Cyto- and genotoxicity of ^{123}I- and ^{125}I-UdR in vitro: Apoptosis induction, micronucleus formation and chromatin damage in three human cell lines

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The Auger electron emitters (AEE) ^{123}I and ^{125}I are characterized by different half-lifes (13.2 h vs. 59.4 d) and by different average numbers of Auger electrons emitted per decay (8 vs. 15). The biological response in synchronized mammalian cells labelled with various activity concentrations of ^{123}I- and ^{125}I-UdR were investigated and compared in respect to accumulated decays and dose rate to further elucidate the biological effectiveness of Auger electrons.

SCL-II, Kidney-T1 and Jurkat cells were synchronized in G1-phase, subsequently labelled with ^{123}I- respectively ^{125}I-UdR and the cellular up-take and DNA-incorporation of I-UdR were determined. Chromatin damage was quantified by the alkaline Comet-assay, apoptosis induction was assessed by the Annexin V/PI assay employing flow cytometry and micronucleus formation was quantified using the Cytochalasin-B–micronucleus assay at various times post-labelling. ^{137}Cs gamma rays served as reference radiation.

^{125}I-UdR induced overall a slightly stronger response in human cell lines than 123I-UdR regarding micronucleus formation and chromatin damage. Apoptosis induction was much more profound in ^{125}I-UdR-labelled cells immediately after labelling when compared to ^{123}I-UdR. Both AEE induced a pronounced long-lasting G2/M phase arrest.

Albeit of a lower dose rate, ^{125}I-UdR is 1.2 to 1.5 times more genotoxic in comparison with ^{123}I-UdR. On average one decay (^{125}I-UdR) every 120 seconds per DNA/cell is sufficient to induce a permanent cell cycle arrest.