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Preface: Special Issue on Plasma Systems for Biological/Medical Applications

Plasma medicine is an emerging interdisciplinary field that involves not only plasma physicists and medical doctors but also biologists, chemists, and other experts interested in understanding the phenomena mediated by non-thermal plasma and their medical applications. Recent applications of non-thermal plasma include wound healing, hemostasis, and sterilization of medical instruments.[1-3] Currently, there are three approaches to plasma therapy. The first method is to induce cell death through the direct exposure of biological cells or living bodies to plasma. Here, the chemically-reactive gas species – including hydroxyl radicals, atomic oxygen and nitrogen, and nitrogen oxides – and the strong potentials produced by the plasma are the primary contributors to cell death. The second method is to create a plasma–activated medium (liquid), where the reactive oxygen species (ROS), reactive nitrogen species (RNS), and ultraviolet (UV) emissions produced by the plasma interact with a solution or water. These plasma-activated media extend applications over a wide range as a new modality.[4,5] The final method is the plasma-assisted enhancement of immune effects through direct exposure.[6] Although plasma chemistry in these processes remains to be elucidated, the physiological outputs such as plasma-mediated apoptosis with different sensitivities (e.g., selective targeting of cancer cells)[7,8] suggest that it is important to understand interactions among ROS, RNS, UV light, cells and living bodies. With an improved understanding of intracellular molecular mechanisms of plasma-mediated apoptosis and immunotherapy to fight cancers, we might be able to develop effective and safe plasma equipment for future clinical applications. The advancement of plasma medicine will not only bring about the development of novel alternatives to conventional medical technologies but also expand the frontier of plasma science and promote academic growth.

This timely special issue contains an excellent compilation of the latest results. The enclosed articles report on interesting new developments in a diverse range of cutting-edge plasma-medical fields. We sincerely hope this special issue will be a valuable contribution to the progress of this novel research area.

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