

5. The role of nanotechnology in biomedicine: Solutions

Nanotechnology is becoming increasingly significant in the healthcare sector in areas such as drug delivery, gene delivery and diagnostics. One of the challenges of pharmaceutical research is to deliver the drug to the targeted place in the human body⁴.

Targeted drug delivery systems

Polymer based nanocapsules are considered effective vehicles for drug delivery systems⁵. There are several advantages of having a polymer coating on the drug. It prevents the drug from being released half way inside the body and thus in turn protects the healthy tissues in the body from the harmful effect of the drug. These kinds of polymeric capsules have been used to treat cancer as they contain Paclitaxel, an anti-cancer drug. Targeted drug delivery has also been proposed to cure osteoarthritis (OA), the erosion of the joint cartilage tissues.

Nanotechnology in gene delivery

Gene therapy is a method of correcting genetic disorders by replacing defective genes with repaired genes. Research is being conducted to see if the conventional routes of viral vectors for gene transfer can be replaced by nanotechnological tools. Nanochips have found applications in biological imaging and molecular diagnostics⁴. Targeting tumors with magnetic nanoparticles is a significant area of research in nanotechnology⁶. In the case of magnetic targeting, the drug is attached to the magnetic nanoparticle and then with the help of an external magnetic field, the magnetic nanoparticle moiety is delivered to the targeted site.

1) Do you think it is possible that personalized medicines based on nanotechnology will be developed in the future? What kind of research would need to be carried out in order for this to happen?

It is possible. However, detailed research is required into the extent to which nanomaterials can be used in this way without causing side effects.

2) Find out what is meant by functionalization of nanomaterials. Why is it so important in medicine?

Functionalization of nanomaterials refers to the process of modifying the surface of nanoparticles by applying appropriate coatings. These are mostly organic based coatings. Functionalization of nanomaterials is extremely important in medicine as it allows drugs to navigate into the blood stream more easily.

References

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5. Ruggiero C, Pastorino L, Herrera OL. Nanotechnology based targeted drug delivery. In: *2010 Annual International Conference of the IEEE Engineering in Medicine and Biology.* IEEE; 2010: 3731-3732.
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Further reading

Hirak K. Patra, Anthony P.F. Turner. The potential legacy of cancer nanotechnology: cellular selection, *Trends in Biotechnology* 2014, 32:21-31, 2014