Gold and Silver Nanoparticles for Skin Cancer Chemoprevention and Therapy

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Skin cancer is the most commonly diagnosed cancer in the United States. In this project, gold and silver nanoparticles were tested for skin cancer chemoprevention and therapy. Results indicate that gold and silver nanoparticles in the size range 10-100 nm and concentration range 1-10 mg/L are not toxic to nontumerigenic HaCaT cells. Dot-blot assay and apoptosis results show that DNA damage due to UVB exposure is significantly reduced in the presence of silver nanoparticles in the size range 10-40 nm, thereby proving the chemopreventive effect of silver nanoparticles. On the other hand, gold nanoparticles do not show any chemopreventive effect in various studies. Cell cycle studies suggest that silver nanoparticles in the size range 10 nm – 40 nm arrest the cells at the first checkpoint prior to DNA duplication to facilitate repair of UVB-induced CPD formation. Furthermore, silver nanoparticles in the smaller size range up-regulate the expression of anti-apoptic proteins and down-regulate the expression of pro-apoptotic proteins. Toxicity studies indicate that while gold nanoparticles are not toxic to A431-NS epidermoid carcinoma skin cancer cells, silver nanoparticles in the size range 10-40 nm are toxic to A431-NS cells with cell viability ranging from 10-30%, thereby proving their therapeutic value for skin cancer. Thus, while gold nanoparticles are not chemopreventive or therapeutic, silver nanoparticles have both a chemopreventive effect against UVB-induced damage and a therapeutic effect against skin cancer cells. A green method for producing silver nanoparticles that uses aloe vera as a reducing agent was developed and these nanoparticles had chemopreventive properties against UVB-induced damage that are similar to commercially obtained silver nanoparticles.

Awards Won:

Third Award of $1,000