DNA microarray

Understanding the structure of the human genome allowed scientists to study the actual function of specific genes, which is very important in understanding health and disease. DNA microarray is one technique that enhances the understanding of the genome from structure to function. A microarray is a laboratory technique used to spot the expression of thousands of genes at the same time. DNA microarrays are microscope slides which are printed with thousands of tiny spots in distinct positions, with each spot containing a known DNA sequence or gene. These slides are referred to as gene chips or DNA chips.

The DNA molecules attached to each slide act as probes to detect gene expression, which is also known as the transcriptome or the set of messenger RNA (mRNA) transcripts expressed by a group of genes. It is a high throughput, highly parallel RNA expression assay technique that permits quantitative analysis of RNAs transcribed from both known and unknown genes. One of the major importance of this technique is that it provides diagnostic marks by comparing gene expression patterns in normal and pathological cells, as it can simultaneously track expression levels of many genes, it also provides a source of operational context for prediction of complex cell control systems. To perform a microarray analysis, mRNA molecules are typically collected from both a test sample and a control or reference sample. For example, the reference sample could be from a healthy individual or where a gene is expressed, and the test sample could be collected from an individual with a disease like cancer or a certain gene knockout. The two mRNA samples are then converted into complementary DNA (cDNA), and each sample is labeled with a fluorescent probe of a different color.

For example, the test cDNA sample may be labeled with a red or pink fluorescent dye, whereas the control cDNA may be labeled with a blue fluorescent dye. The two samples are then mixed together and allowed to bind to the microarray slide. The process in which the cDNA molecules bind to the DNA probes on the slide is called hybridization. After hybridization, the microarray is scanned to measure the expression of each gene printed on the slide. If the expression of a particular gene is higher in the test sample than in the control sample, then the corresponding spot on the microarray appears pink/reddish. In contrast, if the expression in the test sample is lower than in the control sample, then the spot appears blue.

Finally, if there is an equal expression in the two samples, then the spot appears a mix of both colors which could result in keeping in consideration the colors mentioned above in a magenta color. These data collected via microarrays can be used to create gene expression profiles, which emphasize the importance of microarray in showing instantaneous changes in the expression of many genes in response to a particular condition or treatment.