

## ASSESSMENT OF LOW AND HIGH LET RADIATION INDUCED CHROMOSOMAL ALTERATIONS FOLLOWING ACUTE, CHRONIC, WHOLE AND PARTIAL BODY EXPOSURE: STATE OF THE ART FOR BIOLOGICAL DOSIEMTRY IMMEDIATELY AND RETROSPECTIVELY

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The importance of detecting risks at the low doses (<5cGy) and low dose rates in radiation protection is well recognised. Similar issues surround the acquisition of knowledge on common genetic factors that might determine inter-individual differences in low dose cancer risk. These matters are of continuing importance in respect of social/economic policy relating to the industrial and medical uses of ionising radiation, and for risk assessment among people occupationally are being exposed to low and/or high LET radiation, such as astronauts, pilots, stewardess and nuclear power plant workers. Furthermore, in view of the potential threat of a major radiation incident instigated by terrorists and in cases of technical accidents in nuclear power plants, the ability to measure the radiation dose received by individuals potentially exposed in such an event as well as to define the exposure pattern, whole or partial body, are essential in order to deal effectively with the consequences of the event and to minimize its impact on exposed individuals. Moreover, there is a need to be able to triage the population rapidly, in order to elucidate on the low dose as well as high dose risk assessment for low and high LET radiation. In addition, these sets of information may shed light on improving radio-therapy regimen for cancer patients.

Consequently, several biological assays were developed, validated and attempts were made to investigate formation of radiation induced chromosome aberrations: Mechanisms, Kinetics and Spectra. The newly obtained data in different cohorts accidentally and /or occupationally exposed to ionising radiation while analyses were performed immediately or retrospectively indicate that: (a) Fluorescence in situ hybridization (FISH) technique using chromosome, chromosome- arm, chromosome region, centromere and telomere specific DNA libraries has improved the resolution of detecting all classes of radiation induced chromosomal inter- and intra-changes. This technique is useful for dose assessment in cases of acute and chronic exposure immediately, and in particular retrospectively (b) Combination of premature chromosome condensation (PCC) technique with FISH has given new insights into the kinetics of formation of different classes of aberrations following exposure to low and high LET radiations (c) The status of condensation of chromosome and proximity of chromosome regions in interphase nucleus at the time of irradiation seem to influence the types and frequencies of radiation induced chromosome exchange aberrations (d) Studies on the spectra of radiation induced chromosome aberrations revealed two distinct hallmarks for high LET radiation in comparison to low LET radiation. (e) PCC assay proved to be a unique method to be used for immediate dose assessment at low (5cGy) as well as high doses (>3 Gy), and to discriminate between whole- and partial-body exposure in case of accidental over-exposure to high doses of ionising radiation.