Gene Chips and Microarrays Encyclopedia Article

Gene Chips and Microarrays

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Gene Chips and Microarrays

The **Human Genome Project** began in 1990, with the goal of **sequencing** the complete human **genome**. The projected time for the project's completion was 40 years. Yet, in 2001, the sequencing was essentially complete. The reason for the project's rapid completion is the development of the **gene** chip.

A gene chip is typically constructed from glass. Wafer-like in appearance, it resembles microtransitor chips. However, instead of transitors, a chip is contains an orderly and densely packed array of **DNA species**. The thousands of sequences of DNA are robotically spotted onto the chip. The pattern is called a microarray.

Genetic material is obtained from the biological system of interest. This can be DNA or **RNA**. For example, to gain insight into which genes are active at a particular time, **messenger RNA** is isolated. The isolated material is reacted with a fluorescent probe and then the mixture is flooded over the surface of the chip. Hybridization of the added nucleic acid and a piece of the tethered DNA will occur if the sequences compliment one another. The development of fluorescence on the chip's surface identifies regions of binding, and the known pattern of the tethered DNA can be used to deduce the identity of the added sample.

Vast amounts of information are obtained from a single experiment. Up to 260,000 genes can be probed on a single chip. The analysis of this information has spawned a new science called bioinformatics, where biology and computing mesh. Gene chips are having a profound impact on research. Pharmaceutical companies are able to screen for gene-based drugs much faster than before. The future of chips economically is with the practicing physician. For example, a patient with a sore throat could be tested with a single-use, disposable, inexpensive gene chip in order to identify the source of the infection and its antibiotic susceptibility profile. Therapy could commence sooner and would be precisely targeted to the causative infectious agent.