for genetic mutations at specific gene loci in sperm and spermatogonial cells. Differences in radiation damage after treatments of mature germ cells and premeiotic spermatogonial cells are discussed.


Results are reported of experimental tests on recovery systems that act after radiobiological damage, and of studies on the types of genetic damage induced and the recovery of mutational types of damage from spermatogonial cells of Drosophila virilis. Dose rate studies with y-rays in aerobic and anaerobic atmospheres were employed in investigations of post-irradiation methods for reducing genetic damage. Higher values for dominant lethals were recovered from spermatogonials after irradiations with 22-MV y-rays than with 60-Co y-rays. Investigations were made of chromosome breakage, cell degeneration, genetic damage, and mutational studies of sex-linked and autosomal loci. Direct comparisons were made of loci on the sex chromosomes and the autosomal loci in sperm and spermatogonial cells. (From NSA 10: 1, 1963.)


In order to determine the lower industrially usable dose, studies were carried out on the mortality, sterility, and the reduction of the biological activity of the granary weevil. A 50 g equivalent 60-180Co source was used for the tests, regulating the dose by adjusting the distance. Groups of insects were exposed to 0, 1, 8, 13, 20, and 30 hr of radiation. The results have indicated that exposure to doses between 0.5 and 1 hr exerts partial lethal and sterilizing action; complete sterilization is reached at about 8 hr. (From NSA 17: 1, 1965, 8.068.)


The doses of X-rays required to sterilize R. prolivus in the nymphal and adult stage and the effects of this sterility in limiting the growth of laboratory-reared populations is being investigated. (Auth.)


Immune 5th instar Rhodium nymphs and adults of both sexes were exposed to various doses of 2 Mv x-rays, chosen to produce reductions in fertility up to and including complete sterility. In male insects irradiated at 5th instar nymphs and reared to the adult stage, sterilizing doses interfered with mating, thus making these males useless as a means of inhibiting the growth of populations into which they are introduced. Exposure in the adult stage, on the other hand, had less effect on mating behaviour. Thus, with a very high dose (17-300 T) and high ratios of sterile to fertile males, a substantial reduction occurred in percentage of viable eggs from normal females. However, this was true for the 1st month only. In the 2nd and 3rd months, the effect on population fertility disappeared, a result of the early deaths of irradiated males. Greater effectiveness in limiting population growth over extended periods might be expected to result from the introduction of males that had been partially sterilized by exposure to lower doses. (Auth.)


The sensitivity in terms of dominant-lethal induction (strictly speaking: reduced hatchability) has been measured for successive eggs laid by D. melanogaster after irradiation of the female with 1000, 4000 and 8000 rad.

Hypersensitivity is found in eggs laid by females aged 7 days during the first 1/3 h after irradiation. This is attributed to irradiation of Metaphase I. A lower level of sensitivity is found in eggs laid over the next
six days. This is attributed to the irradiation of oocytes in all stages prior to Metaphase I. Finally, a residual incidence of dominant lethals is observed in eggs laid more than 8 d after irradiation, which are presumed to have been irradiated as oogonia. Dosimetry (i.e., rate of maturation of eggs) shows an entirely different radiation response. 4000 rad produces a slight depression of egg-laying during the period of low dominant-lethal production, a more marked depression coinciding with the main production of dominant lethals, and a particularly severe depression on day 8 after irradiation. The pattern of sensitivity after 6000 rad is the same but more marked. The egg-laying rate remains more than 6 d after irradiation is slightly depressed by 4000 rad, and more so with increasing doses until 10000 rad, when complete sterility is produced. After such a dose the ovaries are atrophied, without oocytes or oogonia. (Auth.)


