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Microarray: Cutting-Edge Diagnostic Tool

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INTRODUCTION

Microarrays measure the relative concentration of DNA arrangements in a blend by determining where hybridization events took place. They quantify the relative concentration by combining thousands of nucleic acids. In regular use, a DNA cluster allows determine the relative concentrations of mixture of labelled nucleic acids by hybridizing these "targets" with the "probes" on the cluster (Bumgarner *et al*., 2013).

Fig1. Microarray chip

HISTORY

Grunstein and Hogness have made the initial DNA cluster through colony hybridization (Grunstein and Hogness, 1975). Bumgarner, (2013) utilized the hybridization of a radiolabelled DNA or RNA to rapidly screen large number of colonies to identify clones containing complementary DNA for r adiolabelled test. Hans Lehrach quickly clustered clones from microtiter plates onto channels gathering computerized forms using automatic frameworks during early 1990s (Lennon and Lehrach, 1991). During early 2000s, cDNAs were widely accessible, allowing creation of open reading frames (ORFs)- a portion in a DNA sequence excluding stop codon (Richmond *et al*., 1999). The development of DNA clusters was rapidly accelerated by adapting both unused generation strategies and fluorescent discovery methods. As a result, as we gain more knowledge of DNA groupings of different genomes, we are better able to make clusters that completely reflect all the properties, sequence variation, arrangements of a genome. In the course of time, there has been a continuous switch from spotting generally long DNA fragments to creating clusters of 25-60 bp oligos. The growing amount of data on DNA arrangement made oligo clusters possible. Furthermore, oligos enhanced specificity for authoritative target planning since they could be tailored to target specific attributes or regions of the genome that differed greatly from others.

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BASIC TYPES

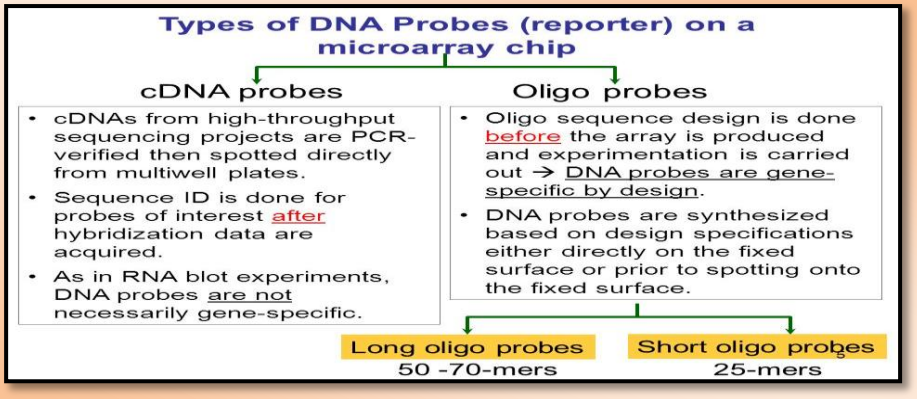
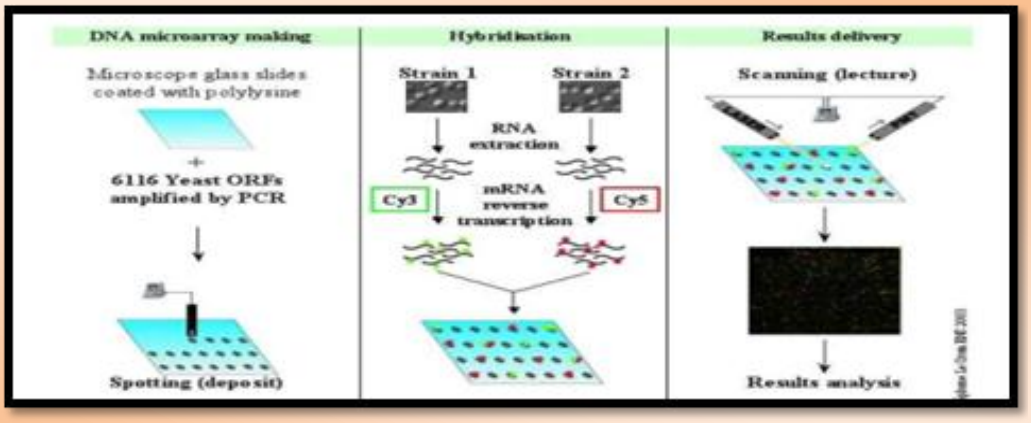


Fig2. Types of DNA probes on a microarray chip

PRINCIPLE



(Source- universe84a.com/dna-microarray)

