A State of the Art Review on Applications of Nanoparticles in Nano medicine

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ABSTRACT: Nanoparticles have been catapulted into almost every discipline of scientific study by highly tunable physical and optical properties and the ability to bind an ever expanding library of ligands. As nanoparticles are closer to being completely deployed at the clinical level, some of the recent developments in the use of nanoparticles are being studied in medicine. A number of nanoparticles are presented together with their physical and optical properties to be used in a variety of medical applications, from imaging and diagnostics to therapy and treatment. While other reviews are targeted to particular applications or to individual types of nanoparticles, the purpose of this review is to provide a wider perspective on the visualization, diagnosis and treatment of diseases with different types of nanoparticles. One of the difficulties of summarising the medical applications of nanoparticles (NPs) is that they are continually evolving and growing in reach and breadth. Nothing short of incredible is the pace and effectiveness at which NPs are deployed at any step of the clinical process.

KEYWORDS: Diseases, Medical, Nanoparticles, Systems, Technology.

INTRODUCTION

One of the key objectives of NP-based platforms is to achieve therapeutics' targeted delivery and tracking while minimising side effects. NP-based technology has recently led to the introduction of modern multiplex systems that incorporate both a form of treatment and imaging for a more aggressive and efficient approach to the fight against diseases such as cancer [1]. Lipid-based NP-systems, such as liposomes and micelles, were the first generation of NP-based therapies approved by the FDA [2]. One of the main goals of NP-based platforms is to achieve the targeted delivery and monitoring of therapeutics while minimising side effects. Recently, NP-based technology has led to the implementation of new multiplex systems for a more aggressive and efficient approach to the battle against diseases such as cancer that combine both a method of treatment and imaging.

Figure 1: Illustrates the potential of NPs in therapeutic, imaging [3]

The first generation of NP-based treatments approved by the FDA were lipid-based NP-systems, such as liposomes and micelles. The emphasis of this paper will therefore be on the medical applications of GNPs and MNPs, along with the creation of multifunctional NPs integrated into up and coming polymers and lipids. A broad view of recent medical research focused on NP is provided [4].

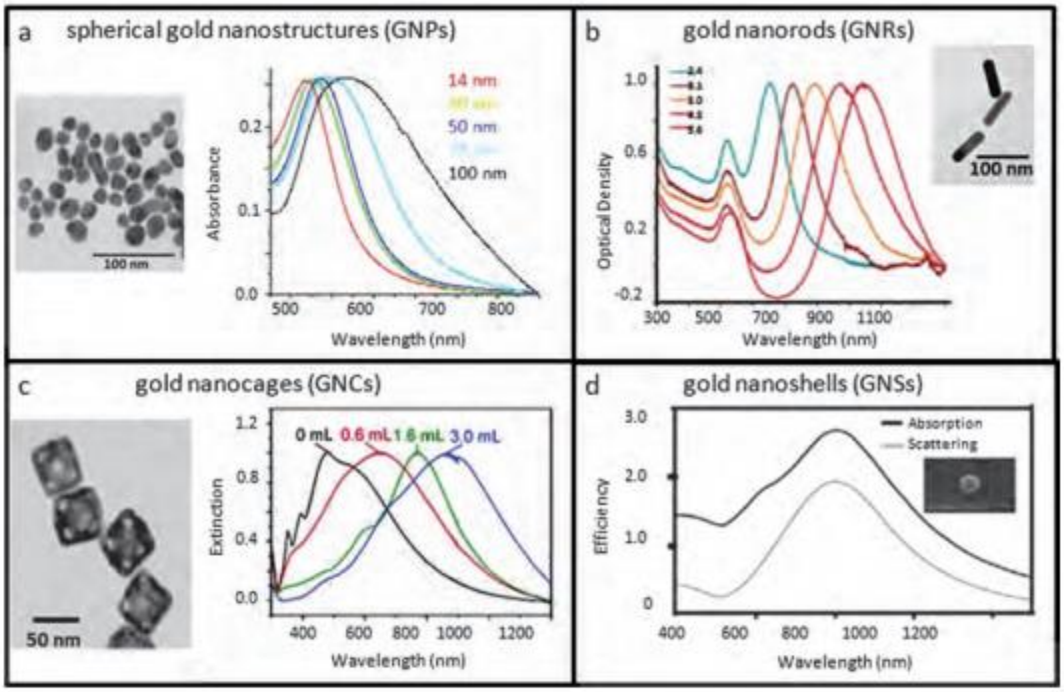

Figure 2: Illustrates the Gold-based nanostructures as a tool [5]

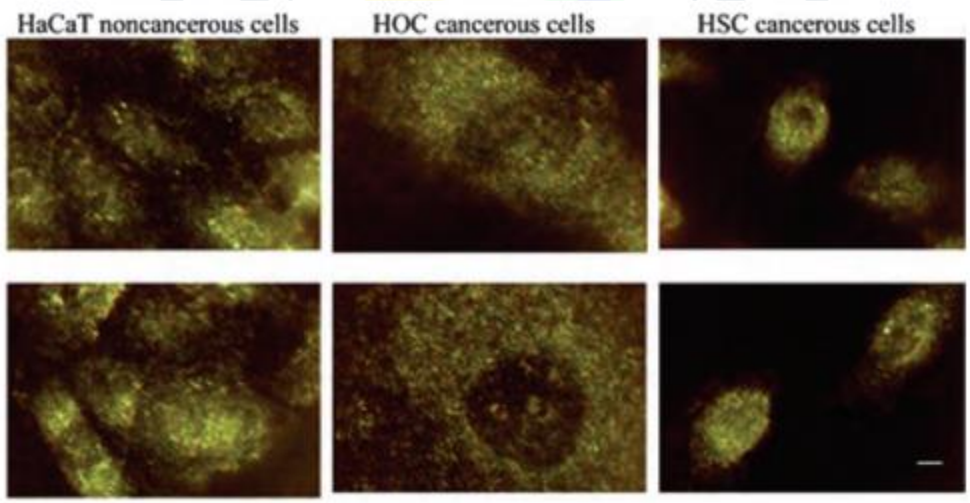

Figure 3: Illustrates the Nanoparticle-based Dark field microscopy [6]

