Online LTP Seminar

Lecture 4

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Role of RONS in Plasma Medicine

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Abstract: In this talk, I address research directed towards biomedical applications of cold atmospheric pressure (CAP) plasma such as sterilization, surgery, wound healing and anti-cancer therapy. It is known that plasmas in air readily create reactive oxygen species (ROS) and reactive nitrogen species (RNS). ROS and RNS (or RONS), in addition to a suite of other radical and non-radical reactive species, are essential actors in an important sub-field of aerobic biology termed 'redox' (or oxidation-reduction) biology. These species clearly play some role, but the time- and space-dependence of observed plasma therapy argues for a more complex mechanism. It is postulated that CAP can trigger a therapeutic shielding response in tissue in part by creating a time- and space-localized, burst-like form of oxy-nitrosative stress on near surface exposed cells through the flux of plasma-generated RONS. RONS-exposed near-surface layers of cells communicate to the deeper levels of tissue via a form of 'bystander effect,' similar to responses to other forms of cell stress such as radiation. There is evidence that plasma exposure can stimulate the adaptive immune system as well. In this proposed model of CAP therapeutics, the plasma stimulates a cellular survival mechanism through which aerobic organisms shield themselves from infection and other challenges, with RONS as the central actors.

Brief Bio

David B. Graves joined the University of California at Berkeley Department of Chemical Engineering in 1986 after receiving his PhD (Chemical Engineering) from the University of Minnesota. He retired from UCB in May 2020 and joined the Princeton Plasma Physics Lab as Associate Lab Director, effective June 1, 2020. He also has an appointment as Professor in the Department of Chemical and Biological Engineering at Princeton University, starting July 1, 2020. David Graves is a fellow of the American Vacuum Society and the Institute of Physics and was the recipient of the Electrochemical Society Young Author Award, the NSF Presidential Young Investigator Award, the Tegal Plasma Thinker Award, and the 3rd annual Plasma Prize of the

Plasma Science and Technology Division of the AVS. He was named the Lam Research Distinguished Chair in Semiconductor Processing at UC Berkeley for 2011-16. He received the Allis Prize for the Study of Ionized Gases from the American Physical Society in 2014 and the 2017 International Symposium of Dry Processes Nishizawa Award.