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Magnetic Nanoparticles in Oncotheranostics: Advancements in Biosensors and Drug Delivery

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Introduction

Biosensors and drug delivery systems have revolutionized the field of oncotheranostics, particularly through the utilization of inorganic synthetic and biogenic magnetic nanoparticles. Oncotheranostics refers to the integration of diagnostics and therapeutics for cancer treatment, enabling personalized medicine and targeted therapy [1]. In this context, magnetic nanoparticles have emerged as powerful tools due to their unique properties, such as their ability to be manipulated by external magnetic fields and their potential for multifunctional applications. This article explores the significance of biosensors and drug delivery systems using inorganic synthetic and biogenic magnetic nanoparticles in the field of oncotheranostics. Attractive nanocarriers stand out enough to be noticed in translational oncology because of their capacity to be utilized both for cancer diagnostics and treatment. This survey sums up information on utilizations of Manufactured and Biogenic Attractive Nanoparticles (MNPs) in oncological theranostics and related regions [2].

Description

Attractive nanoparticles are biocompatible and loan themselves well to alteration by different biorecognition ligands. The fundamental qualities of MNPs are their subcellular size, going from a couple of nanometers to several nanometers, permitting them to connect with nano-sub-atomic measured biomolecules. Magnetic nanoparticles can be used in a variety of biomedical applications due to their unique properties, such as diagnostics, drug delivery, treatment with hyperthermia, isolation of tumor cells and precise reagent manipulation. Biosensors are analytical devices that detect and quantify specific biological or chemical substances by utilizing a biological recognition element, such as enzymes or antibodies, coupled with a transducer [3].

In oncotheranostics, biosensors are employed to identify cancer-specific biomarkers, such as proteins or nucleic acids, which indicate the presence or progression of cancer. By integrating magnetic nanoparticles into biosensors, enhanced sensitivity and selectivity can be achieved. Inorganic synthetic magnetic nanoparticles, such as iron oxide or manganese oxide nanoparticles, can be engineered to have precise sizes, shapes, and surface properties, allowing for the development of highly efficient biosensors. These nanoparticles can be functionalized with specific ligands or capture agents to selectively bind to cancer biomarkers, enabling their detection and quantification. On the other hand, drug delivery systems in oncotheranostics are designed to deliver therapeutic agents specifically to cancer cells while minimizing their impact on healthy tissues [4].

Magnetic nanoparticles offer unique advantages in this context, as they can be utilized both as drug carriers and as mediators of targeted drug delivery. Inorganic synthetic magnetic nanoparticles can be loaded with therapeutic agents, such as chemotherapy drugs or gene therapies, and functionalized with targeting ligands that specifically recognize cancer cells. These nanoparticles can then be guided to the tumor site using an external magnetic field, allowing for precise localization and controlled release of the therapeutic payload. Furthermore, biogenic magnetic nanoparticles, such as magnetosomes produced by magnetotactic bacteria, have gained attention due to their natural magnetic properties and biocompatibility. These biogenic nanoparticles can be harnessed for drug delivery, providing a promising alternative to synthetic counterparts [5].

Conclusion

Biosensors and drug delivery systems incorporating inorganic synthetic and biogenic magnetic nanoparticles have emerged as powerful tools in the field of oncotheranostics. The integration of magnetic nanoparticles into biosensors allows for sensitive and selective detection of cancer biomarkers, facilitating early diagnosis and monitoring of cancer progression. Moreover, magnetic nanoparticles serve as versatile platforms for targeted drug delivery, enabling precise localization and controlled release of therapeutic agents to cancer cells. The development and optimization of these technologies hold great promise for improving cancer diagnosis, treatment, and patient outcomes. As research in oncotheranostics continues to advance, the synergistic combination of biosensors and drug delivery systems utilizing magnetic nanoparticles will undoubtedly contribute to the development of more effective and personalized cancer therapies.

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Conflict of Interest

There are no conflicts of interest by author.

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