The effects of a single irradiation at 4000 r on larvae of the powder-post beetle Lyctus brunneus (Steph.), are described. These included a reduced and delayed emergence of the 1st generation. The number of beetles produced per female returned to normal in subsequent generations. The vigour of emerged beetles as judged by their average weights did not appear to be much affected. Irradiation at a sublethal dose thus seems unlikely to be a practical method of employing γ-radiation for the treatment of infestations by wood-boring insects. One of the chief limiting factors in the employment of lethal doses for such treatments is the mass of screening required, hence a technique enabling lower doses to be used would be of value. (Auth. summary)


Work by K.F. Kariyiu, I. Velasco and E. Ortiz on Ceratitis capitata (Wied) is described, which includes moderately successful mass breeding studies. A Ca127 source (γ-field) was used, a new Co57 source (allowing greater precision) being expected. - Papas (8-9) were irradiated at 1000 r/min and mated with non-irradiated females. Egg production and fertility were investigated over the range 4-18 kr. Male fertility decreased with increasing dose, some fertility still remaining at 18 kr. -PM and labelled flies were produced for dispersal tests. After only 24 h access to labelled honey solution (3.8 mg/ml), adult males were identifiable even beyond 4 weeks. The biological dose of PM from adults labelled either as larvae or adults is shown. Adult feeding is less expensive and equally effective. The distribution (maximum in thorax - ingestion) minimum in wings is tabulated for different stages. Records are based on 10 individuals, both sexes, for concentrations of 3.0 μg Pb/g larval medium, and 76 μg Pb/ml honey water solution. Experiments with Sr90 yielded insufficient radioactivity. Sr90 remaining in the pulp skin. - In addition to γ-irradiation, radioactive substances are being tried for inducing sterility.


The study of irradiated, unfertilized Habrobracon eggs was combined with the study of irradiated eggs fertilized by unirradiated sperm to detect different kinds of nuclear damage. Damage is used in the sense of induction of death of the cell either immediately after irradiation or after few or many mitoses occur. Types I to V lethality were studied and the probable cause of each was determined. During the study on the comparison of ultra-violet and ionizing radiation effects on the nucleus, it was concluded that ultra-violet radiation has a quantitatively different response than γ-radiation. Discussion is included on the different effects of the two types of irradiation. (From NAA 14: 1962, 1962.)


No difference could be detected in the numbers of emerged adults, rate of emergence or stage at death in the grain when two types of infested wheat, English and Manxseed, containing mostly papaers, were treated with γ-radiation and accelerated electrons. Mature adults were more susceptible to the killing and sterilizing effects of γ-radiation. The estimated LD50 was about 4500 rad higher for accelerated electrons than for γ-rays, the estimated dose for 50% reduction in progeny about 40% higher. The difference in dose for 99.9% mortality and sterility was about 3000 rad. Possible explanations of the observed results are discussed, engineering studies for radiatio
observed results are discussed. The likelihood of grain weevils providing a useful biological dosimeter in engineering studies for radiation disinfection of grain holds little promise.

1188 

1189 

In males of D. melanogaster were irradiated with 1000 reeds x-rays and exposed to an 80% of 8.2. Frequencies of dominant lethals, translocations, sex-linked lethals, deleted X's and induced crossing-over in the male were estimated for matings on s, s, s, and s following treatment. It is claimed that the fern used in these experiments was in the spermatocyte or early spermatid stage at the time of irradiation. Thus the frequencies of mutations recorded give an estimate of the relative sensitivities of these various stages of germ cell development to x-rays. Results show that sex-linked lethals and translocations follow similar patterns, reaching a peak on d 5, the level then dropping off through d 6 and 7 to a low value on d 8. Dominant lethals show an increase from d 6 to a high level on d 8 which is maintained over d 7 and 8. Deleted X's and induced crossing-over increase from d 5 through d 6 and 7 to reach a peak on d 5. The relationship between the type of aberration studied and the sensitivity pattern of the treated germ-cell is discussed. (From auth.)

1191 

Normal spermatogenesis in D. viridis was studied by examining living cells by phase-contrast microscopy. Primary spermatocytes occurred in cysts of 8 cells. Cytological analysis of sections from adult males indicated a 2d-cycle in males until the males are sexually mature at d 4. Following the 6th d the number of immature cells in the testes decreased steadily without further peaks in the number of primary spermatocytes on alternate days. Spermatozoids were motile and functional until the 6th d. Typical configurations of chromosomes during spermatogenesis are presented. Results are included from a series of tests to determine the effects of irradiation on D. viridis males as measured by dominant lethal and translocation rates in cells at various stages of spermatogenesis and sperm differentiation. Males of different ages were irradiated under similar conditions and mated with mature virgin females within 1 h after irradiation and left for 5 d. No fatal testes were deposited, the males were then mated to mature virgin females and daily egg counts made. After a 2 d-mating period, the males were remated and egg counts made. This procedure was continued for a total of 8 consecutive mating periods. Data are tabulated on rates of dominant lethals resulting from irradiation during various stages of spermatogenesis. (From USA 15 1961, 141p.)

