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Plasma bioscience and medicine: new paradigm for cancer treatment

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There is the urgent need of new human health care's technology against cancers or tumors based on plasma electronics, medicine and biology. Main target of our study is to enhance efficacy and selectivity of plasma on cancer cells with metabolic modifiers, functionalized nano-materials and by inducing immune-modulations. Our research mainly focused on three subtopics given below.

1) Plasma Induced Immuno-modulations: Our work mainly comprises plasma induced modulation of immune cells; which find applications for curing various kinds of resistant tumors and other dreadful diseases. Our preliminary finding suggests plasma significantly activates immune cells which increases cell death in cancers in co-culture and in vivo conditions.

2) Plasma with Functionalized Nano- or Bio-materials: We have also found that co-treatment of PEGylated gold nanoparticles and cold plasma suppresses tumor growth by decreasing mesenchymal markers in tumor xenograft mice models. Importantly, co-treatment resulted in a substantial decrease in sphere formation and the self-renewal capacity of glioma-like stem cells.

3) Plasma with Metabolic Modifiers: Our findings on metabolic modifiers and plasma co-treatment suggest that metabolic modifiers enhance the efficacy and selectivity of plasma to kill cancers through intracellular metabolic modulations.

Finally, we conclude that functionalized nanoparticle and metabolic modifiers with non-thermal plasma and plasma induced immune-modulations can be used as a treat various resistant cancers.

Related Publications:

1. BIOMATERIALS, 2016, 87, 118-130 "Low doses of PEG-coated gold nanoparticles sensitize solid tumors to cold plasma by blocking PI3K/AKT driven signaling axis to suppress cellular transformation with growth and metastasis inhibition"
2. J. PHYS. D: APPL. PHYS., 2016, 49, 084001 "Cytotoxic macrophage-released tumor necrosis factor-alpha (TNF- α) as a killing mechanism for cancer cell death after cold plasma activation"
3. SCIENTIFIC REPORTS, 2015, 5, 8587. "Responses of Solid Tumor Cells in DMEM to Reactive Oxygen Species Generated by Non-Thermal Plasma and Chemically Induced ROS Systems"
4. SCIENTIFIC REPORTS, 2015, 5, 8726. "Non-thermal plasma with 2-deoxy-D-glucose synergistically induces cell death by targeting glycolysis in blood cancer cells"
5. PLOS ONE, 2014, 9, e103349. "Altered antioxidant system stimulates dielectric barrier discharge plasma-induced cell death for solid tumor cell treatment"

