Studying the response to ionizing radiation (IR): An experimental and theoretical approach

Alexandros G. Georgakilas, Violeta Gika, Zacharenia Nikitaki
DNA Damage laboratory, Physics Department, School of Applied Mathematical and Physical Sciences, National Technical University of Athens (NTUA), Zografou 15780, Athens, Greece
e-mail: alexg@mail.ntua.gr

Exposure to ionizing radiation (IR) as a genuine exogenous stress induces a variety of responses in the cell initiated by the DNA damage response (DDR) and DNA repair, apoptosis and inflammatory or immune response\(^3\). Therefore, stimulation of this IR-response mega system especially at the organism level consists of several subsystems and submechanisms and exerts a variety of systemic effects\(^2\). Our group focuses on the study of the induction and processing of complex DNA lesions applying different methodologies. At the same, we are interested on the effects of low doses in the case of diagnostic examinations (<0.1 Gy). In this presentation, I will first present experimental evidence on how the mammalian cell or organism is expected to respond to complex DNA damage induction i.e. the signature of IR and primary ‘danger signal’. At second, I will discuss the extremities of this response i.e. the phenomena of radiosensitivity and radioreistance in bacteria and human cells and insights gained by applying bioinformatics\(^3\). Last but not least and in the light of our recent work, I will present novel findings in the case of IR-low doses and expected levels of complex DNA damage calculated using Monte Carlo damage simulation (MCDS 3.10A) for DNA double strand break (DSB) induction and the general purpose Monte Carlo N-particle (MCNPX) radiation transport code system.

Acknowledgements
This work has been supported by an EU Marie Curie Reintegration Grant MC-CIG-303514, co-financed by the European Union (European Social Fund-ESF) and Greek National funds through the Operational Program ‘Educational and Lifelong Learning of the National Strategic Reference Framework (NSRF)-Research Funding Program: THALES (Grant number MIS 379346) and COST Action CM1201 ‘Biomimetic Radical Chemistry’.

References