Magnetic Functionalized Nanoparticles for Biomedical, Drug Delivery and Imaging Applications

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Introduction

Metal nanomaterials represent a significant doorway for the future of Medicine.
Although, metal nanoparticles are still not very looked into, these particles have already found their place within various biomedical applications such as site-specific imaging in vivo, cancer detection, cancer therapy, neurodegenerative disease therapy, HIV/AIDS therapy , ocular disease therapy, and respiratory disease therapy.

About Nanoparticles

Despite the recent advances in nanomedicine, there are still many obstacles in the way of nano-therapy:

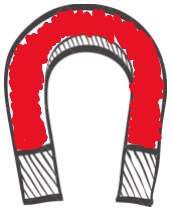
- there's still no way found to produce the nanomaterials in a large enough quantity to make it economically viable
- Unknown long term toxicity
- It is hard to achieve a synthesis route which produces easily repeatable outcomes

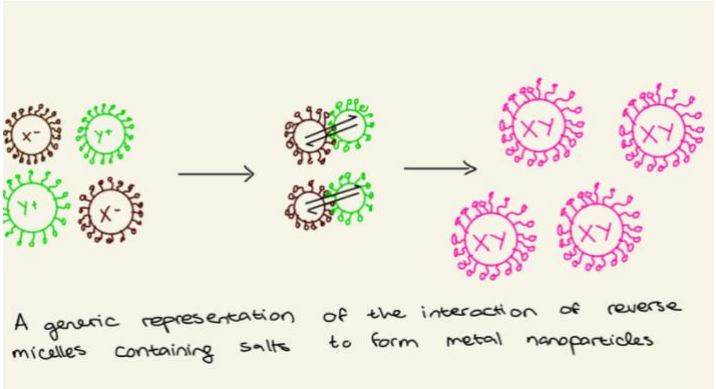
If the issues would be resolved, nanoparticles could be one of the largest steps towards a new modern medical era.

- Due to the large surface area of the nanoparticles they are useful for drug delivery
- Nanoparticles are also convenient for use in CT or MRI imaging
- Antimicrobial effects
- Antiviral
- MNPs as a key tool in the treatment of chronic diseases such as cancer, which through hyperthermia treatment may induce antitumoral immunity

How does it work ? (Ex. Drug Delivery; Cancer Targeting)

The Nanoparticles are strategically designed with dimensions mimicking biological vesicles or molecules found in our body so these are able to pass through blood vessels to safely reach their target and eventually release their cargo at the site of the disease. The main advantage of magnetic nanoparticles lies in controlling their distal location or thermal activation by applying alternating magnetic fields (kHz-MHz) that do not cause adverse effects to the human body. The particles can easily passage or accumulate into several tumors, allowing the administration of drug delivery for different routes, including brain tumors, and can cross the blood-brain barrier (BBB) effectively.





A generic representation of the interaction of reverse micelles containing salts to form metal nanoparticles

Conclusion

In brief, single metal nanoparticles have been shown to currently possess a wide range of biomedical applications, with more application for these nanoparticles being discovered. One of the limiting factors that these nanoparticles face in medical treatments is to find a way for precise accurate targeting of areas within the body, be it for targeting of a drug delivery or for therapies involving the nanoparticles directly. It will take some time for Nanoparticles to be routinely applied in medicine.