Félix, R. and J. Ramírez. Prcgama de Genética y Radiobiología, Comisión Nacional de Energia Nuclear. Mexico City, Mexico. A procedure for analyzing interspecific differences in the reduction of the life span of Drosophila species exposed as young adults to irradiation.

Within recent years many papers have been published on the reduction of the life span of species of Drosophila when adults are exposed to high doses of irradiation. In most of the experiments comparisons are made on the LD_{50} values obtained a number of days after the treatment. Without considering the sex or age of the irradiated adult flies there are two more components of the phenomenon which should be considered: a) as Nöthel (1963) pointed out the normal distribution shape of the survival curves is modified when high doses are applied, and b) when differences between the life span of two species are found, the LD_{50} values determined for several periods after irradiation may not be comparable due to the dissimilarities to be found among the survival curves from each of the two species.

In this experiment the survival rate of four species of Drosophila were determined after irradiation with several doses of 1 MeV electrons and a mathematical procedure was followed with the purpose of obtaining comparable data on the LD_{50} values and on the reduction of the life span regarded as a whole event.

Four species of Drosophila: melanogaster, simulans, virilis, and pseudoobscura were reared in the agar-cornmeal medium regularly employed at the laboratory. Groups of 300 flies were collected no later than 24 hours after emergence from the pupal stage and introduced into polyethylene containers for the electron treatment. After irradiation each group was transferred every five days to half-pint bottles with newly prepared medium. The counting of the flies was done after definite one day intervals until the death of the last imago from each group was scored. The irradiation was administered at room temperature, otherwise cultures with control and treated flies were kept in an incubator at 25°C ± 1 throughout the experiment.

The flies were irradiated at the Van-der-Graaf accelerator at the National University of Mexico, with a flux of 1 MeV electrons at an exposure rate of 8.32 ± 0.70 Krad/sec (current: 5mA).

Table I shows the mean life span for each treated group and its control (Félix, 1968) obtained in the following manner: plotting of mortality percentage against survival rate a sigmoid curve was drawn; from this a second graph was obtained using the probit transformation in order to situate on the time scale the point (mean survival time) corresponding to the mid point in the scale of mortality. (Tables I and II are found on page 83.)

The reason was computed by dividing the mean survival time of each group by its control. The subtraction of this value from the unit was done in order to obtain the reduction of the mean life span due to the treatment (Table II).

TABLE III. LD_{50} values in KR.

D. pseudoobscura	33.77920 ± 0.85530
D. virilis	37.72521 ± 1.65044
D. simulans	39.17064 ± 1.17928
D. melanogaster	40.11480 ± 1.44851

Graphs were drawn plotting the reduction of the mean life span against the doses; such sigmoid curves were transformed into straight lines applying the probit transformation; the LD_{50} fits the midpoint on the scale of reduction of the mean life span. The student's distribution shows a significant difference at a 0.05 level between the LD_{50} values of the four species, excepting melanogaster-simulans (Table III).

Having in mind that the LD_{50} is referable to only one point on the survival curve, the following method was developed in order to obtain data on the survival rate considered as a whole event, and to compute differences between species of Drosophila.

No significant differences at a 0.05 level was found among the probit graphs compared two at a time, by means of the "F" test, but such results may not be conclusive if the long mathematical elaboration of the experimental data outlined above is taken into account.

