GEC18-2018-000385

Abstract for an Invited Paper
for the GEC18 Meeting of
the American Physical Society

Activation of stem cell identity by low temperature plasma in primary prostate cells

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Low-temperature plasmas, at atmospheric pressure and temperature, are efficient sources for highly reactive particles. In this presentation the concentration of the plasma generated reactive species, their transport into liquids and subsequent action on primary prostate cancer cells, and matched normal tissue from the same patient, will be discussed. Prostate cancers are heterogeneous mixtures of cancer cells with differing properties. Our aim is to understand the response of these cellular sub-populations to plasma treatment in order to develop a therapy targeted at the cancer 'stem' cells, recognised as the resistance population responsible for reoccurrence. While overall significant cell death is observed post treatment, critically, a very small resistant population of viable cells remained after exposure. Understanding how these cells survive, including resistance mechanisms, and cell death signalling processes that are initiated following treatment, is required to optimise LTP-induced killing of prostate cancers. We report the precise molecular mechanisms triggered by LTP treatment in the near-patient models of prostate cancer. An immediate early and multifaceted anti-oxidative response was induced within 30 minutes of treatment, regardless of tissue origin. This was sufficient to protect a proportion of cells, with a more stem/progenitor phenotype, from toxic levels of reactive oxygen species. A number of stem cell maintenance programs were also activated, including Notch signalling, which have been implicated in tissue regeneration. Notch is fundamental to organism development, by acting as a master regulator of stem cell fate, and is activated by plasma treatment. To develop an effective therapy, with reduced likelihood of relapse, we propose specifically targeting this pathway using a combination of plasma treatment with Notch inhibitors.