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Light Induced Release of Neutrophil Extracellular Traps

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Neutrophils release decondensed chromatin or extracellular traps (NETs) in response to various physiological and pharmacological stimuli. Apart from host defensive functions, NETs play an essential role in the pathogenesis of various autoimmune, inflammatory, and malignant diseases. In recent years, studies have been performed on photo-induced NET formation, mainly activated by UV radiation. Understanding the mechanisms of NET release under the influence of UV and visible light is important to control the consequences of the damaging effects of electromagnetic radiation. Raman spectroscopy was applied to record characteristic Raman frequencies of various reactive oxygen species (ROS) and low-frequency lattice vibrational modes for citrulline. NETosis was induced by irradiation with wavelength-switchable LED sources. Fluorescence microscopy was used to visualize and quantify NET release. The ability of five wavelengths of radiation, from UV-A to red light, to induce NETosis was investigated at three different energy doses. We demonstrated, for the first time, that NET formation is activated not only by UV-A but also by three spectra of visible light: blue, green, and orange, in a dose-dependent manner. Using inhibitory analysis, we established that light-induced NETosis proceeds through NADPH oxidase and PAD4. The development of new drugs designed to suppress NETosis, especially when induced by exposure to intense UV and visible light, can help to mitigate light-induced photoaging and other damaging effects of electromagnetic radiation.

Primary author: Mr ARYNBEK, Yersultan (JINR, INP, KazNU)

Co-authors: Dr ARZUMANYAN, Grigory (JINR); MAMATKULOV, Kahramon (LHEP, JINR.)

Presenter: Mr ARYNBEK, Yersultan (JINR, INP, KazNU)

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