

Principles of DNA Chip System and Its Application

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As the genome projects proceed toward their goal of sequencing the entire genomes of several organisms including human, brilliant progress has been achieved in the technical fields, which provides us useful tools for screening genes of biological meaning, and for scanning large amount of genetic information in a speedy manner. Although previous techniques of molecular biology have been valuable tools for studying gene expression, transcriptional control and gene mapping, it requires that the significant amount of time, money and skills to carry out the genetic analysis with previous techniques. A new technology which is speedy and economical to investigate the genetic information is DNA chip, and it has advantages over the gel-based assays in that it improves the automation of the genetic analysis because its nucleic acids are bound to a reusable solid support. Labeled probes of unknown nucleotide sequence are hybridized to an ordered array of known DNA which is immobilized on a silicon chip. The scanner reads out the fluorescence signals which result from the hybridization, and analyzes their pattern. DNA chip is synthesized by using two basic technologies as below. One of the methods begins with arraying oligonucleotides onto a slide glass and the slide glass is hybridized with fluorescence-labeled probes. After the hybridization, complementary sequences are determined by scanning. The above oligonucleotide array can be employed in detecting mutations, locating target regions within genes, investigating gene expression, and identifying gene function. The other method begins with spotting cDNA onto the glass slide and the spotted glass is hybridized with fluorescence-labeled probes. The cDNA array chip can be an excellent tool for high throughput screening.

The DNA chip technology may be employed for gene expression pattern profiling, mutation detection, sequencing by hybridization, high throughput screening of new drug and diagnosis of human, livestock and plant disease.