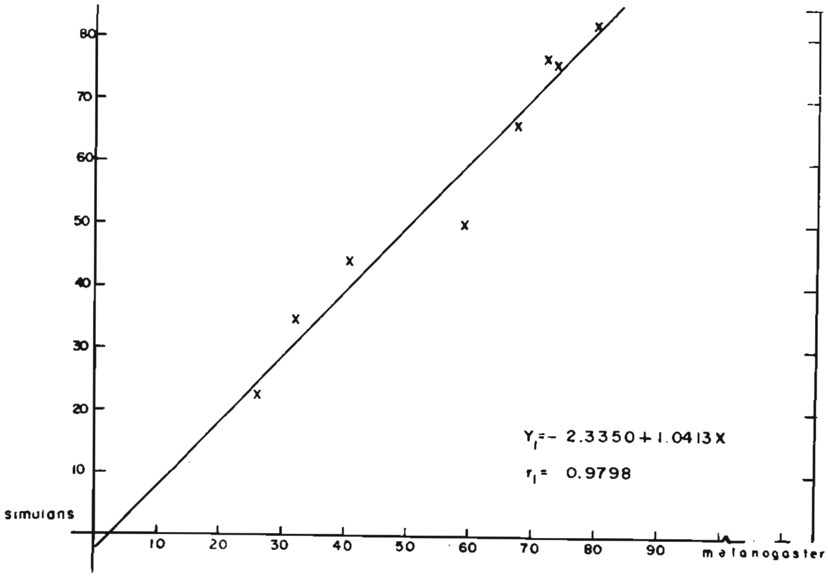

Fig. 1. Reduction of the mean life span. D. melanogaster against D. simulans.

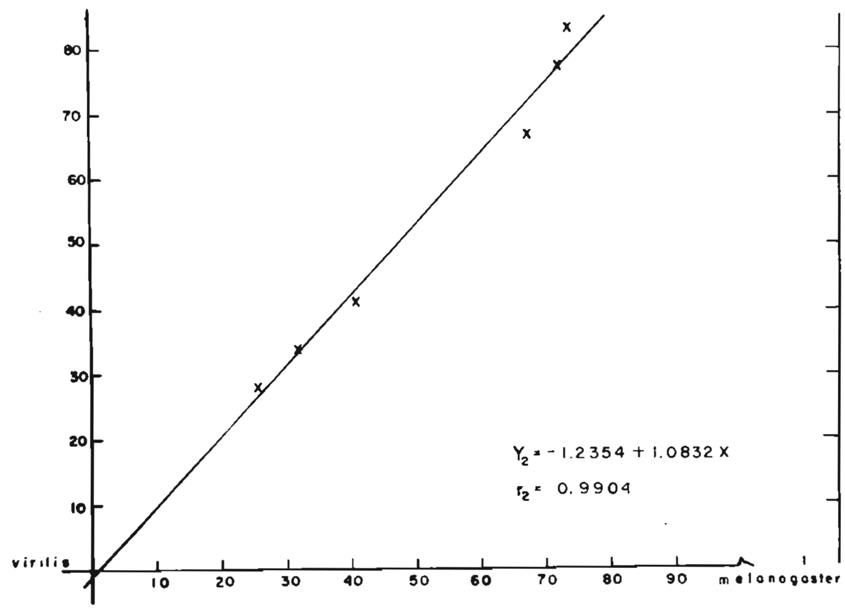

Fig. 2. Reduction of the mean life span. D. melanogaster against D. virilis.

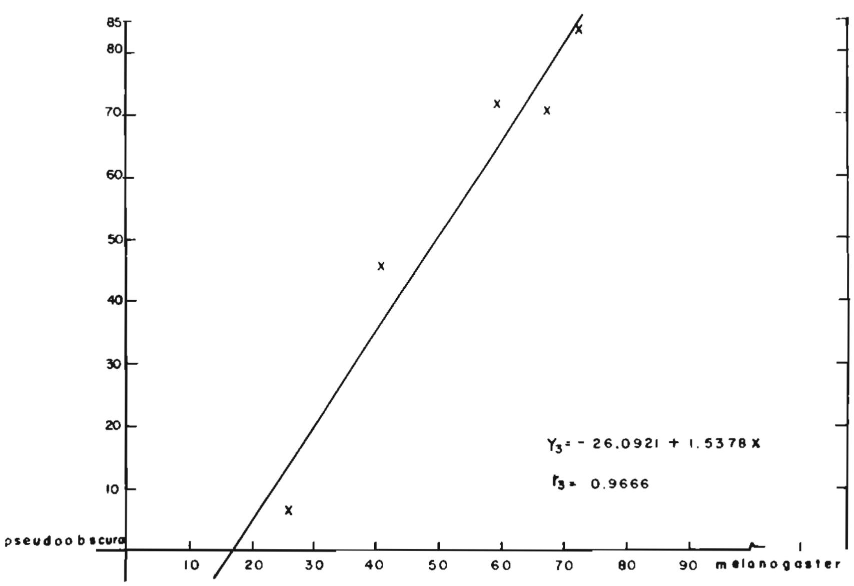

Fig. 3. Reduction of the mean life span. D. melanogaster against D. pseudoobscura.