Fig3. Figure showing DNA microarray principle

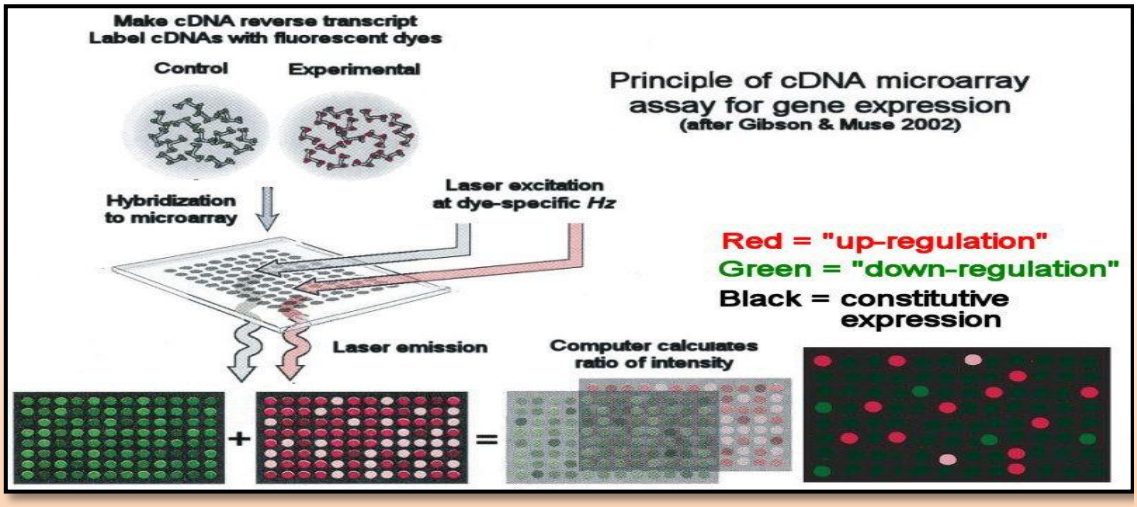


Fig4. Figure showing cDNA microarray assay principle

PLATFORM

Printed type by Miller and Tang, (2009):

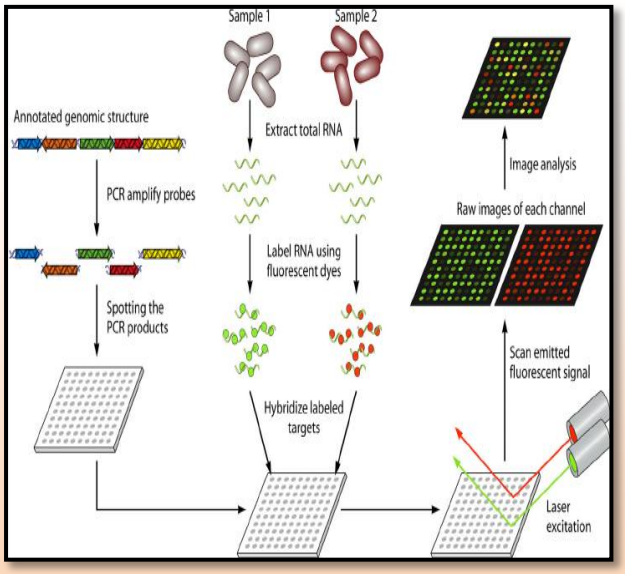
- The solid support is made from glass slides.
- Assays for oligonucleotides, probes ranging from 25 to 80 bp are used and for dsDNA cDNA, PCR amplicons ranging between 200 to 800 bp, shotgun library clones are used as probes.
- Medium density (10000-30000).
- No commercial applications; new virus discovery, molecular HIV surveillance, pathogen detection, diagnosis of infectious disease detection, antimicrobial resistance detection, etc (docplayer. net).

In situ synthesized type by Miller and Tang, (2009):

- Photochemistry is used to synthesize oligonucleotides directly on a quartz wafer; probe sets are included per target.
- Probes with 20-25 bases on Affymetrix Gene Chips
- The Affymetrix score is over 106 (high)

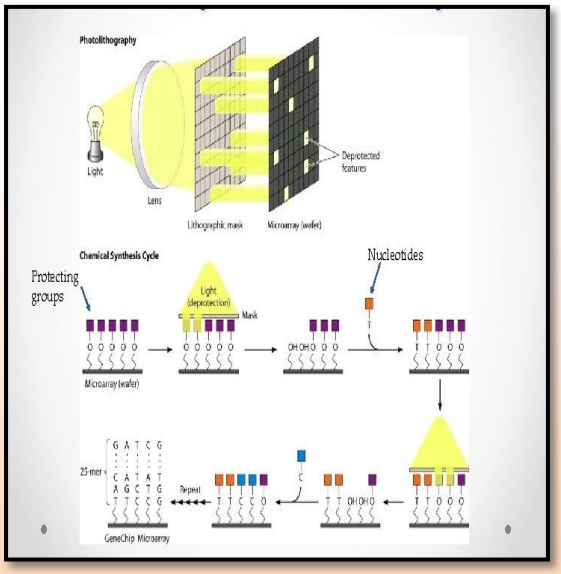
In the absence of commercial applications, it may be used for diagnosis of infectious disease detection, strain typing, pathogen detection, molecular HIV surveillance, antimicrobial resistance detection, virus discovery (docplayer. net).

Printed Microarray



Source- Millar and Tang, 2009

In situ Synthesized Arrays



Source- Millar and Tang, 2009

Fig5. Figures showing Printed Microarray (left) & In-situ Synthesised Microarray platform (right)

POTENTIAL APPLICATION

- ✓ Detection of respiratory viral pathogens
- ✓ Testing for antimicrobial drug resistance
- ✓ Detection and identification of microbes
- ✓ Molecular genetics
- ✓ Expression analysis

LIMITATIONS

1. Indirect measurement of relative concentration (Weise and Liehr, 2021)- The signal recorded at a particular spot on a DNA microarray is proportional to the concentration of the single DNA sequence hybridizing there, (Weise and Liehr, 2021) although it not linear.
2. In microarray fabrication, each step contributes to noise and variation.
3. The massive amount of data generated by microarrays makes storing, analysing, and interpreting these data a major challenge.

CONCLUSION

Biomedical and clinical researchers can use DNA microarrays to analyse a variety of biomedical samples. DNA microarrays are reliable, robust, and convenient genomics tools. New applications of this approach are increasingly being explored by the research community.

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