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BioChips – A technology for the future

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Abstract: The most promising innovation of the future is the biochip, a product of computer science, electronics, and biology. It's a novel bio-security tool for keeping tabs on who's accessing sensitive data and where. Biochips are expected to usher in the field of genomics. Because of their speed, accuracy, and miniaturization, biochips have the potential to become as useful as computer chips. The commercial potential for both scientific study and medical practice is enormous. The preliminary concise research try to define biochip, and explore its production procedures, among other things, exemplify the efficacy of our approach. This report indicates that biochips have enormous commercial potential, with promising uses in both academic and medical settings.

Keywords: Biochip; Biology; Technology; Clinical; Security.

1. Introduction

In recent years, "biochips" have emerged as the most fascinating technology to come out of the intersection of biotechnology, electronics, and computers. Scientists now have access to novel tools as a result of developments in proteomics, genomics, and medicines, which will allow them to better decipher the intricate biochemical processes happening inside cells and bring them one step closer to their ultimate aim of understanding and treating human illnesses. The technology of micro-miniaturization has been gradually refined by the semiconductor industry at around the same time. The convergence of these disciplines resulted in the Biochip, which has allowed biotechnologists to start fitting their formerly cumbersome sensing equipment into smaller and lighter places. There might be tens of thousands, or even millions, of biosensors packed onto a single biochip. With these sensor pieces packaged

on a solid substrate over a microscope slide, hitherto time-consuming operations may be completed rapidly and efficiently. In most cases, biochips do not include electronics like microchips. Each biochip functions as a "micro-reactor" that detects a single analyte. It doesn't matter what kind of biological molecule the analyte is (DNA, protein, enzyme, antibody, etc.). Gene decoding is only one of several biological processes that may be performed by the thousands on a biochip in a matter of seconds.

1.1Biochip

In order to get a high throughput in a short amount of time, scientists have begun to use biochips, which are essentially a collection of reduced microarrays arranged on a sturdy substrate. Numerous biosensors and other sensor components fill this gadget. These aren't technological gadgets like microchips. An individual biochip may be seen as a microreactor designed to detect a specific analyte, such as an enzyme, protein, DNA, biological molecule, or antibody. Hundreds of biological activities, such as decoding genes (a sequence of DNA), may be performed on this chip in a matter of seconds, making it a powerful tool for scientists.

Affymetrix, an American firm, is responsible for developing the first biochip, known as a DNA microarray, or GeneChip. Each of these items represents one DNA sensor that may be used to detect a specific flaw. Clinical applications are on the rise, and the biochip has already shown its worth in fields like systems biology and disease biology. Microarrays are a group of tiny, identically-sized chips that are arranged over a large, sturdy surface. They speed up the execution of hundreds of reactions. The fields of molecular biology, biochemistry, and genetics are often intertwined throughout the biochip creation process. Biochips are utilized for studying biochemical processes in living organisms. What are biochips, how they work, and what are the benefits and drawbacks of using them? all of these questions and more are addressed in this paper.

2.Biochip Technology

The two main parts of a biochip implant system are the transponder and the reader (or scanner). The technology uses radio frequency identification (RFID) chips that transmit and receive data through low-frequency radio waves and a reader. Between 2 and 12 inches is typically the range at which a biochip may be read or activated by a reader. figure 1 shows the geometry of biochip.

Size

A biochip may be as little as a single grain of raw rice. The width may be anything from 2 to 12 inches.

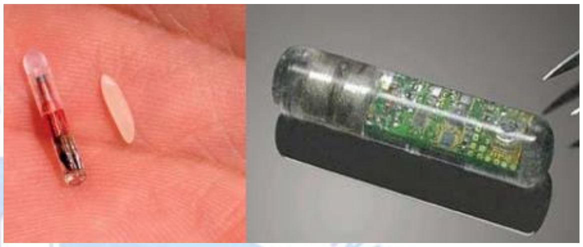

Figure 1. Biochip

2.1 Components: Transponder

The real biochip implant is the transponder. It's a passive transponder, which means it doesn't generate its own power. An active transponder, on the other hand, would need its own power source, often a tiny battery. It is inert until the reader sends it a little electrical charge, at which point it becomes active.

a.The Reader

To "excite" or "activate" the implanted biochip, the reader employs a "exciter" coil that generates an electromagnetic field via the use of radio signals to provide the required energy (less than 1/1000 of a watt). The "activated" implanted biochip will send a code or ID number, which will be received by the reader's receiving coil.

b.Working

The first stage has the operator producing a weak electromagnetic field using radio transmissions. Step 2: Power up the implanted biochip Step 3: The activated chip sends the reverse identification code to the user through radio signals

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In step four, the reader fortifies the received code to convert it to digital form, and then displays it on an LCD.

