Dna Microarrays Encyclopedia Article

Dna Microarrays

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Dna Microarrays

DNA microarrays, also known as "gene chips", refer to nylon membranes or glass slides that contain either synthetic oligonucleotide DNA or **cDNA** probes. Each probe has unique sequences that correspond to a specific **gene**. There are thousands of probes on one microarray, each less than 200 microns in size. The probes consist of either 20-25 oligonucleotide **bases** that are annealed to glass slides by laser photolithography, or cDNA sequences that are 500-5,000 bases long and are synthesized prior to immobilization onto the array.

Microarrays provide a tool to quantitate levels of **gene expression** for all genes in an organism. To determine levels of gene expression, scientists extract **mRNA** from the tissue or **cell** samples and reverse transcribe the extracted mRNA into complementary DNA (cDNA) and tag it with a fluorescent dye. The cDNA that corresponds to the gene sequence on the microarray will hybridize due to its complementary base pair sequence. The relative abundance of the specific cDNA measured by the amount of fluorescence provides a quantitative measurement of the level of gene expression, making it possible to simultaneously investigate characteristics of thousands of gene expression patterns in a single experiment.

Microarray technology allows scientists to research the molecular interactions of genes and gene products and can be used for gene discovery, disease diagnosis, drug discovery, and toxicological research. For example, if scientists can compare levels of gene expressed in normal cells to the genes that are expressed in **cancer** cells, it might lead to identifying genes that help to explain the cause of altered physiological or pathological processes that lead to the formation of tumors. Furthermore, gene expression patterns that are unique to certain tumors can be used for diagnostic purposes.

Microarrays can rapidly detect genetic variants, providing a genome-wide, genotype analysis. Additionally, genetic variants associated with disease, whether they are polymorphisms or gene mutations, can help diagnose single gene disorders, cancer susceptibility risks, as well as determine efficacy of drug treatments. Microarrays can also be used to identify a large number of specific DNA biomarkers such as single **nucleotide** polymorphisms (SNP), which can be used to determine genetic relatedness or for identifying markers that represent specific stages of disease.

The complex task of analyzing the massive amount of data generated by microarrays is often daunting. Algorithms and specialized computer programs are currently being developed to assist scientists in this task.