ISSN-2322-0066

Research Journal of Biology

Microarray Proteomics and its Clinical Application

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Commentary

Received: 12/04/2015
Revised: 22/04/2015
Accepted: 25/04/2015

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Keywords: Microarray; metabolome; transcriptomics; proteomics

ABSTRACT

With the development of proteomics, Microarray Proteomics, including protein chip or protein microarray, has received widespread attention because of its characteristics such as high flux, high specificity and sensitivity appeared, and are increasingly used in protein expression spectrum and protein interactions of systemic research. Microarray has also become a tools for the early disease diagnosis and to study the prognosis and treatment of disease, and has been also extended to clinical application.

INTRODUCTION

The principle, classification, preparation, application in the diagnosis of disease, advantages, disadvantages and development prospects of the Microarray Proteomics are introduced in this short commentary [1-3]. Mass Spectrometry is the key technology of proteomics, its advances first was in the development of ionization techniques such as matrix assisted laser desorption ionization (MALDI) [4] and electrospray ionization and secondly was in the ability to conduct tandem MS (MS/MS) [5] to fragment peptides by collision-induced dissociation, paved the way for the development of proteomics as a field.

Characterization of proteins is now done by mass spectrometry i.e from the identification the protein to its quantification, either by studying the post-translation modification [6] or protein interactions. A fragmented protein or an intact protein can be identified by MS either by top-down or bottom-up approach [7-10]. It has been know that the compared to intact proteins, peptides are relatively easy to handle and easy to study physiochemical properties [11,12]. However, the analysis of complex biological matrices by MS is highly dependent on off-line separation technologies such as 2-dimensional gel electrophoresis (2-DGE) or HPLC that simplify such samples prior to mass analysis; and HPLC is also the standard front end on-line separation methodology for many liquid chromatography-MS (LC-MS) based instrumentation platforms [13-17].

CLASSIFICATION OF MICROARRAYS PROTEOMICS

Microarrays Proteomics are divided in two groups:

a) Functional protein microarrays
b) Protein-detecting microarrays
c) Protein Lysate Microarrays

Functional microarrays proteomics

Functional proteomics is used to study a particular proteome by understanding the network of molecular interaction. It is a powerful tool to study proteins of related function [18]; functional protein microarrays allow high-throughput screening and quantification of protein interactions on a proteome-wide scale, thus providing an unbiased perspective on the connectivity of the different protein-protein interaction networks [19,20]. In 2000, Schreiber et al. [21] presented that purified recombinant proteins

could be microarrayed onto chemically derivatized glass slides without seriously affecting their molecular and functional integrity. More recently, Snyder et al. [22] have been able to immobilize ≈5,800 proteins from *Sacharomycescerivisiae* onto microscope glass slides. This protein chip was then probed with different phospholipids to identify several lipid-binding proteins [23-25].The authors also used this proteome chip for the identification of substrates for 87 different protein kinases. Using this microarray data set in combination winteraction and transcription factor binding data, the authors were able to reveal several novel regulatory modules in yeast.

Protein-Detecting Microarrays

Protein-detecting microarrays are ideal reagents for establishing how this information flows through these interacting networks [26-28], however, requires measuring the abundance and post-translational modifications of many proteins from complex biological mixtures. One of the most frequently used strategies to prepare this type of microarray involves the use of monoclonal antibodies as specific protein capture reagents [29-31].

Protein Lysate Microarrays

An interesting alternative to antibody microarrays is to immobilize cell lysates and then use specific monoclonal antibodies to identify and quantify the presence of a particular analyte in the corresponding lysate [32,33]. This technology was first described by Liotta and co-workers to monitor pro-survival checkpoint proteins as a function of cancer progression. The same approach has recently been used for the discovery and validation of specific biomarkers for disease diagnosis and patient stratification [34,35].

Advantage of Microarrays Proteomics

Microarrays Proteomics is highly parallel, high flux, miniaturization and automation of proteomic detection technology [36-38]. It is on a carrier of the gene chip size, different kinds of fabric density probe protein, protein microarray, experiment with the chip protein mixture under test incubation reaction, then marked the second of the fluorescent antibody reaction with chip protein complex [39,40], on the scanner reads fluorescence intensity, further quantitative analysis the result of the hybrid [41]. The role of protein chip in the proteome research mainly research difference shows the interaction between protein and protein. According to few scientist different production methods and applications, the protein chip can be divided into two kinds: one kind is protein expression chip, it will be a lot of testing with molecules [42-45] (often for antibody) fixed on the surface of the chip and the arrangement of microarray type, so after add sample can find out the presence of these molecules in the sample target; the other is a core of protein function [46-48].

Applications of Microarrays Proteomics

Unlike the DNA/oligo microarray or analytical protein microarrays, functional 9 protein microarrays provide a flexible platform that allows development and detection of a wide range of protein biochemical properties. To date, well-developed assays include detection of various types of protein-ligand interactions [49], such as protein-protein, protein-DNA, protein-RNA, protein-lipid, protein-drug, and protein-glycan interactions [50,51].

Biomarker Identification

Though the applications described above are most useful in basic research, functional protein microarrays may have enormous impacts on clinical diagnosis and prognosis. When proteins on a functional protein microarray are viewed as potential antigens that may or may not associated with a particular disease, it becomes a powerful tool in biomarker identification [52].

Summary

Though there are many advantages and development in Microarray Proteomics. But there are also many of disadvantages and technological barrier and that still need to be overcomed. With the progress in technology, we had an optimistical attitude to those difficulties, and the application of Microarray Proteomics will become more extensive in clinic and scientific research.

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