Transgenerational Effects in Mice Exposed to Continuous Low dose-rate Gamma-rays – Analysis of Germ Cell Mutation –

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Abstract

Transgenerational effects of continuous low dose-rate (LDR) gamma-ray irradiation of male mice have not been well studied. The incidence of copy number aberrations (CNAs) in the progeny of male C57BL/6J mice continuously exposed to LDR (20 mGy/22 h/day, 1mGy/22 h/day, 0.05mGy/22 h/day) gamma-rays for 400 days (total dose: 8000 mGy, 400 mGy, 20 mGy) and to high dose-rate (HDR, 0.8 Gy/min) gamma-rays (total dose: 4000 mGy) were analyzed. Using oligo-microarray CGH (Agilent Technologies), we analyzed a total of 461 genomes (111 progenies from 20 sires in the 20 mGy/22 h/day irradiated group, 48 progenies from 7 sires in the 1 mGy/22 h/day irradiated group, 46 progenies from 6 sires in the 0.05 mGy/22 h/day irradiated group, 6 progenies from 1 sire in the 4000 mGy HDR irradiated group and 140 progenies from 21 pairs of parents in the non-irradiated group). Progenies from the 20 mGy/22 h/day, 1 mGy/22 h/day irradiated mice had significantly higher frequencies of genomic aberrations than progenies from the non-irradiated mice. These aberrations were all verified by the TaqMan Copy Number Assay as "new mutations".

Table 1 Number of mice with aberrations detected by oligo-microarray CGH

		No. of F_1 mice analyzed	No. of mice with aberrations
20 mGy/ 22h/day irradiated group	♀	48	3 (6.3 %)
	♂	63	8 (12.7 %)
	♀+♂	111	11 (9.9 %)
1 mGy/ 22h/day irradiated group	♀	27	4 (14.8 %)
	♂	21	1 (4.8 %)
	♀+♂	48	5 (10.4 %)
0.05 mGy/ 22h/day irradiated group	♀	21	1 (4.7 %)
	♂	25	0 (0.0 %)
	♀+♂	46	1 (2.1 %)
0.8 Gy/ min (4 Gy) irradiated group	♀	5	0 (0.0 %)
	♂	1	0 (0.0 %)
	♀+♂	6	0 (0.0 %)
Non irradiated group	♀	73	1 (1.4 %)
	♂	67	2 (4.4 %)
	♀+♂	140	3 (2.1 %)

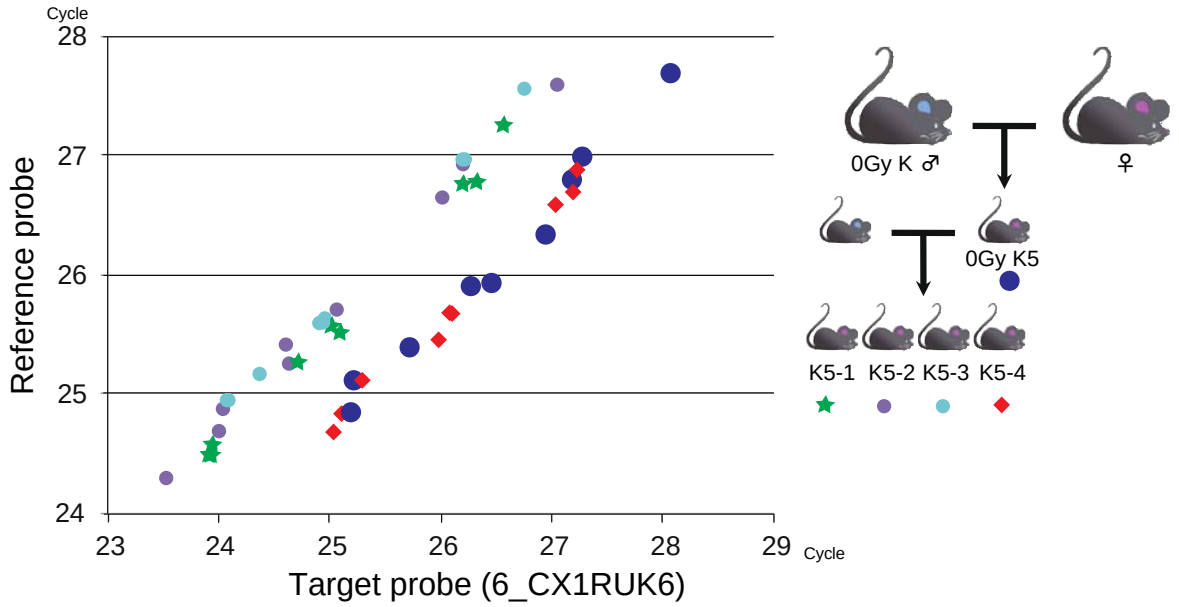

Fig. 1 TaqMan® Copy Number Assay showed that one of the F2 mice, K5-4 (◆)had only one copy of the genomic region 6_CX1RUK6, as well as the F1 mouse, 0GyK5 (●), whereas, the other litter mates K5-1(★), K5-2(●), K5-3(●) mice had two copies of the region. The transferrin receptor (Tfrc) gene was used as the copy number reference.