A DNA OR PROTEIN CAPILLARY MICROARRAY
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Advances in Microarray Technology, 11-13 October 2005

We report a tri-dimensional capillary microarray as a micro reactor for various chemical and biological reactions at the nanoliter scale. The attachment of a biological molecule onto the inner surface of the capillary is obtained through photochemical reaction under UV$_{365}$ nm irradiation. The array is materialized by a succession of cylindrical cross-section molecules immobilized along the capillary.

HYBRIDIZATION ASSAY

The capillary microarray was reported first for linear detection of nucleic acid sequences. A capillary surface chemistry and a photochemical ligation reaction were developed for the covalent attachment of oligonucleotides on the inner surface of the channel.$^{(1)}$. We compared hybridization reactions performed in various fluidic conditions$^{(2)}$ (static, continuous flow and oscillating mode) at 42°C for 20 minutes. The dynamic/oscillating modes led to a high specificity (Fig.1) and a higher 100-fold sensitivity compared to the control static mode as assessed by signal/noise ratios.

IMMUNOASSAY

The capillary format has been evaluated for protein array experiments. The validation of protein immobilization was achieved through the Cy3 labeled streptavidin attachment. Afterwards, the successful binding of specific antibodies to immobilized proteins showed the abided protein functionality after ligation$^{(3)}$. Finally, we developed a specific antigen-antibody test with two immobilized antigens: LLO (recombinant bacterial listeriolysin O) and PB (recombinant protein-base). It allowed the detection of corresponding antibodies in human sera (Fig.2). The fluorescent detection was carried out with secondary FITC antibodies.

The capillary immunoassay showed performances similar to results obtained with standard microtiterplate Elisa test.

SPECIFICITY OF HYBRIDIZATION ASSAY

![Image of EGFP and P2A oligonucleotides immobilized in the same capillary. The array was hybridized with a mixture of EGFP and P2A complementary oligonucleotides labeled respectively with Cy3 and FITC.]

SPECIFICITY OF IMMUNOASSAY

![Image of LLO and PB antigens were attached in two capillaries. Each other is recognized by his specific antiserum and detected by secondary FITC labelled antibody.]

The capillary is a versatile microreactor for various biomolecule attachment and various biochemical reactions. The manufacturing method of capillary microarrays is simple. Oligonucleotide, protein, sugar and chemical microarrays could be developed with this technology. The fluidic characteristics of this microreactor suggests that a combination of different biochips could be integrated in a Lab-on-chip microsystem and this could provide next generation platforms for genomic and proteomic applications.

References
(1) Light-directed assembly of microarrays in a glass capillary B. Fouqué , S. Porte, M. Balakirev, M. Berger, F. Perraut and F. Chatelain µTAS . October 2003, California, USA .