MUTATION INDUCTION OF CHINESE HAMSTER V79 CELLS BY NITOGEN ION BEAMS

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Mutagenesis is one of the most important biological effects of ionizing radiation. With the progress of cell culture techniques, studies on the dose-response relationship and the mechanisms of radiation-induced cell mutation become possible. Most quantitative data have been obtained for low-LET radiation and a limited amount of informations is available for high-LET particles although the mutation of cells by ionizing radiation has been studied profoundly by many investigators.

In general, high-LET radiation has been found to be more effective in producing mutation than x or gamma rays. Because of the potential applications of heavy ion radiation in cancer therapy, there is a need for information on the carcinogenic and mutagenic effects of heavy ions. We have started a research program to study the dose-effect relationships of mutation for heavy ions.

Most quatitative data on mutation induction by radiation have been obtained on the basis of selection with purine or pyrimidine analogues, i. e., hypoxanthine guanine phosphoribosyl transferase minus ($HGPRT^-$) (resistance to 6-thioguanine or other purine analogues). Asynchronous Chinese hamster V79 cells in experimental growing phase were irradiated with nitrogen ions (65.8 MeV/n; $LET_\infty \simeq$ 392 KeV/μm), subsequently seeded at a low density, and incubated for 5 days before seeding for mutants with 6-thioguanine medium. The replating method was used to obtain the mutation frequency.

Both nitrogen ions and γ-rays increased the number of mutants per viable cells curvilinearly with an increase in dose (Figure 1). Nitogen particles appear to be highly effective in producing mutation, as compared to γ-rays (Figure 1). The RBE value, which was determined by taking the mutation frequency per viable cells ($6\text{-}7 \times 10^{-5}$) by a γ-ray dose given 10 % survival (6.5 Gy) as the reference point, was 1.9. A comparison

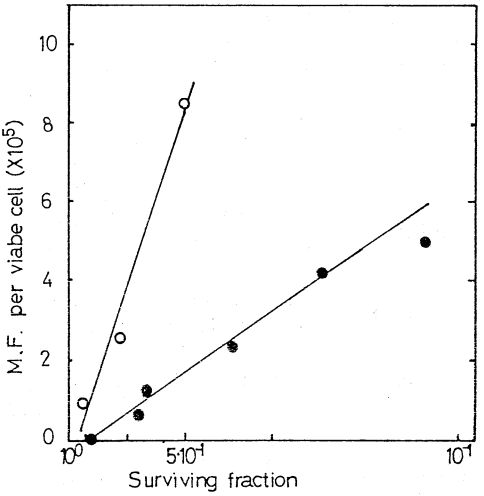

Figure 1. The effect of nitrogen ion (65.8 MeV/n) (o—— o) on mutation in Chinese hamster V79 cells, as compared to γ-rays (● —— ●).

between the RBE for mutation induction (1.9) and for cell killing (1.3) at 10 % survival level indicates that, compared to γ-rays, nitrogen ions can produce more mutation lesion than lethal injuries (Table 1).

Table 1. RBE value for cell killing and mutation induction for nitrogen ions.

Cell	RBE: inactivation (10% survival)	RBE: mutation induction ($6\sim7 \times 10^{-5}$)	
HF 19	1.7	2.8	Cox et al. (1977)
V 79	2.5	5.3	
V 79	1.3	1.9	