# Invited Talk 1.2

UNSCEAR 2020/2021 Report on Biological mechanisms relevant for the inference of cancer risks from low-dose and low-dose-rate radiation

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In 2016, the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) established an Expert Group on biological mechanisms relevant for the inference of cancer risks at low doses and low dose-rates. The Committee defines low doses as those of 100 mGy (low LET radiation) or less and low dose-rates, those of 0.1 mGy/minute (low LET radiation) or less. The Expert Group undertook a systematic review of the relevant literature to identify relevant studies, each study was evaluated in terms of is relevance to the report and quality. Specific mechanisms/endpoints considered in the report include DNA damage; DNA damage signalling, chromatin remodelling and epigenetics; effects on other signal transduction pathways; gene and protein expression; DNA repair and effects on somatic cells; genomic instability, bystander effects, damage/effects on non-nuclear cellular components, adaptive response and hyper-radiosensitivity; stem cells and target cell populations for radiation carcinogenesis; effects at the whole organism level, including effects on the immune system. The report concludes that, while complete understanding of the mechanisms and modulators of carcinogenesis following low-dose and low-dose-rate radiation exposures is not yet available, little in the way of robust data could be identified that would prompt the need to change the current approach taken for low-dose radiation cancer risk inferenceas used for radiation protection purposes. The potential contributions of phenomena such as transmissible genomic instability, bystander phenomena and adaptive response remain unclear. Some studies indicate that low-dose and low-dose-rate exposures can extend lifespan and possibly reduce tumour burdens in experimental animals; however generally, there is insufficient mechanistic understanding of these observations. There is evidence emerging that low dose exposures can stimulate tumour vascularisation. Overall, the Committee concluded that there remains good justification for the use of a non-threshold model for risk inference given the robust knowledge on the role of mutation and chromosomal aberrations in carcinogenesis. Looking to the future, the Committee recommended an approach that combines mechanistic understanding of low dose radiation carcinogenesis with epidemiological studies through the use of mathematical modelling integrating data from experimental systems. Furthermore, the UNSCEAR 2020/2021 Report, Annex C [1] includes an appendix setting out quality criteria to be taken into account in evaluations of experimental studies of radiation exposure.

**References**

[1]. UNSCEAR. Sources and Effects of Ionizing Radiation. Volume III: Scientific Annex C. UNSCEAR 2020/2021 Report. United Nations Scientific Committee on the Effects of Atomic Radiation. United Nations sales publication E.22.IX.3. United Nations, New York, 2021.
(https://www.unscear.org/unscear/en/publications/2020_2021_3.html)