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The epigenetic biomarker γH2AX

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20 years since the discovery of the epigenetic biomarker γH2AX, its role in DNA damage response and repair has been well supported by numerous studies. γH2AX is a variant of the H2A histone family, that is phosphorylated at serine 139, denoted as γ-phosphorylation, when double strand breaks (DSBs) are generated into DNA. DSBs are among the most toxic of DNA lesions and must be repaired to preserve chromosomal integrity. DSBs can be generated by exogenous environmental insults (e.g. irradiation, chemicals, etc.). In addition, DNA metabolic intermediates can generate DSBs: I) indirectly, in the process of DNA lesions (single stranded or others) that are converted to double-strand breaks in succeeding phases of cell-cycle, or subsequent DNA repair steps, II) directly during highly specialized cellular functions as V(D)J recombination, class switching, meiotic recombination, and apoptosis. Once a DSB is generated into DNA, γ-phosphorylation forms in seconds and extends both sites of the DSB at a distance of mega base-long domains. γH2AX has required for the accumulation of many DNA damage response (DDR) proteins at the site of DSBs, facilitating signal transduction for DSBs damage response. Today, the volume of evidence that has been produced support that γH2AX is an excellent marker to detect double strand breaks. γH2AX technology has been used in clinical trials to monitor cancer treatments and is expected to expand further in this field.

Recent Publications

1. Rogakou E P, Boon C, Redon C and Bonner W M (1999) Mega base Chromatin Domains Involved in DNA Double- Strand Breaks *In Vivo*. Journal of Cell Biology 146(5):905–915.
2. Paull T T, Rogakou E P, Yamazaki V, Kirchgessner C U, Gellert M and Bonner W M (2000) A critical role for histone H2AX in recruitment of repair factors to nuclear foci after DNA damage. Current Biology 10(15):886–895.
3. Tubbs A and Nussenzweig A (2017) Endogenous DNA Damage as a Source of Genomic Instability in Cancer. Cell 168(4):644–656.
4. Mavragani I V, Nikitaki Z, Souli M, Aziz A, Nowsheen S, Aziz K, Rogakou E and Georgakilas A G (2017) Complex DNA Damage: A Route to Radiation-Induced Genomic Instability and Carcinogenesis. Cancers 9(7):91-105.

Biography

Emmy P Rogakou is a Founder and CEO of the EpigenFocus, an innovative medical biotechnology company, in Athens, Greece. EpigenFocus is dedicated to developing epigenetic biomarkers for diagnostics. She is also collaborative Senior Researcher in the First Department of Pediatrics, Medical School, University of Athens, Greece. She has major contribution in the discovery of the role of γH2AX in DNA double-strand break repair, at the W M Bonner Lab, NIH, USA, that resulted in leading-the-field, scientific publications, and her work is highly cited over 13,000 citations.

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