3.Applications

The following are some examples of how biochips may be put to use.

A human or animal's whereabouts may be determined with this chip. The data on this chip may be updated to reflect any changes to a person's medical, financial, or demographic status. A biochip is the key to reliable online transactions. Medical, monetary, travel documents, and other information may all be restored with the use of these chips. The biochip has several medical applications, including blood pressure monitoring, glucose monitoring, and oxygen detection.

4.Future Scope

There has been ongoing development of the biochip as a platform for technological experiments. The current attempt to combine high-throughput DNA array analysis with so-called representational difference analysis (RDA) is an intriguing breakthrough in this area. Two tissue samples' cDNA may be compared side-by-side using RDA technology. A useful scenario is contrasting tissue samples taken from a metastatic and a non-metastatic malignancy. A "subtracted cDNA library" is created by subtracting the cDNA from one tissue from the other. By constructing a high density DNA array from this subtractive library and then adding fluorescently tagged probes, the identification of differentially expressed genes may be automated, allowing, for example, a researcher to determine which genes are specific to metastatic cancer cells. Research employing this approach has shown that there are significant differences in gene expression between localized and metastatic Ewing's sarcoma (by at least a factor of two in most cases).

4.1 Clinical field

Protein-based biochips are another promising field for future research. Protein substrates might be arrayed on this biochip for future application in diagnostics and drug discovery. This biochip may have further uses, such as monitoring the catalytic activity of different enzymes, if a biosensor setup were included into it. There is a lot of effort being put into learning how to use proteins and peptides on different chip substrates. Nano-patterning on single layers or protein self-assembly is being explored as potential means of achieving this aim, with the end result being chips on which the three-dimensional patterning of proteins may be controlled.

Unique, practically applicable expansions of biochip applications will be made in the future, allowing for substantial progress to be made without the need for intensive engineering of brand-new technologies. For instance, a recently published paper detailed a unique practical technique for high-throughput genotyping of single nucleotide polymorphisms (SNPs) and mutation detection by allele-specific extension on conventional primer arrays. Significant ramifications for fields like pharmacogenomics may be expected from the assay's high throughput SNP typing in both non-clinical and clinical laboratories.

Last but not least, advanced detection methods like surface plasmon resonance (SPR) are being used in the growing area of protein biochips. SPR was recently used to detect the interaction between autoantibodies and 2-glycoprotein I (a2GPI) immobilized on protein sensor chips, an interaction that has been linked to lupus. Due to SPR, the contact could be detected despite the relatively modest protein immobilization density on the device. This strategy has great promise for the future.

5.Conclusion

The accuracy, speed, and portability of biochips are all outstanding attributes. The realm of chip manufacturing, molecular biology, genomics, and signal processing are all relevant to the biochip sector, which may be seen of as the junction of these four fields. Because of its cheap cost, high throughput, and miniaturization, this technology has the potential to play a pivotal role in a wide range of fields, including clinical research, diagnostics, drug development, toxicity investigations, and patient selection for clinical trials. In a number of the primary research locations, there has been an expansion of the market for biochips and the uses of these chips.

References

[1]https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular biology/biochip.

[2] S.K.Azhageshwari, S.Nivetha, 2014, The Bio-chips, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) IFET – 2014 (Volume 2 – Issue 01).

[3] A. C. Lee, Y. Lee, D. Lee, S. Kwon; Divide and conquer: A perspective on biochips for single-cell and rare-molecule analysis by next-generation sequencing. *APL Bioeng* 1 June 2019; 3 (2): 020901

[4] Cady, NC (2009). "Microchip-based PCR Amplification Systems". Lab-on-a-Chip Technology: Biomolecular Separation and Analysis. Caister Academic Press.

[5] Fan et al. (2009). "Two-Dim nsional Electrophoresis in a Chip" Lab-on-a-Chip Technology: Biomolecular Separation and e Analysis. Caister Academic Press.