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Perspectives on biomarkers for radiation exposure and cancer: Opportunities and challenges

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Radiation and radioactive material have frequently been used for decades in research, industry, medicine and weapons of mass destruction. Radiation exposures both accidental as well as planned pose certain risk to human health and evidently developing markers for radiation exposure forms priority research area for protecting health from harmful effects and for saving the victims. Radiation therapy used to treat many types of cancers often results in induction of secondary nodules which aggravates patient condition and often compels abandoning the treatment. In the event of accidental or intentional radiation exposures, the need for medical countermeasures for treatment or mitigation is highly urgent. To develop effective counter measure, an understanding of the mechanisms of action by which radiation induces cell or tissue/organ damage is required which currently remains incompletely understood. It is however known that radiation causes oxidative cellular damage which is manifested in pathologies and, therefore, many of the countermeasures evaluated to date have been anti-oxidants. The identification of biomarkers for radiation damage gives an opportunity for developing and evaluation of credible medical counter measures for mass casualties due to radiation exposures by terrorists. In addition, in early detection of cancer and in progression of treatment by radiotherapy using suitable markers to determine the response would help improve health care and in successful treatment of cancer patients. Moreover, current endeavours of space flight programs will require biomarkers for commonly observed cancer and central nervous system ailments in astronauts who are predominantly exposed to high LET cosmic radiation. In view of uncertainties in doses received, type of radiation and dose rates, the search for suitable biomarkers poses numerous challenges of optimizations needing extensive future research for practical applications.

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