1192 

All developmental stages of the rust-red flour beetle, T. castaneum, were treated at 30°C by y-radiation from Co60 with doses varying from 1000-19800 rads, at a dose rate of 4000 rads hr. Development of adults from irradiated eggs and larvae was completely prevented by 11820 rads. About 90% of adults emerged from pupae irradiated at 16800 rads but only 3% survived. A 60% kill of eggs was obtained by 5000 rads, of larvae by 4700 rads, of pupae by 10500 rads and of adults by 13300 rads. Only 1% of adults remained alive after treatment with 19800 rads. A 99.9% reduction in progeny was observed after treatment of eggs, larvae and pupae with doses in excess of 6600 rads. Very slight fertility was observed in adults treated at 13300 rads. No recovery of fertility was detected after the irradiation of any developmental stage. All developmental stages of T. castaneum are more resistant to radiation than T. confusum. T. castaneum is also more resistant than Tribolium granarium except in the susceptibility of adults to sterilization. The dose evaluated for control of T. granarium (16000 rads) produces complete sterilization of T. castaneum, but allows 10% of the sterilized adults to survive. (Auth. summary.)

The section of the conference on the Preservation of Foodstuffs by Ionizing Radiation (arranged by the FAO at the UAEA in Harwell, November 17-22, 1958), which was devoted to the division and post-irradiation control of cereal products, is summarized. The behavior of single species was investigated, and it was found that 4000 rep y-radiation destroyed corn and rice weevils (Calandra granaria and C. oryzae, respectively) in 20 d and flour beetles (Tribolium castaneum) in 20 d after irradiation. At this level of radiation, no harmful chemical or organoleptic changes could be found. The second part of the report deals with economic aspects of pest control.


The effect of γ-radiation on boll weevil (Anthonomus grandis Boheman) adults, pupae, and eggs was determined (following exposure to Co-60). Longevity and egg-laying capacity of reproducing weevils were drastically reduced at doses of 5000 r or higher, whereas virgin males exposed to 10000 r resulted in transient sterility whereas 15000 r produced permanent sterility. However, these doses resulted in very rapid mortality of both sexes. A ratio of 3: 8: 1 of sterile males: normal males: normal females did not affect egg laying or hatch. These appeared to be little, if any, effect of adult boll weevil age on susceptibility to the lethal effects of γ-rays. Emergence of adults from pupae, young, and old pupae exposed to 10000 r was eliminated, greatly reduced, and unaffected, respectively. However, the lethal effects carried over because all of the adults died within 2 weeks. Exposure of eggs to 600 r did not affect hatch or subsequent development whereas 2400 r drastically reduced hatch and prevented subsequent development. (Abst.)


Irradiation of adult Apisitinae (genera Aporina and other genera) at doses of 800, 500, 1000, 1500, 2000, and 4000 r produced: (1) no effect on longevity of the treated adults; (2) pronounced reduction in sex fecundity with increasing x-ray doses; (3) indications that mature eggs were less affected by x-ray treatment than the less mature ones; and (4) sharply reduced percentage of females in the progeny of those individuals which received the highest doses. (Abstr. 65, 2, 1963, 274)


Studies were initiated by the authors to assess the genetic effects of radiation on biochemical traits. Both newly emerged males and females from Lucas's wild-type strain were subjected to various doses of γ-irradiation (0, 500, 1000 and 1500 r) and mated to all possible combinations, resulting in a total of 40 factorial arrangements of treatments. Three mating pairs were included in each subclass of two identical experiments, resulting in a total of 40 mating pairs per generation. Mean daily egg production over a 10-d period of the treated females (generation one), their progeny (generation 2), and offspring (generation 3) resulting from a single mating of generation two was obtained in each experiment. Somatic effects would be expressed in generation 1 whereas genetic effects would be expressed in generations 2 and 3. The significance of the linear and quadratic main effects of treatment on males and females, as well as the various interactions, were determined by orthogonal comparisons. In general, the results support previous evidence found by the authors that radiation-induced polygenic damage in surviving offspring is not large. (From abstr.)


