AgNPs: Silver Bullets for Skin Cancer Chemoprevention and Therapy

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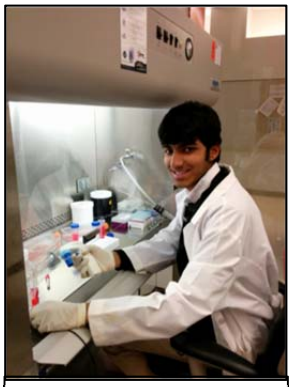
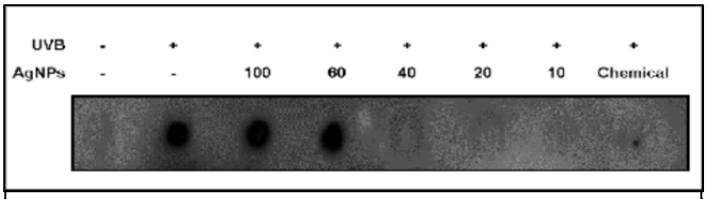
Skin cancer is the most commonly diagnosed malignancy in America. Each year, over two million new cases of skin cancer are diagnosed, which is greater than the combined incidence of cancers of the breast, prostate, lung and colon. Therefore, prevention of skin cancer remains a priority area of research. The traditional approach to protect against the harmful effects of UV has been to use sunscreen lotion as a direct barrier on the skin. Sunscreens are formulated to contain UV filters or reflectors such as zinc oxide and titanium dioxide nanoparticles. Several studies have shown the inflammatory/toxic effects of these nanoparticles in normal skin cells. For this reason, it is necessary to consider the efficacy of novel nanoparticles in skin cancer prevention as well as new methods to synthesize these nanoparticles. Silver has historically been used as an antimicrobial agent. However, it is not known if AgNPs it plays a chemopreventive role against UV-induced skin carcinogenesis.



Student researcher culturing HaCaT cells.

Dr. Srinivas Palanki is collaborating with Dr. Ajay Singh from the Department of Oncologic Sciences to study the effect of silver nanoparticles (AgNPs) on skin cancer chemoprevention and therapy on a project funded by the Abe Mitchell Cancer Research Fund. His research group cultured skin epidermal immortalized, non-tumorigenic keratinocytes (HaCaT) and epidermoid carcinoma skin cancer cells (A431-NS) and the effect of size and concentration of AgNPs was tested for both skin cancer therapy as well as skin cancer chemoprevention against UV-induced cell damage. Cell viability analysis via colorimetric assay indicated that AgNPs in the size range 10 nm to 100 nm are not toxic to HaCaT cells. Cell viability analysis via colorimetric assay indicated AgNPs in the range 1 mg/L to 10 mg/L are not toxic to HaCaT cells but are toxic to A431 cancer cells, thereby demonstrating the therapeutic effect of AgNPs. Dot blot analysis indicates that UV-induced DNA damage in HaCaT cells with AgNPs of size range 10 nm to 40 nm is significantly reduced. UV-induced apoptosis studies via FACS indicated that AgNPs in the size range 10-40 nm provide significant protection (4 fold) against UV-induced apoptosis, thereby demonstrating the chemopreventive effect of AgNPs. Future work is focused on synthesizing AgNPs via a green method by using Aloe Vera extract as a reducing agent and testing for potential synergistic effects between AgNPs and Aloe Vera in chemoprevention. The eventual goal is to develop a topical lotion with AgNPs that protects against UV-induced skin cancer.



Dot blot assay on HaCaT cells exposed to UV radiation indicates that AgNPs in the size range 10-40 nm prevent UV-induced DNA damage.