

Workshop "Plasmas in Medicine"

PLASMED PROJECT: BIOMEDICAL APPLICATIONS OF NON-EQUILIBRIUM LOW TEMPERATURE PLASMAS

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Over the past two decades, many teams around the world demonstrated very interesting applications of non equilibrium cold plasmas in the domains of sterilization and decontamination. Recently, researchers have shown that this kind of plasmas is of huge interest in medicine, more especially for haemostasis, skin diseases, stomatology, wound healing, and hygiene. Our very recent work showed that non equilibrium cold plasmas at atmospheric pressure are also clearly very promising for the treatment of certain types of tumors.

In Orleans, an important project "Plasmed" dedicated to the study of therapeutic applications of plasmas in cancerology and dermato-cosmetology, gather together plasma researchers, biologists, medical doctors and partners from companies. Already, very interesting results have been obtained in vitro and in vivo, showing plasma antitumor effect on human U87-Luc glioblastoma (brain tumor). In this study, Balb/c nude female mice were injected sub cutaneously with U87 tumor cells previously transfected by the luciferase gene. The experiments were performed using a pulsed floating electrode DBD plasma reactor driven by an adjustable power supply allowing plasma treatments over a wide range of parameters concerning applied voltage and discharge frequency up to one kHz. Bioluminescence (BLI), a gene expression imaging modality that is closely dependant upon metabolism and proliferation, was used to assess tumor growth. Results indicate that a very substantial delay in tumor grow is initiated for plasma treated tumors compared to non-treated ones.

In this paper, after a general introduction on current plasma biomedical developments, especially plasma medicine, we will focus on the work performed at GREMI in collaboration with CIPA-TAAM laboratory and other local labs, IEM and CBM. We will report on in vitro and vivo experiments on Balb/c nude and C57 Bl-6 mice (tolerance study, antitumor efficacy in vitro, ROS role in cell death, antitumor activity in vivo). We will then emphasize on the developments concerning new atmospheric plasma discharges, plasma jets and "plasma gun", as the one developed in the lab, of interest for future biomedical applications of cold non-equilibrium plasmas.