To study the effect of various gases and combinations of gases on the induction of dominant lethal mutations x-irradiated D. virilis oocytes (two stages of oocytes were used). Females containing stage 7 oocytes were irradiated with 2000 r and females containing stage 14 oocytes were irradiated with 800 r. The flies were irradiated in the presence of 1 atm of argon, He, methane, CO, air, O2, or combinations of 2 atm of argon, He, or methane plus 1 atm of O2. The percentage non-hatch was attributed to the induction of dominant lethal mutations. It was found that the LD50 of mature oocytes (stage 7) irradiated in air is about 350 r while the LD50 for stage 9 oocytes irradiated in air is about 500 r. This demonstrated that stage 14 oocytes are more x-irradiated in conditions than shown an increased induction to occur in conditions irradiated in one of argon, He, or methane compared to oocytes irradiated a provocative effect against it the absence of oxygen. (The induction of dominant lethal effects decreased Cd 7 r were induced when the oocyte of oocytes irradiated in one atm were irradiated in the presence of the percentage hatch of the group was observed. The difference was statistically significant. The dose or irradiation in stage. μ The work was subsequently performed by Dickerman, C.R. INDUCTION OF DOMINIO DROSOPHila VIRILIS. Genetics For abstract, see 778.

780 Finkman, H.E. EFFECTS OF 2-(Heterologon Research A Products, Richmond, Va.

Effects on reproductive abilitMixes, species, and cultures of feeding of radiation on radiation were more x-ray resistant. C. D. Finkman, H.E. X-RAY TOL Biology Research Annual Rep, Richmond, Va.

Stabilizing and x-ray treatment and T. crassum. Under C. Dickerman, C.R. Bull C.

Exposure of adults of Adonis a has no effect on longevity, mortality females or lesser the resulting from the mating of a exposed to 2000 r were killed developed normally after 30% required a much lower dose c. by exposure by exposure between 1000 r x-irradiated.

781 Gilmore, N.G., Fernández, IGNITAZIONE SUERO LA BOL S. CRIST. EN VENEZUELA. Nuclear Energy, Mexico City See 782.
that stage 14 oocytes are much more sensitive to radiation damage than stage 7. Stage 7 or 14 oocytes were irradiated in conditions of increased oxygen tension (20 atm air, 1 or 30 atm of O2). The groups showed an increased induction of dominant lethals as scored by percentage non-hatch, when compared to oocytes irradiated in one atmosphere of air. Stage 7 or 14 oocytes irradiated in the presence of 8 atm of argon, He, or methane with 1 atm of oxygen showed a large decrease in induced dominant lethals when compared to oocytes irradiated in 1 atm of pure O2. This demonstrates that argon, He, or methane have a protective effect against the induction of dominant lethal mutations. Stage 7 or 14 oocytes irradiated in the absence of oxygen (presence of 1 or 10 atm of argon, He, methane, or CO) showed a large decrease in the induction of dominant lethal mutations when compared to oocytes irradiated in 1 atm of air, thus showing that decreased O2 in the oocyte leads to decreased damage to the cell. Fewer dominant lethals were induced when the oocytes were irradiated in 10 atm of argon, He, methane, or CO as compared to oocytes irradiated in one atmosphere of the same gas. In preliminary investigations stage 7 oocytes were irradiated in the presence of 10 atm of carbon monoxide with fractionated doses. A slight increase in the percentage hatch of the groups irradiated in two fractions as compared to the groups irradiated in one dose was observed. The differences in percentage hatch of the groups irradiated in fractionated doses were not statistically significant. Testable evidence was presented that indicates that sooner during fractionated doses or irradiation in stage 7 oocytes does not increase the frequency of induced dominant lethal mutations. The work was subsequently published in Genetics 48 (1963) 311-9.


