DNA damage signals and Space Radiation Risk

Francis A. Cucinotta,

NASA Lyndon B. Johnson Space Center, Houston TX 77058, USA

Space radiation is comprised of high-energy and charge (HZE) nuclei and protons. The initial DNA damage from HZE nuclei is qualitatively different from X-rays or gamma rays due to the clustering of damage sites which increases their complexity. Clustering of DNA damage occurs on several scales. First there is clustering of single strand breaks (SSB), double strand breaks (DSB), and base damage within a few to several hundred base pairs (bp). A second form of damage clustering occurs on the scale of a few kbp where several DSB's may be induced by single HZE nuclei. These forms of damage clusters do not occur at low to moderate doses of X-rays or gamma rays thus presenting new challenges to DNA repair systems. We review current knowledge of differences that occur in DNA repair pathways for different types of radiation and possible relationships to mutations, chromosomal aberrations and cancer risks.