THE MEAN LIFE SPAN OF RATS IRRADIATED AT DIFFERENT PERIODS OF POSTNATAL DEVELOPMENT

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Interest in the problem of changes in radiosensitivity with age has increased perceptibly in recent years [1-13]. The established fact that young, growing animals are highly radiosensitive in contrast to sexually mature animals does not reflect the whole complexity of this problem. This is shown, in particular, by the figures given below, indicating the mean life span of rats after irradiation with large doses of x-rays (Table 1).

TABLE 1. Distribution of Rats by Age and Doses of Irradiation

Age	Dose of irradiation (in r)								
	500	1,000	2,000	4,000	10,000	15,000	25,000	50,000	Total
Sexually mature (3-4 months old)	66	74	94	—	64	83	45	35	461
25-30 days old	94	103	50	—	76	42	58	17	440
9-10 days old	100	134	52	50	126	66	120	44	692
Newborn (1-3 days old)	76	104	78	108	142	59	108	36	711
Total	336	415	274	158	408	250	331	132	2,304

EXPERIMENTAL METHOD

Figures showing the age of the rats and the doses of irradiation are given in Table 1. Irradiation was given by means of an RUM-3 apparatus, voltage 180 kV and current 20 mA. The tube anode was 24 and 30 cm from the spine of the animals. Whole-body irradiation was given to rats in groups of 4-6 at a time in the case of the young animals and in pairs in the case of the large animals. The distance of 24 cm was used only with the young rats. No filter was used. The dose rate varied from 250 to 430 r/minute. The animals were kept under observation for 30 days.

EXPERIMENTAL RESULTS

Figures showing the mean life span in relation to the age of the irradiated animals and the dose of irradiation are are given in Table 2. Their accuracy can be judged from the statistical mean values also given in the table. All the mean values were treated statistically in order to determine the significance of their difference. The mean life spans of the rats of different ages and receiving identical doses of irradiation were compared. From the figures in Table 2, curves were constructed, and those are shown in Fig. 1.

Analysis of these curves shows that the radiosensitivity (as shown by the mean life span) pattern in relation to age varies with the dose of irradiation. By the study of the course of the curves a clue may be obtained to the cause of the, at times, quite considerable differences of opinion expressed by various workers on the radiosensitivity of animals of a certain age group. By comparing the course of the curves for the different age groups we can not only discuss a concrete difference in the reaction to irradiation, but also, no less important, we can foretell the mean life span in the case of irradiation with any dose between the limits of absolute lethal doses and sublethal doses. Under these circumstances it must be remembered that survival may occur between limits of 500 and 100 r. The corresponding figures are given in Table 3 . The mean life span of the survivors was not specially determined.

TABLE 2. Mean Life Span of Rats Depending on the Age of the Experimental Animals and the Dose of Irradiation

Age	Index	Dose of irradiation (in r)							
		500	1,000	2,000	4,000	10,000	15,000	25,000	50,000
Sexually mature (3-4 months old)	Mean life span (in days)	13.4*	13.1	3.8	—	3.7	3.7	1.8*	1
	Mean square deviation	±6.1	±6.6	±0.4	—	±0.55	±0.2	±1	±0.2
	Mean error	±2.76	±0.84	±0.04	—	±0.07	±0.01	±0.14	±0.02
25-30 days old	Mean life span (in days)	14.1*	4.3	3.4	—	2.9	2.7	1.6*	1
	Mean square deviation	±5.3	±1.1	±0.6	—	±0.4	±0.8	±0.7	0
	Mean error	±0.57	±0.11	±0.08	—	±0.05	±0.13	±0.09	0
9-10 days old	Mean life span (in days)	12	8.9	5.8*	4.9	4	1.9	1.6	1.0
	Mean square deviation	±3.1	±0.9	±0.8	±0.8	±0.9	±1.1	±1	±0.2
	Mean error	±0.33	±0.11	±0.12	±0.13	±0.08	±0.15	±0.1	±0.03
Newborn (1-3 days old)	Mean life span (in days)	10.8	8.1	6.1*	4.9	3	1.9	1.6	1.1
	Mean square deviation	±1.2	±1.1	±0.9	±1.2	±1.5	±0.8	±0.5	±0.3
	Mean error	±0.14	±0.11	±0.11	±0.13	±0.18	±0.13	±0.05	±0.06

*The difference between the mean values compared within the limits of this dose are not statistically significant.
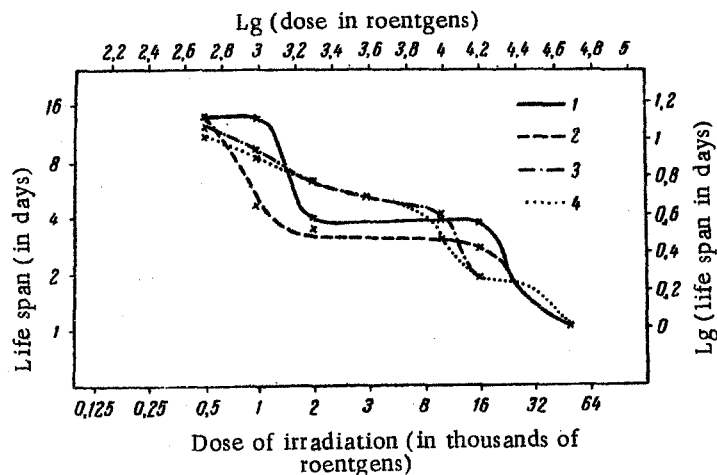
Life span of rats in relation to age at the time of irradiation and dose of irradiation. 1) Sexually mature; 2) 25-30 days old; 3) 9-10 days old; 4) 1-3 days old.

TABLE 3. Survival Rate of Rats Depending on Age and Dose (in percent)

Age	500 r	1000 r
Sexually mature (3-4 months old)	92.4	17.5
25-30 days old	8.5	0
9-10 days old	13.0	0
Newborn (1-3 days old)	2.7	0

The experimental results described show that the mean life span of animals depends on their age at the moment of irradiation and on the dose of irradiation. These facts may help in the evaluation of current ideas regarding changes in radiosensitivity with age, and in the discovery of more effective ways of solving this problem.

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