Effects on reproductive abilities, induced dominant lethals, and life spans were investigated for single- and mixed-species cultures of flour beetles, T. confusum and T. castaneum, given x-radiation. T. castaneum was more x-ray tolerant. Co-existence as well as 5 x-radiation reduced T. confusum progeny. (Auth.)


Stomatal and lethal x-ray doses were determined for various developmental stages of Tribolium confusum and T. castaneum. Under the experimental conditions, T. castaneum was more x-ray resistant than T. confusum. Radiation of both species increased as development and differentiation progressed. The 1-5 exposure was the most sensitive stage. (Auth.)


Exposure of adults of Aedes aegypti (L.) to γ-radiation in doses from 500 r up to 5000 r, in steps of 500 r, had no effects on longevity, feeding or mating habits. Exposure to 5000 r, the highest dose used, did not sterilize females or lessen their readiness to mate, though it did so with the males, and the few eggs that resulted from the mating of such males with normal or irradiated females failed to hatch. Half the eggs exposed to 2000 r were killed and development of the larvae delayed, whereas eggs hatched and larvae developed normally after 1000 r, 3000 r killed almost all eggs. It is concluded that males of A. aegypti required a much lower dose of γ-ray exposure for sterilization than females, and that eggs can be killed by exposure between 2000 r and 3000 r.


Unfertilized females of D. melanogaster Meigen mate with males exposed to 8 hr of γ-radiation in the pupal or adult stage and deposited the normal number of eggs, some of which hatched. Females irradiated in the pupal or adult stage produced fewer eggs after exposure to high doses of gamma radiation than unfertilized females but showed no reduction in the percentage of eggs leading adults. The longevity of males or females exposed in the pupal or adult stage was not affected by the radiation treatment. Males and females irradiated in the larval stage were shorter lived than untreated insects. Unfertilized females mated with irradiated males (16 hr) produced sterile eggs, but when mated a second time with untreated males, produced viable eggs. Unfertilized female flies mated with normal males showed viable eggs, but when subsequently mated with irradiated males, they continued to produce viable eggs. The number of viable eggs decreased normal females and males reduced the number of progeny. (Auth.)


Unfertilized D. melanogaster Meigen females mated to males exposed to 16 hr of γ-radiation in the pupal or adult stage produced an average number of eggs as untreated females mated to untreated males, but few or no adults emerged. Females exposed to 16 hr during the pupal or adult stage and mated to untreated males produced no eggs. When males and females were treated with 16 hr at 1.5, 5, or 10.5-days-old and mated immediately after treatment, normal numbers of eggs were produced but very few adults emerged, except for females treated with 10.5 days, which produced a significantly larger number of eggs than females treated at 1 and 5 days of age. When 1.5, 5, or 10.5-days-old males were irradiated with 16 hr and mated 1 or 6 days after treatment to untreated females, normal numbers of eggs were produced, but again few or no adults emerged. An indication that restoration of damaged sperm did not occur is that when males exposed to 15 or 16 hr were individually fertilized by a series of untreated virgin females within an 8-hour period on the same day, treatment and 15 or 16 days after treatment, the females laid a normal number of eggs, but 99% of these eggs were sterile. Power eggs were deposited by the 4th and 5th untreated females in each series than by the 1st and 2nd females. (Auth.)


Data presented suggest 1) that call a 3rd batch of sperm of D. melanogaster (as done in dosage-frequency experiments) an homogenous sample is erroneous since it contains a mixture of sperm cells which "die" differently. 2) that a 3rd batch of sperm contains no spermatozoa, whereas the highest sensitivity to x-rays is localized in the meiotic stages and 3) that in the C57 it is due to the process which independently from each other: a causing an increase in chromosome breaks, the other affecting the amount of rejoining of breaks. (Auth.)


Geneticists in both male and female cereal leaf beetles, Oulema melanopus (L.), show considerable genetic activity in all stages of adult development. Feasible-DNA lines were used to trace development. Beetles were subjected to x-rays to produce dominant lethal sterility.

