

Atmospheric Pressure Plasmas in Medicine

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Abstract

Atmospheric pressure plasmas are partially ionized gases that can be generated at ambient pressure and room temperature. In the past decade, the use of these plasmas in the biomedical field have flourished with applications ranging from wound healing to cancer therapy. Due to the vast clinical potential of this highly interdisciplinary field of ‘plasma medicine’, a fundamental mechanistic understanding of plasma-cell interaction is required to fully (and safely) utilize plasma for its medical benefits.

In this talk, I will cover the main concepts on the link between plasma physics, oxidation-reduction (redox) chemistry, and biological effects. Substantial evidence indicates that plasma-generated reactive oxygen and nitrogen species (RONS) are the main effectors of biological response via stimulation of intracellular oxidative stress. The consequence of oxidative stress depends on several factors, including the amount and localization of the accumulated RONS. Interestingly, while high levels of oxidative stress can result in toxic effects, low levels can promote cell stimulatory and tissue regenerative effects. This biphasic ‘dose’ response to an agent is a phenomena known as hormesis.

Based on this principle, I will report on the development and progress of atmospheric pressure plasmas in several medical applications and the challenges moving forward towards the clinic.

Biography

Dr. Abraham Lin’s research aims to characterize and develop atmospheric pressure plasma systems for biomedical applications. His experience includes developing applications for regenerative medicine, neural engineering, and peripheral vascular disease. Currently, his foremost interest is in cancer immunotherapy. His core research areas are :1) studying plasma-induced cell death mechanisms, 2) investigating plasma effects on the tumor micro-environment, and 3) designing effective combination cancer treatment strategies with plasma. Due to the multi-disciplinary nature of his research, Dr. Lin collaborates with a vast interuniversity team of researchers which include plasma physicists, chemists, biomedical engineers, data scientists, tumor biologists, immunologists, and clinicians. He is currently mentoring two PhD students and one MSc student, and his research is supported by the Flanders Research Foundation.

