. Scale bar:100  $\mu m$ . ( $S_{b(black BG)} = Barrier$  space created with black background,  $S_{p(black BG)} = Printed$  space created with black background)



Fig. S-4 Dimension of the Optimized Channel



**Fig. S-5** Evaluating degree of dilution. (a) Baked channel after wax printing. (b) Image captured from FluoroZen showing the degree of dilution with each step after adding Cy3-DNA and SSC buffer in the specified channels. (c) Bar chart showing the intensity changes w.r.t concentration.



**Fig. S-6** Understanding the influence of design parameters on fluid flow in microfluidics. (a) Whole channel showing no outflow of red colored food dye with increase in sample volume from  $0.1 - 1 \mu L$  (top) and Hollow channel showing outflow of red colored food dye with increase in sample volume from  $0.1 - 0.5 \mu L$  (bottom). (b) Circle and Square shaped whole channels with increase in area from left to right showing the same fluid behavior or the "coffee ring effect". Simplified design with reduced sampling time to conduct experiments on paper based (c) 96-well plate, and (d) 384-well plate. (e) An Olympic Channel design showing mixing of two food dyes when introduced from opposite ends. (f) Star shaped channel showing star like flow indicating that the fluid flow is guided by the design of the channel.



**Fig. S-7** Limit of detection of FluoroZen in terms of fluorescence intensity (RGB pixel value) corresponding to Figure 6. Image sets of arrays with various concentrations of Cy3-DNA oligonucleotide probes from  $0 - 10 \mu$ M and the background. Original image, blue, green, and red channel.

COMPONENTS	COST (\$)
Excitation Filter (XF1074 525AF45)	200
Emission Filter (XF3085 565ALP)	125
Green LED (525nm)	0.1
Nuts and Bolts	1.0
Bread Board	1.0
Resistor	0.1
Battery	1.0
Switch	1.0
3D Printing	15
TOTAL COST	344.2

Table. S-1 Cost estimate of FluoroZen with all its components.

## DNA Copy Number Calculation:

Assuming that the average weight of 1 base pair (bp)  $\approx 660$  g/mol For 20bp,

Total number of DNA molecules (g) =  $\frac{20 * 660 \text{ (g/mol)}}{6.023 \text{ X } 10^{23} \text{ (molecules/mol)}} = 2.191 \text{ X } 10^{-20} \text{ g}$ For 100 µM stock concentration, DNA Copy Number =  $\frac{1030.9 \text{ X } 10^{-6} \text{ g}}{2.191 \text{ X } 10^{-20} \text{ g}} = 470.5 \text{ X } 10^{14}$   $\approx 4.705 \text{ X } 10^{16} \text{ number of DNA copies/ } 1.65 \text{ mL}$ For 1 µL of working volume, DNA Copy Number =  $\frac{4.705 \text{ X } 10^{16}}{1.65 \text{ X } 10^3} = 2.85 \text{ X } 10^{13}$ For 0.4 µM limit of detectable concentration, Dilution Factor =  $\frac{100 \text{ µM}}{0.4 \text{ µM}} = 250$ Therefore at 0.4 µM, we are detecting, DNA Copy Number =  $\frac{2.85 \text{ X } 10^{13}}{250} = 1 \text{ X } 10^{11} \text{ number of DNA copies} \approx 11 \log 10$