TABLE I

Reduction of the mean life span of adults after treatment with different doses of 1 MeV electrons

Doses (KR):	Control	8.32	16.64	24.96	33.28	41.60	49.92	58.24	66.56	74.88	83.20	91.52
	Mean life span in days											
D. simulans	34.83	26.97	22.88	19.56	19.50	16.89	17.32	11.80	8.10	8.49	6.21	3.79
D. virilis	54.03	38.79	35.50	33.71	31.68	26.16		17.87	12.29	9.06		
D. melanogaster	36.47	27.00	24.68		21.59		14.83	11.82	10.09	9.62	7.35	
D. pseudoobscura	32.31	30.29		20.80	17.40	14.19	9.05	9.51	5.25			

TABLE II

Radiation-induced shortening (%) of the mean life span of adults after treatment with different doses of 1 MeV electrons

Doses (KR):	8.32	16.64	24.96	33.28	41.60	49.92	58.24	66.56	74.88	83.20	91.52
D. simulans	22.54	34.31	43.83	44.02	51.49	50.26	66.11	76.75	75.64	82.17	89.11
D. virilis	28.21	34.28	37.61	41.36	51.57		66.92	77.25	83.23		
D. melanogaster	25.98	32.32		40.81		59.32	67.60	72.32	73.62	79.85	
D. pseudoobscura	6.24		35.61	46.14	56.08	71.97	70.58	83.71			

From the data comprised in table II, graphs were drawn plotting the reduction of the mean life span of D. melanogaster against D. simulans, D. virilis and D. pseudoobscura (Figs. 1, 2 and 3). The correlation coefficients (r_1, r_2 and r_3) show no significant difference at a 0.05 level.

The derivatives from the graphs show the smaller radiosensitivity of D. melanogaster as compared with the other three species:

$$\frac{dy_1}{dx} = 1.0413$$

$$\frac{dy_2}{dx} = 1.0832$$

$$\frac{dy_3}{dx} = 1.5378$$

Following the same method D. virilis is 1.0494 times less sensitive than D. pseudoobscura and the latter species is 1.4137 times more sensitive than D. simulans.

References: Félix, R. 1968. Ann. Inst. Biol. Mex., Vol. 38 Serie Biol. Exp. (In press). Nöthel, H. 1963. Genetics Today, Proc. XIth Int. Congr. Genet., Vol. I: 72-73.

Shiomi, T. Nagasaki University, School of Medicine, Department of Genetics, Japan. The mutagenic effectiveness of 14.1 Mev neutrons in post-meiotic germ cells of D. melanogaster.

Virgin males of Canton-S isogenic strain and dual purpose stock females (y sc^{S1} $In^{(1)}$dl-49 sc^8; bw; st pP) inseminated by Canton-S males were exposed to 14.1 Mev neutrons and male germ cells irradiated at post-meiotic stages, especially at sperm stages, were tested for the presence of sex-linked recessive lethals and autosomal translocations (2;3). Each of the irradiated males were crossed to five virgin females in five successive one-day periods. Mutation frequencies in successive inseminations following irradiation were detected (Table 1).

Table 1. Mutation frequencies following mating sequence.

	1st	2nd	3rd	Total(24hrs)	24-48hrs.
X-linked recessive lethals in %					
2000 rad	7.19	3.66	3.64	3.88	3.41
1280 rad	2.65	1.79	2.04	2.06	1.65
500 rad	2.46	1.18	1.41	1.58	1.04
0 rad	0	0.88	0	0.11	0
Autosomal translocations in %					
2000 rad	3.79	3.65	3.19	3.34	2.63
1280 rad	2.65	1.55	1.54	1.68	1.54
500 rad	0.21	1.03	0.88	0.76	0.61
0 rad	0	0	0	0	0.18

It became clear that the mutation rates were not constant even during the first 24 hr with the mating sequence after neutron exposure. The shape of brood pattern curves varied with the stage of spermatogenesis and the age of irradiated males. The RBE of 14.1 Mev neutrons as compared with X-rays was demonstrated to be lower for recessive lethals than for translocations at all stages of spermatogenesis tested (Table 2).

Table 2. RBE of 14.1 Mev neutrons compared with X-rays

	X-Lethals		Translocations	
	1-day-old males	3-day-old males	1-day-old males	3-day-old males
Brood 1	0.83	1.58	1.21	1.63
Brood 2	1.15	1.92	1.27	2.22