

Transgenerational Effects in the Progeny of Mice Exposed to Acute High
and Chronic Low Dose-rate Gamma-rays
– Germ Cell Mutation Analyses–

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Abstract

Transgenerational effects of low dose-rate (LDR) radiation have not been well studied. We have estimated the incidence of copy number variations (CNVs) in the progeny born from 65 week-old male C57BL/6J mice after continuous exposure to gamma-rays at several LDRs (0.05, 1 or 20 mGy/day for 400 days to total doses of 20, 4000 or 8000 mGy) or from 18 week-old male C57BL/6J mice after exposure to a HDR of 770 mGy/min (total dose 3 Gy). This year, using array CGH to screen for CNVs, we analyzed 44 progenies born from 65 week-old male C57BL/6J mice after exposure to a HDR of 770 mGy/min (total dose 3 Gy). To identify “real new mutations,” we tested all candidate CNVs found using quantitative PCR and estimated that the frequency of F1 mice containing CNVs in this group is 9.1%.

Table 1. The number of the (candidate) CNVs detected by array CGH and confirmed by qPCR

Number of affected probes in 1st CGH	Number of affected probes in 2nd CGH	Non-irradiated Mating: 65 weeks		20 mGy/day (8000 mGy) Mating: 65 weeks		70 mGy/min (3000 mGy) Mating: 18 weeks		70 mGy/min (3000 mGy) Mating: 65 weeks	
		Detected by CGH	Confirmed by PCR	Detected by CGH	Confirmed by PCR	Detected by CGH	Confirmed by PCR	Detected by CGH	Confirmed by PCR
≥2 (Type L)		9	9 [1]	23	23 [1]	5	5	1	1
	≥5	1	1 [1]	5	5	0	0	0	0
	4	1	0	2	1	0	0	0	0
1 (Type S)	3	3	1 [1]	2	1	1	0	1	0
	2	21	3	3	2	8	3	4	2 [1]
	(Total)	26	5 [2]	12	9	9	3	5	2 [1]
	(Type L+S)	35	14 [3]	35	32 [1]	15	8	6	3 [1]
	(No. of mice analyzed)	156		142		59		44	

The numbers in brackets indicate those of duplications (internal numbers).

Table 2. The number of the F1 mice with CNVs

		No. of mice analyzed	No. of mice with CNVs (%)			
			Type L		Type S	
770 mGy/min (3000 mGy) Mating: 65 weeks	Female	25	1 (4.0)	1 (4.0)	2 (8.0)	
	Male	19	0 (0.0)	2 (10.5) [1]	2 (10.5) [1]	
	Total	44	1 (2.3)	3 (6.8) [1]	4 (9.1) [1]	
770 mGy/min (3000 mGy) Mating: 18 weeks	Female	28	2 (7.1)	0 (0.0)	2 (7.1)	
	Male	31	3 (9.7)	2 (6.5)	5 (16.1)	
	Total	59	5 (8.5)	2 (3.4)	7 (11.9)	
20 mGy/min (8000 mGy) Mating: 65 weeks	Female	67	8 (11.9) [1]	9 (13.4)	17 (25.4) * [1]	
	Male	75	13 (17.3)	2 (2.7)	15 (20.0) *	
	Total	142	21 (14.8) ** [1]	11 (7.7)	32 (22.5) ** [1]	
Non- irradiated Mating: 65 weeks	Female	81	4 (4.9)	6 (7.4) [2]	10 (12.3) [2]	
	Male	75	4 (5.3) [1]	1 (1.3)	5 (6.7) [1]	
	Total	156	8 (5.1) [1]	7 (4.5) [2]	15 (9.6) [3]	

The numbers in brackets indicate those of duplications (internal numbers). *P<0.05, **P<0.01