DISCUSSIONS

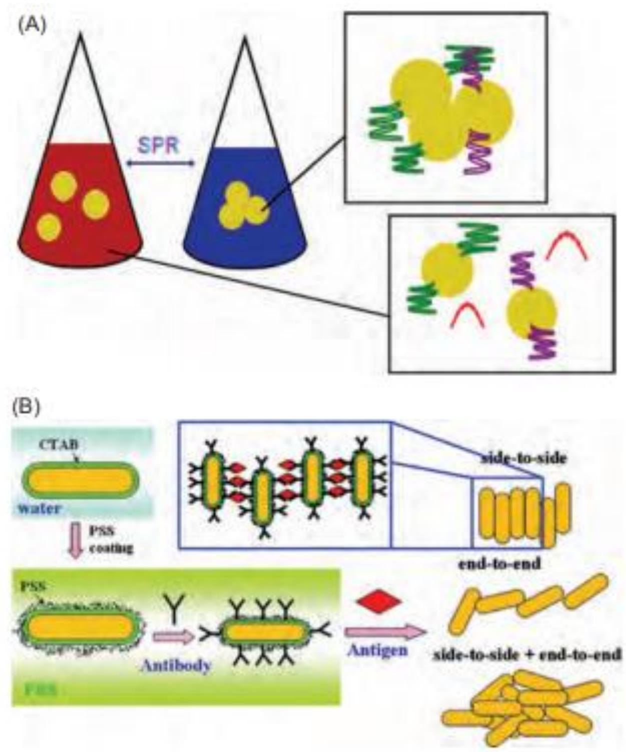

Figure 4: Depicts the Nanoparticle-based diagnostic assays [7]

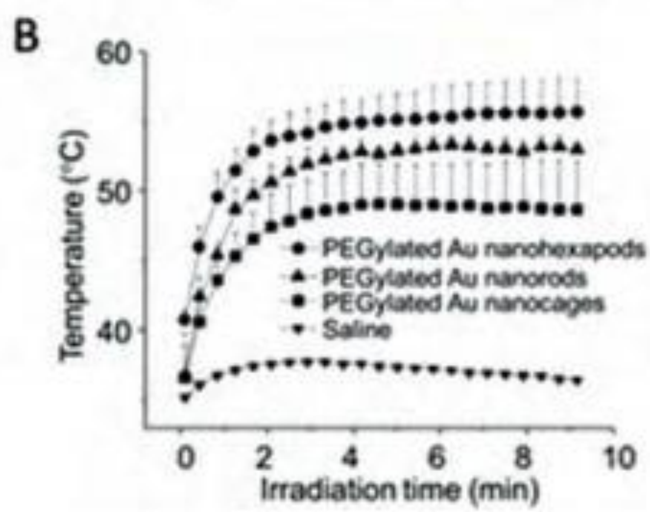

Figure 5: Depicts the Plots of average temperature increase within the tumor region [8]

There has been immense interest in the use of novel solid state nano materials for medical and biological applications in recent years. In combination with the remarkable recognition capabilities of biomolecules, the unique physical properties of nanoscale solids (dots or wires) could lead to miniature biological electronics and optical devices, including biosensors and probes. Some interesting examples that use nanostructured materials conjugated with DNA as novel biosensors are listed below [9]. Figure 1 illustrates the potential of NPs in therapeutic, imaging. Figure 2 illustrates the Gold-based nanostructures as a tool. Figure 3 illustrates the

Nanoparticle-based Dark field microscopy. Figure 4 depicts the Nanoparticle-based diagnostic assays. Figure 5 depicts the Plots of average temperature increase within the tumor region.

CONCLUSION

It seems only a matter of time before NPs emerge as the cornerstone of medical imaging, diagnostics and care at the clinical level, with a number of nanotechnology trials now at the clinical trial stage. With applications at every level of the clinical phase, as more and more studies participate in innovative experimentation, NP use continues to grow. It is no wonder that, considering their incredible variety of potential composite materials, ligands, encapsulates, and optical and physical properties, they have already been associated with an enormous range of biomedical subjects. Going forward, the development of multi-functional NPs is likely to be at the forefront of future work for imaging and payload delivery. In NP drug and gene delivery vehicles, changes will be made, as shown by some of the work discussed here. While scientists, doctors and patients alike will probably be shocked by the ever - biomedical applications of NPs, it is plain to see that their research and design will press ahead with great vigor. NP-based platforms, however, are still at the initial development stage and much further study is needed before they can be clinically implemented. Protection and toxicological concerns still need to be resolved in order to draw on the full potential of NP-based therapeutics in nanomedicine.

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