Integrated System for Cancer Biomarker Detection

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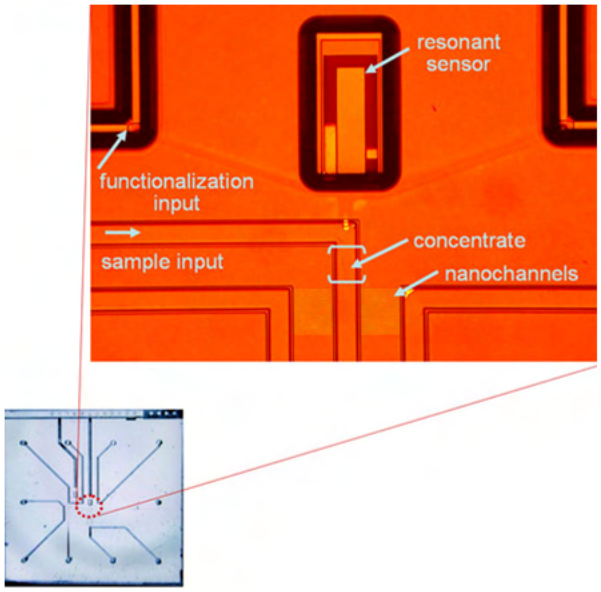
There is evidence to suggest that the next generation of cancer-screening tests may employ not just one, but a small panel of less than ten biomarkers that together add statistical power to the detection of specific cancers. While immunoassays such as ELISA are well established for detection of antigen-based biomarkers, the fidelity of the assay is governed by the disassociation constant, K_d, of the antibody-antigen complex. If the antigen concentration is significantly below K_d, then the binding kinetics are slow and readout precision of the antigen-antibody complex can be degraded by noise.

We propose a general approach for improving the performance of ligand-receptor assays. The approach is based on a nanofluidic device that controllably concentrates a dilute sample and an ultra-sensitive suspended microchannel resonant mass sensor that detects specific biomarkers within the concentrate. Since the amplification (or gain) of the concentrator is adjustable, the dynamic range and detection limit of the immunoassay can be governed by the properties of the concentrator and not K_d. Since the integrated concentration/detection system is batch-fabricated by conventional foundry-level processing techniques, the cost per device could potentially be less than ten dollars.

Over the past year, we have fabricated the first generation of integrated systems (Figure 1). The devices appear to be functional based on initial visual inspections. We are currently validating the performance of the system by using quantum dots for a calibration assay. We are also in the process of validating the performance of the concentrator and mass sensor (as individual components) with prostate-specific antigen so that we can make comparisons to existing methods in terms of sensitivity and selectivity.



▲ Figure 1: Integrated system for concentration and detecting biomolecules.