During the year we completed work on the X-mutation rate-g dose relationship after 1/4, 1/2 and 1 kR, testing daily sperm samples, days 1-12, at 25°C. The relationship is linear except that 1/4 kR gives the same rate as 1 kR and higher than 1/2 kR in days 9-10 sperm drop to the linear level in days 11-12. Possibly parthenogenetic selection is delayed until day 12 at 1/4 kR. The control rate is constant for all days. The normal rate is constant after irradiation as development occurs at these temperatures, proving that the level of mutation response is "stage specific" in spermatogenesis, not "time specific" after irradiation. There was variation by a factor of 2 between series of tests at 15°C. Studies on induced chromosomal changes showed 50% lethality, proboscis position effect, or associated with each translocation break, but none associated with crossover, in spite of the fact that many are on (1) crossing over mutation to radiation in 15°C tests, (2) Lethality associated with induced autosomal inversion, and (3) Possible synergistic responses to radiation (simultaneous crossovers in chromosomes 2 and 3) in spermatogenic stages.


Tests on the sterilization of Tribolium castaneum (Ferstl. which has become a serious pest of stored grain in Turkey, were carried out by exposing pupae to X-rays from 100R. Doses of 6000 R or more reduced reproductive capacity when applied to 1-2-old male pupae, and 600 R, the highest dose applied, resulted in the sterilization of all the males in 2 out of 3 tests. Doses of up to 7600 R applied to female pupae had no effect on reproductive capacity. Further tests indicated that the effect becomes more apparent in the 3rd generation after irradiation. Following a dose of 1 10,000 R, malformation (alatae) was observed in some adults.


Le rayonnement gamma de Co restituant significativement la moyenne de vie. Tous les insectes meurent en 12 (1) 1 5000 R, en 4) 1 10000 R. La mortalité apparaît brusquement après une période de latence plus ou moins longue selon la dose, variant de 12 (1) 5000 R à 1 (23000 R). L'étude du coefficient de mortalité et de la moyenne de survie en fonction de la dose suggère la présence de deux mécanismes sensibles distinctement induits par l'irradiation. La sterilisation par les rayons Co est plus efficace à 150 kV qu'à 50 kV. L'irradiation des parents a pour conséquence de diminuer la fécondité et le poids des descendants, et d'augmenter leur durée de développement. Ces effets sont transmis à une génération sans que l'expérimentation prouve à aucune exception. Alors qu'ils les deux premiers tiennent à disparition, l'augmentation de la durée du développement reste stable pendant les 10 générations. (Voir 371).


Le rayonnement y issus de la bombe au Co réduit significativement la moyenne de vie des mâles de Syrphus orientalis à partir de 5000 R, et celle des femelles à partir de 7000 R. A 5000 R, tous les insectes meurent en 12 (1). Depuis 600 R, l'étude de la mortalité et de la survie en fonction de la dose montre que l'irradiation fait apparaître progressivement une héridité de la sensibilité dans la population, donc de l'individu le plus résistant. L'examen des courbes de survie révèle que la mortalité est toujours différente. Elle s'échelonne brusquement après une période de latence plus ou moins longue selon la dose. L'étude de la variabilité de la mortalité montre que la dose, l'irradiation augmente ou diminue la sensibilité des insectes aux variations intemperatures de milieu. La sensibilité au rayonnement semble augmenter avec l'âge. Dès 5000 R la fécondité se trouve réduite de moitié. A 5000 et 6000 R on observe une phase de fécondité temporaire. La stérilité totale est acquise à 15 000 R. La fécondité est beaucoup moins affectée que la fécondité, parfois même à 18 000 R on observe des femelles. Il est possible d'envoyer l'emploi des radiations pour la désinfestation de ces dernières. (Abst.)
Variation in egg viability among individuals has made precise determinations of dominant lethal mutation rates difficult at rates less than 0.1. To overcome this difficulty a technique of partial-body irradiation was developed which made it possible to make all comparisons intra-quarter. Six groups were paired into three groups, and frames of eggs from the two queens in a group were always paired and tested together for egg viability. The viability ratio was taken as the ratio of the proportion of eggs hatching from queen "A" of each pair divided by the proportion of eggs hatching from queen "B" so as to correct for environmental variation. After these tests the spermatozoa of "A" were irradiated with 900 r of 60 KVP x-ray and the viability tests repeated. 1000 gametes of each queen were tested in each test. The post-irradiation tests were conducted after the irradiated queen had laid eggs for one week; hence the eggs tested for viability had at the time of irradiation been exposed in a well-defined anterior region of the ovary. This procedure was repeated twice in order to give accumulated doses. After correcting each pair to make the pre-irradiation ratio unity, and averaging the three pairs, the following proportions of dominant lethals (corrected for saturation effect) were found: 200, 0.06, 500, 0.26, and 700, 0.35. The dosage response curve varied as the 1.4 power of the dose, being significantly non-linear.


