Plasmaand ROS Effects on G-Protein Coupled Receptor Signaling

Ji-Hye Yun [1], Pankaj Attri [2], Jae-Hyun Park [1], Eun-Ha Choi [3], and Weontae Lee [1]

[1]Yonsei University, Korea, Republic of

[2]Univ. of Antwerp, Belgium

[3]Kwaongwoon Univ., Korea, Republic of

Plasma has a bactericidalaction against bacteria and various plasma sources, including dielectricbarrier discharge (DBD) and atmospheric-pressure plasma jet (APPJ) arecurrently used commercially worldwide. However, the principle of plasmaactivity is rarely proven at atomic level of protein structure and receptors.
G-protein-coupledreceptors (GPCRs) are the largest and most diverse family of membrane proteinsin eukaryotes, which regulate diverse biological and physiological processesthrough orthosteric and allosteric ligand interaction. To elucidate the definite plasma effect onGPCRs related on their function, we performed structural and functional studiesused bacterial rhodopsin as a model protein. The X-ray crystal structures fromdifferent irradiation time of Air DBD plasma treatment was strongly suggestedthat plasma-derived ROS affects the structure and function of the biologicalmembrane protein, bacterial rhodopsin. Light-dependent pumping activity assayshowed that plasma treatment modulates the function in the direction ofincreasing channel activity, suggesting that it may adversely affect cellularhomeostasis. Our study provides novel fundamental information on the structuralchanges of receptor molecule at atomic level upon plasma treatment and proposesdeep insights into the molecular principles in the sterilization through plasmairradiation.