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Interaction of Low Temperature Plasmas with Prokaryotic and Eukaryotic Cells

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Due to promising possibilities for their use in medical applications such as wound healing, surface modification of biocompatible materials, and the sterilization of reusable heat-sensitive medical instruments, low temperature plasmas and plasma jets are making big strides as a technology that can potentially be used in medicine[1−2]. At this stage of research, fundamental questions about the effects of plasma on prokaryotic and eukaryotic cells are still not completely answered. An in-depth understanding of the pathway whereby cold plasma interact with biological cells is necessary before real applications can emerge. In this paper, first an overview of non-equilibrium plasma sources (both low and high pressures) will be presented. Secondly, the effects of plasma on bacterial cells will be discussed. Here, the roles of the various plasma agents in the inactivation process will be outlined. In particular, the effects of UV and that of various reactive species (O_3, O, OH...) are highlighted. Thirdly, preliminary findings on the effects of plasma on few types of eukaryotic cells will be presented. How plasma affects eukaryotic cells, such as mammalian cells, is very important in applications where the viability/preservation of the cells could be an issue (such as in wound treatment). Another interesting aspect is the triggering of apoptosis (programmed cell death). Some investigators have claimed that plasma is able to induce apoptosis in some types of cancer cells. If successfully replicated, this can open up a novel method of cancer treatment. In this talk however, I will briefly focus more on the wound healing potential of cold plasmas.

[1]E. A. Blakely, K. A. Bjornstad, J. E. Galvin, O. R. Monteiro, and I. G. Brown, "Selective Neuron Growth on Ion Implanted and Plasma Deposited Surfaces", *In Proc. IEEE Int. Conf. Plasma Sci.*, (2002), p. 253.
[2]M. Laroussi, "Non-thermal Decontamination of Biological Media by Atmospheric Pressure Plasmas: Review, Analysis, and Prospects", *IEEE Trans. Plasma Sci.*, Vol. 30, No. 4, pp. 1409-1415, (2002).