

## The Biological Effectiveness of Different Radiation Qualities for the Induction of Chromosome Damage in Human Lymphocytes

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Chromosome aberrations were measured in human peripheral blood lymphocytes after *in vitro* exposure to <sup>28</sup>Si-ions with energies ranging from 90 to 600 MeV/u, <sup>48</sup>Ti-ions with energies ranging from 240 to 1000 MeV/u, or to <sup>56</sup>Fe-ions with energies ranging from 200 to 5,000 MeV/u. The LET of the various Si beams in this study ranged from 48 to 158 keV/μm, the LET of the Ti ions ranged from 107 to 240 keV/μm, and the LET of the Fe-ions ranged from 145 to 440 keV/μm. Doses delivered were in the 10- to 200-cGy range. Dose-response curves for chromosome exchanges in cells at first division after exposure, measured using fluorescence *in situ* hybridization (FISH) with whole-chromosome probes, were fitted with linear or linear-quadratic functions. The relative biological effectiveness (RBE) was estimated from the initial slope of the dose-response curve for chromosome damage with respect to γ-rays. The estimates of RBE<sub>max</sub> values for total chromosome exchanges ranged from 4.4±0.4 to 31.5±2.6 for Fe ions, 21.4±1.7 to 28.3±2.4 for Ti ions, and 11.8±1.0 to 42.2±3.3 for Si ions. The highest RBE<sub>max</sub> value for Fe ions was obtained with the 600 MeV/u beam, the highest RBE<sub>max</sub> value for Ti ions was obtained 1000 MeV/u beam, and the highest RBE<sub>max</sub> value for Si ions was obtained with the 170 MeV/u beam. For Si and Fe ions the RBE<sub>max</sub> values increased with LET, reaching a maximum at about 180 keV/μm for Fe and about 100 keV/μm for Si, and decreasing with further increase in LET. Additional studies for low doses <sup>28</sup>Si-ions down to 0.02 Gy will be discussed.