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Commentary

A Guide to Glass cDNA and *In situ* Oligonucleotide Microarrays

Ramesh Bhatia*

Department of Genomic Sciences, Central University of Kerala, Kerala, India

DESCRIPTION

An array is an arrangement of samples where known and unknown Deoxyribose Nucleic Acid (DNA) samples are matched based on base pairing rules. Common assay systems, including microplates or conventional blotting membranes, are used in an array investigation.

Microarray technology was developed as a result of extensive genome sequencing efforts and the capability to immobilize thousands of DNA fragments on coated glass slides or membranes. A microarray pattern of ssDNA probes which are immobilized on a surface called a chip or slide. In order to identify a specific DNA or Ribonucleic Acid (RNA) in a sample, microarrays use hybridization.

Principle

Microarrays mainly work on the theory of hybridization between two DNA strands. Fluorescent labeled target sequences that bind to a probe sequence generate a signal that depends on the strength of the hybridization determined by the number of paired bases.

Types of DNA microarrays

- A Glass cDNA microarray involves the micro spotting of pre-fabricated cDNA fragments on a glass slide.
- High density oligonucleotide microarrays often referred to as a chip which involves *in situ* oligonucleotide synthesis.

Glass cDNA microarrays: These are the first type of DNA microarrays developed and are produced by using a robotic device which deposits (spots) a nanoliter of DNA onto a coated microscopic glass slide.

Manufacturing process involves the selection of the material to spot onto the microscope glass surface. Preparation and purification of DNA sequences represents the gene of interest. Spotting DNA solution onto chemically modified glass slides *via* a contact printing.

***In situ* oligonucleotide array:** Oligonucleotides are synthesized on chips. Light is directed through a photolithographic mask to specific areas of array surface. Activation of areas for chemical coupling and attachment of a nucleotide containing photolabile protecting group X is done. Next light is directed to a different region of the array surface through a new mask. Second building block containing a photolabile protecting group X is added and the process is repeated until the desired product is obtained.

Due to such very high information genes, they are finding widespread use in the hybridization-based detection and analysis of mutations and polymorphisms such as single nucleotide polymorphisms.

Advantages of microarrays

- Glass cDNA microarrays include their relative affordability with a lower cost.
- Its accessibility requiring no specific equipment for use such that hybridization does not need specialized equipment.
- Data captured can be carried out using equipment that is very often available in laboratory.
- *In situ* oligonucleotide arrayformat includes the speed, specificity and reproducibility.

Disadvantages of microarrays

- Glass cDNA microarray requires intensive labor for synthesizing, purifying and storing DNA solutions before microarray fabrication. They may hybridize to spots designed to detect transcript from a different gene.
- *In situ* oligonucleotide arrays tend to have expensive specialized equipment's for hybridization, staining of label, washing and quantification process.
- Short-sequences used on the array have decreased sensitivity/ binding compared with glass cDNA microarrays.

Applications of microarrays

- Microarray analysis measure changes in the multigene patterns of expression to understand about regulatory mechanisms and broader bioactivity functions of genes.
- Microarray technology has widespread use in comparative gene mutation analysis to analyze genomic alterations such as sequence and single nucleotide polymorphisms.

Correspondence to: Ramesh Bhatia, Department of Genomic Sciences, Central University of Kerala, Kerala, India, E-mail: bhatiaramesh@gmail.com

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- In microbiology, microarray gene mutation analysis is directed to characterization of genetic differences among microbial isolates, particularly closely related species.
- Microarray technology has extensive application in pharmacogenomics.
- Comparative analysis of the genes from a diseased and a normal cell will help the identification of the biochemical constitution of the protein synthesized by the diseased genes.