Browning, L.S. University of St. Thomas, Houston, Texas. A radiation dose rate effect occurring in developing reproductive cells of male Drosophila.

About 600 specimens of D. melanogaster in the late third instar larval stage (after the larvae have become motionless) or the prepupal stage were removed from culture medium, mixed in a beaker of water, then divided into four lots of 150 each. Twelve hours later one group was subjected to continuous gamma radiation from a Ce^{137} source over a 64-hr period for a total dose of 2000 r (0.52 r/min). Each of the other groups was given 2000 r gamma radiation from a Co^{60} source over a period of ten minutes (200 r/min), one group being irradiated at the beginning of the 64-hr period ("0 hrs"), another at the middle of the 64-hr period, and the third at the end of the 64-hr period. About sixty males hatched from each group. Recessive lethals occurring in the paternal X chromosomes (of genotype y sc^{S1} In49 sc^{8}) were scored by crossing the males to Canton S females and individually testing the daughters for lethals. The table below shows the results.

Brood (2-da)	Low Intensity (0.52 r/min) 0-64 hrs			High Intensity (200 r/min) Irradiated at 0 hrs			32 hrs			64 hrs			Unirradiated Controls		
	NO.	L	%	No.	L	%	No.	L	%	No.	L	%	No.	L	%
1	306	27	12.2	282	1	0.4	136	0	0	151	0	0	599	0	0
2	378	29	7.7	390	0	0.0	328	0	0	409	1	0.2	202	0	0
3	250	8	3.2										55	0	0
4	314	9	2.9												
1-4	1,277	83	6.5	672	1	0.2	464	0	0	560	1	0.2	856	0	0
6-11	2,127	9	0.4	192	1	0.7	391	0	0	395	1	0.3			

The difficulties of interpreting data on mutation production when germ cells are undergoing maturation at the time of treatment are well known. However, the data given in the table show an unexpected and almost complete absence of sex-linked recessive lethals recovered after acute treatments with 2000 r applied at times so widely spaced as the time of pupation ("0 hrs") when the testes contain mostly spermatocytes ready to undergo meiosis plus a few spermatogonia, at 32 hrs later when many spermatocytes are undergoing meiosis and post-meiotic cells are present, and at 64 hrs when most of the cells are post-meiotic with many spermatids and spermatozoa present ("Biology of Drosophila," Demerec, Ed., 1950, pp 282-3; 302-4.) One possible explanation for the obliteration of the lethal rate which occurred at each of these stages is that all metabolizing cells undergoing spermatogenesis were killed by the radiation, only the radiation-resistant spermatogonia being left to repopulate the testes and manifest mutation after radiation.

Previously it had been noted in an experiment done in connection with NASA's biosatellite project that when pupae were exposed to 2460 r of gamma radiation continuously over a 64-hr period, a lethal frequency of 7.8% (58/740) in broods 1 thru 4 was produced, but in broods 5 thru 10 only 1 lethal was found in 2,625 tested chromosomes (0.04%). The untreated stock had previously given a rate of 0.05% (9 lethals in 11,625). As shown in the table, when this experiment was repeated, 9 lethals were found among 2,127 chromosomes, making it appear that no depression of the frequency below that of the spontaneous frequency had actually occurred, and the relatively high frequency in the earlier broods (6.5%) was consistent with the earlier experiments. Oster (J. of Cellular and Comp. Physiology 58: 203-7, 1961) has reported a lethal frequency of 0.7% or 9 lethals in 1,247 after an acute dose of 2000 r when young larvae containing only spermatogonia were irradiated. High lethal frequencies have been observed by us in the early broods in three separate experiments in which exposure to approximately 2000 r has been started at approximately the time of pupation and continued at a rate of about 0.5 r per minute.

Acute doses of 500, 1000, and 1500 r applied at the time of pupation have not produced a drastic drop in the lethal frequency, the lethal frequencies in broods 1-3 being 6.7, 4.5 and 2.0%, respectively. This inverse relationship to dose may be a further manifestation of the killing of potential lethal-bearing cells by the higher acute doses, although this must remain speculative until more data have been obtained. The conclusion is justified, however, that doses of acute radiation of 2000 r applied at various times during the pupal stage result in a drastic reduction in the number of recovered lethals, but that at 1500 r and below the effect

is diminished and recovery of recessive lethals is possible. (Work supported by NASA Contract NAS2-4849.)

Fahmy, O.G. and M.J. Fahmy. Institute of Cancer Research, Chalfont St. Giles, England. Design for testing specific mutability at the bobbed locus.

In our studies of the genetic effects of carcinogens, it was felt desirable to undertake specific mutability tests on some heterochromatic gene loci, of which bb was an obvious representative. A major difficulty with bb, however, is that different alleles show considerable variation in viability as well as phenotypic expression, and most homozygous stocks tend to show declining phenotypes on keeping. A strong allele of bb, in combination with f and mal^{bz}, has now been found which remained stable when balanced against sc^{S1} B InS w^a sc^8 (M-5). The homozygous triple-marker females invariably showed an extreme expression of bb, both with regard to the reduction in the size of the bristles and the etching of the abdominal sclerites, but their viability was substantially reduced. The heterozygous females, against a standard-X (f mal^{bz} bb/+), had slightly shortened thinner bristles, indicating that the bb allele had a "semi-dominant" effect. The hemizygous triple-marker males appear bb^+ against a normal Y, but are lethal against Y^{-bb}.

The f mal^{bz} bb/M-5 stock has been successfully used in specific mutability tests at the various marker loci (including w^a on the M-5 chromosome), using several chemical carcinogens. Where activity on bb^+ was required, the stock females were mated to + Y^{-bb} non-bobbed treated males, to ensure the elimination of the background bb mutations from the test. The F_1 consisted of only three of the expected classes; f mal^{bz} bb/Y^{-bb} males were lethal. The F_1 females carrying the M-5 chromosome heterozygously were scored for w^a mutations and a sample was bred on for the assay of the sex-linked recessive mutation frequency in the F_2, by the usual Muller-5 technique. The alternative class of F_1 females (non-M-5) were scored for f, mal^{bz} and bb and all suspected mutants were subjected to confirmatory genetic tests. In particular, flies showing reduction in bristles were backcrossed to the stock bb allele, to distinguish the true sex-linked instances from the autosomal dominant Minutes.

The phenotypic expression of 59 bobbed alleles induced by a carcinogenic hydrocarbon in various test crosses.

Phenotypic expression	Test crosses		
	Homozygous	bb with f mal^{bz}	Y^{-bb}
Wild type	0	0	5
Bristle effect: slight	28	2	2
: intermediate	15	22	29
: extreme	3	6	3
Bristle and abdomen effects	13	29	16
Lethal	0	0	4

Details of the genetic testing of 59 bb alleles induced by the carcinogen 7-bromomethyl-12-methyl benz(a)anthracene are given in the accompanying table. On the whole, alleles with clear expression homozygously also showed with more exaggerated phenotype when crossed to the test stock bb or Y^{-bb}, while those with only slight effects were rendered scorable. The stock bb was more useful in this respect since it revealed the majority of the induced mutants with both bristle and abdomen effects; also with Y^{-bb}, 5 alleles overlapped wild-type and 4 were lethal. It would appear, therefore, that our stock bb was an appreciable size deletion which permitted the recovery of a range of induced deletions within the bb^+ locus, particularly those of smaller size : of slight expression homozygously. Conversely, however, induced deletions of a size approaching that of the test marker, could have been inviable, which might have resulted in underestimating the activity of the tested compounds. The test stock is now being modified to overcome this difficulty.