New trends in nanotechnology-based targeted drug delivery systems

Hussein O Ammar
Future University, Egypt

In recent years, theranostics are emerging as the next generation of multifunctional nanomedicine to improve the therapeutic outcome of cancer therapy. Polymeric nanoparticles with targeting moieties containing magnetic nanoparticles as theranostic agents have considerable potential for the treatment of cancer. The use of directed enzyme prodrug therapy (DEPT) has been investigated as a means to improve the tumor selectivity of therapeutics. Magnetic DEPT involves coupling the bioactive prodrug-activating enzyme to magnetic nanoparticles that are then selectively delivered to the tumor by applying an external magnetic field. Gene therapy is an attractive method for meeting the needs for curing brain disorders, such as Alzheimer's disease and Parkinson's disease. On the other hand, due to the fact that hepatocellular carcinoma (HCC) is resistant to standard chemotherapeutic agents, gene therapy appears to be a more effective cure for HCC patients. Ultrasound-mediated drug delivery is a novel technique for enhancing the penetration of drugs into diseased tissue beds noninvasively. This technique is broadly appealing, given the potential of ultrasound to control drug delivery spatially and temporally in a noninvasive manner.

Design and characterization of gold nanoparticle based cancer vaccine

Ramazan Ozturk, Bakytzhan Bakhautdin, Esen Goksoy Bakhautdin, Ozlem Polat, Muhammad Tofq Salih and Nariman Tursunbayev
Fatih University, Turkey

Novel approaches in design and synthesis of gold nanoparticles (AuNP) allowed the scientists to create them in various shapes with highly variable surface modifications, thereby, increasing the biocompatibility of AuNP and making them more applicable and nontoxic in micromolar ranges. Nowadays, the AuNP have been extensively studied for drug delivery as well as vaccine platforms. In general, the AuNP reduce the toxicity and improve the immunogenicity and efficacy of vaccines. Our aim is to develop a novel AuNP-based vaccine consisting of a protein target and TLR ligands and investigate its toxicity, immunogenicity and efficacy using in vivo allograft mouse model of prostate cancer. Our AuNP formulation is based on 50 nm gold nanospheres with target proteins, polyethyleneimine and TLR agonists. The synthesized formulation was characterized by UV-vis Spectroscopy, SEM, and Dynamic Light Scattering (DLS). We have also investigated the in vitro and in vivo toxicologic properties of the AuNP vaccine in cell culture media using HepG2 cells and in healthy C57BL/6 mice, respectively. The immunogenic properties of AuNP were first investigated in vitro by measuring the activation of NF-kB and AP-1 in reporter cell lines. In preclinical studies, the healthy C57BL/6 mice were immunized with the AuNP. T and B cell immune responses to the antigen were measured by IFN-gamma ELISpot and antibody titre assays, respectively. As a result, our studies revealed low toxicity of our AuNP nano-formulation and its highly immunogenic vaccine potential. For future studies, we are going to test the efficacy of AuNP vaccine using in vivo cancer model.