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Stem Cell Research - Future Challenges - The Biochips

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Stem Cell Research

Much progress has been made since the first human embryonic stem cells were grown in the lab in 1998. The first clinical trials testing the safety of using specialized cells grown from hESCs are just beginning. Technological advances in miniaturization have found a niche in biology and signal the beginning of a new revolution. An understanding of how stem cell differentiation and specialization are controlled is another fundamental development process that researchers need to grasp in hopes of creating effective cancer treatments.

'Biochips' a new revolution technology that may become promising for stem cell research and enters into a new era. Biochips containing microarrays of genetic information promise to be important research tools in the post genomic era. However, one of the most common applications is in the determination of gene expression in human cells and tissues. The basic idea of the biochip technology is to convert the chemistry of life into a static form programmed to monitor genes, proteins and relations between them [1,2]. Biochip programmed by known sequences of DNA/RNA or proteins can recognize the real genes, mutations and levels of expression. The technology is highly effective method that allows monitoring of thousands of genes/alleles at a time in computerized automatic operations with minimal volumes of necessary reagents. Biochips promise an important shift in molecular biology, DNA diagnostics, and pharmacology, research in carcinogenesis and other diseases in which stem cells have the possibility of a holistic understanding of the world of biology [3,4]. Development of high-throughput 'biochip' technologies has dramatically enhanced our ability to study biology and explore the molecular basis of disease and its treatment through gene therapy using stem cell. Biochips enable massively parallel molecular analyses to be carried out in a miniaturized format with a very high throughput. Biochips are collections of miniaturized test sites (microarrays) arranged on a solid substrate onto which a large number of biomolecules are attached with high density. The word "biochip" derives from the computer term "chip". The capture probes are chosen to complement the target sequence to be detected. Each capture probe will bind to its corresponding target sequence. Like a computer chip performing millions of mathematical operations in a few split seconds, a biochip allows for simultaneous analyses of thousands of biological reactions, such as decoding genes, in a few seconds. Although silicon surfaces bearing printed circuits can be used for DNA binding, the term biochip is now broadly used to describe all surfaces bearing microscopic spots, each one being formed by specific capture probes [5]. Global gene expression analysis has helped to identify important genes and signaling pathways in human malignant tumors. Several biosensors have been used in combination with biochips.

The huge amount of information coming from the stem cell research on genome sequence and other research genome programs cannot be utilized to the full without the availability of methods such as biochips which enable these genes or specific DNA sequences to be detected in biological samples. Basic types of DNA chips are the sequencing chip, the expression chip and chips for comparative genomic hybridization. The purpose of the chips is to detect many genes present in a sample in one assay rather than performing individual gene assays as is the established practice. The huge amount of information coming from the stem cell research on genome sequence and other research genome programs cannot be utilized to the full without the availability of methods such as biochips which enable these genes or specific DNA sequences to be detected in biological samples. The biochip system can identify infectious disease strains in less than 15 minutes when testing protein arrays and in less than two hours when testing nucleic acid arrays. Novel protein biochips are under development in academic laboratories and emerging biotechnology companies to advance the pace and scope of scientific discovery. The chance to save lives and decrease suffering is exactly the sort of motivation that should support further stem cell studies for major diseases like cancer. In conclusion, stem cells offer exciting promise for future therapies, but significant technical hurdles remain that will only be overcome through years of intensive research and biochips are a relevant topic for insurers partially already today, much more however in the future.

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