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Short Communication

# Deployment of Biosensor Nanoengineering for Biomolecular Analysis

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## INTRODUCTION

Clinical diagnosis relies heavily on the sensitive detection of biomolecules or chemicals. In the case of disorders like cancer, where early discovery might improve the prospects of recovery and survival, this is especially true. The concentration of clinical biomolecules/chemicals is, however, quite low in the early stages of a disease. These biomarkers, or clinical molecules, confirm the onset of a disease and their concentration represents the stage of illness progression. High-end complex and laboratory-based tools are used to identify biomarkers in traditional procedures, which necessitate specialised laboratory space, competent human resources, and a significant amount of time. Even though microscopy, cell culture, proteomics, and molecular biology-based detection techniques are extremely sensitive, they can take days to identify an analyte [1]. All of these methods and instruments are too large to transport to remote regions and are unreliable for emergency detection. Instruments and detection methods that can be employed for quick and sensitive detection and can be moved conveniently are needed. Biosensors, a type of bioanalytical instrument capable of detecting a small number of biomarkers with the use of nanomaterials and surface engineering, can be used for this. "A device that uses specialised biochemical reactions mediated by isolated enzymes, immune systems, tissues, organelles, or whole cells to detect chemical substances usually by electrical, thermal, or optical signals," according to the International Union of Pure and Applied Chemistry [2].

## DESCRIPTION:

A biorecognition element (BRE), a transducer, and an amplifier and processor are the three main components of biosensors. The BRE detects the analyte of interest, and the transducer turns the biorecognition event into a quantifiable signal, which is then processed by a processor and amplifier to produce a signal output. The main ingredients and classification of biosensors are depicted in a schematic diagram [3]. Biosensors are analytical instruments that are used to detect the presence and quantity of an analyte as well as to measure its concentration. Other things to look into include cell physiology, cell dynamics, and the action of pharmacological compounds on cells [4]. As a result, biosensors are built based on the target and transduction process in order to obtain a quantifiable signal with high resolution that can detect even the tiniest changes in target analyte concentration. Biosensors should also be able to discriminate between the target and non-specific molecules in the detecting fluid. Biosensors' analytical performance is measured in terms of sensitivity, selectivity, detection limit, detection range, reuse capacity, and so on. However, due to the effect of the sensing matrix and co-existing molecules, biosensors are prone to signal generation obstruction. Metallic nanoparticles, polymers, carbon nanomaterials, quantum dots, and other nanomaterials of various sizes, shapes, and characteristics have been utilised to improve biosensor efficiency and eliminate interference from the sensing matrix [5].

The notion of point-of-care diagnostics, a portable diagnostic kit for the robust and sensitive onsite detection of therapeutically significant chemicals, is born from the nanomaterial integration. Because of their increased surface area, size-dependent optoelectronic property, electrical conductivity, high catalytic activity, and biocompatibility, nanomaterials have become an integral aspect of biosensor design to achieve enhanced sensitivity and signal amplification. A surface modified with nanomaterials can adsorb more BREs and detect more analytes than a non-modified surface [6]. Nanomaterials aided in the shrinking of the detecting device by producing a portable nanoscale platform that can reach the same sensitivity as sophisticated devices. BREs are coupled onto the nanomaterials modified sensor surface using appropriate immobilisation procedures to achieve selectivity. By increasing the loading of BREs on nanomaterials, functionalization techniques aid in expanding the detection range of biosensors. Covalent or non-covalent interactions can be used in these tactics. The conjugated skeletons are not destructed by non-covalent interactions, which reduce the loss of electrical characteristics in nanoparticles. Covalent interactions, on the other hand, are favored for the conjugation surface's stability and reproducibility [7].

For the detection of ultra-low concentrations of analyte and its stability in biological samples, both nanomaterials and surface chemistry are required. Biosensors have been successfully applied in a wide range of modern research areas, including clinical detection,

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environmental investigations, cell physiology, and studying the effects of space on astronauts [8].

## CONCLUSION:

The biosensors are made with the target analyte and the transducing mechanism in mind. Biosensors can be divided into labelled and label-free biosensors based on how labels are used.The analyte, such as enzymes, catalase, alkaline phosphatase, electroactive chemicals, or fluorescent molecules, is detected using a reporter or label in labelled biosensors [9]. Despite the fact that the label aids in signal amplification and better selectivity for sensing, it raises the total cost and lengthens the sensing time. Label-free approaches, on the other hand, are dependent on BREs recognising the target and its straightforward recognition. The creation of portable devices is favoured by design. The following section goes through the various components of a biosensor in depth. Biosensors are built on a supporting matrix that has been functionalized to allow BREs to be attached for sensitive analyte detection. The nature of the material, manufacturing type, and design of a sensor matrix all have a significant impact on the sensor's final sensing capacity, and should be carefully selected based on the analyte and transducing mechanism. Some of the most commonly used sensor matrices are paper, graphite, carbon paste, glassy carbon electrodes, screen printed electrodes, and indium tin oxide [10].

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None

**Conflict of Interest**

None

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