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Gold and Silver Nanoparticles in Tissue Engineering

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Commentary

Biochemically designed Nano sized particles with size dimensions in the range of 1-100 nm are known as nano-delivery vehicles. These nanoparticles have a number of innovative and distinct properties, including increased chemical/biological reactivity and sensing capability. Many clinical and biomedical scientists are now implementing a variety of advanced and improved lab practises to improve the potency, safety, and efficiency of gold and silver conjugated plasmid DNA vectors for use as safe metallo vector tools for achieving site specific delivery of bound desired protein and antibiotic resistance genes in the host in the form of colloidal silver/gold nanoparticles and nanoscaffolds. Nonviral gene/drug therapies have emerged as a promising diagnostic and therapeutic option for a variety of genetic, metabolic, neurodegenerative, and central nervous system illnesses.

Due to their low immunogenicity, low toxicity, and excellent tissue specificity for targeted delivery of loaded chemical or biological components, these non-viral nanomaterials are a good candidate for effective and safe alternative gene transfer vehicles/tools to other standard viral vectors tools. As a result, during the last few decades, their clinical and genetic techniques have been tested in in-vivo and in-vitro clinical trials to see if they may be employed as safe and effective non-viral delivery vehicles.

Non-viral gene vectors, such as lipoplexes, liposomes, and polyplexes, have recently been employed in nanoscale diagnostic and therapeutic DNA-based nanomedicine techniques.

1. The dye's penetration into hair follicles was studied *in vitro* on pig skin, which is a good model for human tissue, and it was discovered that nanoparticles penetrate significantly deeper into the hair follicles than any other non-particle form.
2. Gold nanoparticles (AuNPs) and silver nanoparticles (AgNPs) as nanoconjugates or nanoscaffolds multifunctional nanotools prepared by using cationic lipids or polymers are being considered for developing new non-viral vectors based gene therapies. These have also been found to be a more promising choice for gene delivery than viral vectors such as *E. coli,* Lentil virus, Adenovirus, Herpes virus, and Retro
3. Non-viral gene vectors based on nanoparticles offer low cytotoxicity and great biocompatibility, as well as better transfection efficiency, and can be used to target cancer or tumour cells.
4. Polyethylenimine-coated magnetic nanoparticles and cell-penetrating peptides have been proposed as non-viral gene delivery nanobiomaterials (CPPs).
5. Non-viral gene therapy has recently been identified as a promising approach for investigating powerful and safe anticancer efficacy as a better nanomedicine option for treating cancers and tumours.

Because of their advantages, such as high stability and loading capacity, biosynthesized or biogenic metallic nanoparticles, particularly silver and gold nanoparticles (AgNPs and AuNPs, respectively), are increasingly being used. Furthermore, these nanoparticles are synthesised using a green and cost-effective method. Previous research has looked at reducing and/or stabilising agents from a variety of biological sources, such as plants, microbes, and marine-derived products, employing a one-pot or multistep procedure under diverse conditions. Furthermore, substantial research has been conducted to evaluate the biological or pharmacological effects of these nanoparticles, including antibacterial, anticancer, anti-inflammatory, and antioxidant properties. Chitosan, a naturally cationic polysaccharide, has been studied as a reducing and/or stabilising agent in the manufacture of biogenic metallic nanoparticles with possible uses in nanomedicine in recent years. We've looked at the biosynthesis of AgNPs and AuNPs, as well as their chitosan-mediated nanocomposites, and their prospective uses in nanomedicine.

Because of the advantages of this technology, biosynthesis of metallic nanoparticles has gotten a lot of attention. The utilisation of biological methods to synthesise nanoparticles is environmentally beneficial, and reducing agents found on plants, bacteria, or fungi can be used. In recent years, biosynthesis of metallic nanoparticles utilising plant extracts, enzymes, and microbes has been actively researched as an environmentally benign and green method. Plant-mediated biosynthesis of metallic nanoparticles is gaining popularity because it is a straightforward way for modifying the size and shape of nanoparticles that is also cost-effective, nontoxic, and environmentally benign.

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