
Plasma Induced Immuno-modulations for Medical Applications

Nagendra Kaushik ¹, Neha Kaushik ², Manish Adhikari ¹, Bhagirath Ghimire ¹, Rizwan Wahab ³, Abdulaziz A. Al-Khedhairi ³, Su-Jae Lee ², and Eun Ha Choi ¹

¹*Plasma Bioscience Research Center, Applied Plasma Medicine Center, Department of Electrical and Biological Physics, Kwangwoon University, Seoul, Korea, Republic of*

²*Department of Life Science, Hanyang University, Seoul, Korea, Republic of*

³*Zoology Department, College of Science, King Saud University, Riyadh, Saudi Arabia*

The application of plasma medicine as a new medical technology has been actively explored over the last several years. Previously, we have showed the role of atmospheric pressure non-thermal plasmas in various kind of cancer treatment. Now we are focused on plasma as a new human health care's technology against cancers based on immuno-modulation. Main target of our study is to enhance efficacy and selectivity of plasma on cancer cells and cancer microenvironment by inducing immune-modulations. Our research work mainly comprises plasma induced activation of immune cells; which find applications for curing various kinds of resistant cancers and other dreadful diseases. In one of our recent studies, using a monocyte cell model, we show that cold plasma activates the differentiation of monocytes into a macrophage-like phenotype and can increase mitochondrial/lysosomal numbers, suggesting that plasma may stimulate macrophage differentiation or activation. In turn, the interaction of plasma-activated macrophage cells reduced pro-tumorigenic features such as epithelial-mesenchymal-transition (EMT) and the stem-like population of tumor cells. Furthermore, plasma targeted macrophage activity and consequently enhanced apoptosis via expression of the TNF-alpha/NOS+ M1-like phenotype. In another study we have evaluated role of plasma induced damage associated molecular patterns/ immunogenic cell death in immune activation and cancer treatment in skin cancer models. Our main objectives are (i) to clarify basic mechanism on plasma induced immuno-modulations (ii) to develop immunomodulation based strategy for the treatment of various dreadful diseases including cancers (iii) to initiate pre-clinical study. Recent preliminary study suggests that plasma significantly modulated immune cells and can induce cancer cell death in co-culture condition. We have also initiated a study on plasma induced immuno-modulations for treatment of atopic dermatitis and other skin disorders.