p.1727-8 describe an experiment on sperm displacement carried out with (5000 r x-irradiated) males. It showed that such sperm were not as effective in displacing sperm from the female storage organs as sperm from normal (wild type) males. It may well be that irradiation not only produced a high level of dominant lethality but some inactivation of the sperm as well.


It appears that when both the X and the Y chromosomes are present in the same irradiated sperm they have a sparing action on each other. These types of male sterility are observed in the sexes of irradiated males: praepospermogenetic, spermaticogenetic, and postospermogenetic. In the present experiments > 400 males were dissected and scored microscopically for the type of sterility. Spermatogenetic sterility was the only class that showed an increase with dose and was by far the most frequent. It is characterized by a fairly normal testis distally with, however, a large area of necrotic tissue in the proximal part, and by empty seminal vesicles.


Preliminary experiments were carried out on adult males of T. confusum, which were exposed to a neutron dose of about 900,000 r/m3 or about 250 rads. Although subsequent results indicated a significant difference in fertility between the irradiated and control males (P=35, t1=1, t2=47) there seems to be no significant change in fertility during those post-irradiation observation periods (8) for which matings and offspring were tested, i.e. there is no indication of a differential sensitivity of the male germ cells in T. confusum. These studies are being followed up.


The effect of 120 kvp x-rays and fast neutrons with an average energy of about 4 Mev, on the fertility of males of the flour beetle T. confusum was investigated by mating irradiated males with 10 successive females for 2-3 days and determining, in the x-ray experiments, the percent of viable eggs and in the neutron experiments, the number of offspring produced by the females over several days. 29.8% of the eggs produced by 120 females mated with x-rayed males 10 days after irradiation reached minimal values of 10.4% and 26.5% in the higher and lower dose experiments respectively, probably reflecting differences in the sensitivities of cells in various stages of spermatogenesis. Fecundability in the 2900 r experiment tested 65 d following irradiation of the males, had attained control levels, indicating the absence of any permanent damage. In the preliminary females mated with irradiated males in the fertility of the males.


Young adult males of the fly, Drosophila melanogaster, were exposed to 3000 r of 60 kvp x-rays, and the viability of their sperm examined. The irradiation of the males was carried out at a dose of 31 to 12.5 following irradiation of spermatogenesis of recovery of irradiated sperm.

Michigan State Univ., East Lansing, LETHALITY IN Drosophila melanogaster.

The processes involved in the 25 observation of the gametocytes of the spermatozoa into the action of the sperm, but gonadal recombination. Definitive observations on males are lethal, rather than merely examined by two genetic enhancement of radiation d


Ohtsuka, F. GENETIC SEX IN Drosophila melanogaster (Abstr). Irradiation of Drosophila sp and 300 r at 35 °F/min, had a dose-effect relationship vi gente constitute a coil-pair cell-killing, in a population effect.

244
damage, in the preliminary experiment with Drosophila, the mean number of offspring produced by the females mated with irradiated males was 58.3 compared to 77.0 for the controls. No significant difference in the fertility of the males during the 124 following irradiation was noted.


