Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **239** Type: **Invited Speaker / Conférencier(ère) invité(e)**

(I) Non-thermal plasma for cancer treatment, influence of the discharge mode on the cytotoxicity of a radio-frequency plasma jet

Wednesday 9 June 2021 12:10 (25 minutes)

Non-thermal plasma (NTP) is being increasingly considered for its many medical applications. Even though NTP comprises physical factors such as the electric field and charged particles, NTP is mostly recognized to induce biological responses through its production and delivery of reactive species such as reactive oxygen and nitrogen species (RONS). Precise tuning of RONS is an important issue for plasma medicine as different RONS compositions and concentrations can lead to different clinical outcomes. For example, in some situations NTP was found capable of inducing cell proliferation, thus promoting wound healing, while in other situations NTP was found to induce proliferation arrest, thus yielding anticancer effect [1]. This highlights the fact that NTP should not be considered as a simple drug with its dose defined as a single parameter. NTP can be better viewed as a vector to administer reactive molecules, hence making accessible molecules that cannot be administered via more stable solid or liquid states.
Different NTP devices thus possess different physical properties that produce various RONS leading to distinctive biological responses. For example, varying the driving frequency or the plasma-forming gas can lead to different plasma properties and change drastically the outcome of the treatment. In this work, we use the convertible plasma jet in order to produce three different NTPs using the same plasma-forming gas and the same driving frequency [2]. Investigating the cytotoxic effect of NTP with an in vitro model of triple-negative breast cancer cells in suspension, we observed that cytotoxicity not only depends on the discharge mode, but that the cellular response to the addition of nitrogen or oxygen to the plasma-forming gas is modulated according to the discharge mode. This highlights the fact that fine-tuning of plasma parameters could become an essential step in future NTP treatments in the clinic.

The author acknowledges FRQNT, NSERC, MEDTEQ, Mitacs, TransMedTech, NexPlasmaGen Inc. for research funding.

References

[1] L. Boeckmann, M. Schäfer, T. Bernhardt, M.-L. Semmler, O. Jung et al. Applied Sciences, 10, 6898 (2020)
[2] J.-S. Boisvert, J. Lafontaine, A. Glory, S. Coulombe and P. Wong, IEEE Transactions on Radiation and Plasma Medical Sciences, 4, 644-654 (2020)

Author: Dr BOISVERT, Jean-Sébastien (McGill University and CRCHUM)

Co-authors: Dr LAFONTAINE, Julie (Centre de recherche du CHUM); Dr GLORY, Audrey (Centre de recherche du CHUM); Prof. COULOMBE, Sylvain (McGill University); Dr WONG, Philip (Princess Margaret Cancer Centre)

Presenter: Dr BOISVERT, Jean-Sébastien (McGill University and CRCHUM)

Session Classification: W1-5 Plasma for biomedical application (DPP) / Plasma pour applications biomédicales (DPP)

Track Classification: Plasma Physics / Physique des plasmas (DPP)