Young adult males of the flour beetle, T. confusum, have been shown to require about 4 d, following eclosion, to reach sexual maturity. Subjecting 2- or 3-d-old males to 1400 or 2600 r of x-rays depresses their fertility, as evidenced by the increase in the percentage of infertile eggs produced by their mates. This infertility, probably due in part to the induction of dominant lethals, reaches a maximum value 11 to 12 d following irradiation, and then declines. In general, the pattern of response suggests the various stages of spermatogenesis of T. confusum are differentially sensitive to x-rays. No evidence was found for recovery of irradiated sperm used by females, or of induced effects on the fertility of the treated males. (Auth.)


The processes involved in normal insemination in D. melanogaster are being studied by dissection and observation of the genital tract of inseminated females at intervals following copulation. Movement of the spermatozoa into the ventral receptacle of the female did not seem to be accomplished by swimming action of the sperm, but groups of longitudinally-oriented sperm appeared to be drawn into the ventral receptacle. Define mating preferences of males and females correlated with strain were noted. Observation of females irradiated after insemination supported the hypothesis that irradiation destroys a lethal, rather than merely degenerates, effect on the mature sperm cells. Differential survival of gametes was examined by two genetic techniques. Data from both of the experiments agreed in suggesting an apparent enhancement of radiation damage in spermatozoa. (San 16:1962, 9385)


A doubling of the chromosome complement in Monomorium spermatids from haploid to diploid doubles the sensitivity to radiation when dominant lethality is the criterion. X-rays were used.


Treatments of Drosophila spermatogonia with acute doses of 50 r, 110 r, 160 r and 510 r gave a clearly non-linear dose-effect curve for sex-linked recessive lethals. In order to explain the results, a mathematical model for the irradiated cell population has been formulated, considering cell killing, variation in sensitivity to killing and to mutation induction with cell cycle stage, and length of cell cycle. Thus, the frequency of mutations observed will be equal to the product of dose absorbed by sensitive cells, minimal value of sensitive cells' sensitivity of sensitive cells x survival of sensitive cells, divided by total number of cells in population less killed sensitive cells. In this last approximation, effects on resistant cells have been disregarded. According to this model, proportional of doses in this dose range should lead to higher yields of mutants. For 144 r, 297 r, and 152 r over 5 (3 spermatogonial cell cycles in the irradiated embryo), have given results in support of the hypothetical model, showing a linear increase in mutation rate with dose, with a slope higher than 0·3 x for sex-linked lethals per r, indicating a sensitivity at least as high as for mature sperm, for doses lower than a few hundred r.


Irradiation of Drosophila spermatogonia in 20-3-h-old eggs/larvae with doses of 0 r, 50 r, 108 r, 153 r and 507 r, at 25 °C/min, have resulted in sex-linked recessive-lethal frequencies indicating a non-linear dose-effect relationship with reduced effects at the higher doses. It was hypothesized that the spermatogonia constitute a cell-population heterogeneous as regards sensitivity both to mutation-induction and to cell-killing. In a population of N spermatogonia, a dose D would then lead to the observable genetic effect.
If the sensitivity to mutation-induction by X-rays at a fixed energy density of 1 X 10^2 rad, this expression leads to non-linear dose-effect curves. These can be fitted to the experimental results if assumptions are made about the relative frequency of sensitive cells in the population, and about the slope of the survival curve. This formulation of the hypothesis also leads to the prediction that pretreatment of the dose over several cell-cycles should lead to higher yields of mutations, since sub-lethal damage should be repaired for each cell-generation, in accordance with Damarin's observations. This predication has been tested by giving similar doses over 9 h, which yield 2-4 cell-cycles. The results show a significantly higher effect at the 900 r level and a reasonable quantitative agreement with the predictions.

802 Ofstadal, P. INDUCTION OF MUTATIONS AND KILLING OF CELLS IN IRRADIATED SPERMATOGONIA OF Drosophila. Nature, Lond. 180 (1958) 1081-2. If a given dose were pretreated over several cell-generations, the observable genetic damage should be higher than that found after acute treatment. This hypothesis was tested with doses of 100 r and 267 r, as against 6-8-irradiations of spermatozoa at 20 m/min. The results seem to support the idea of differential killing as an explanation. The effect is similar to that found by Vassar et al. (1961) after irradiation of flourlouse larvae, 3-10 d old, and oocytes that were found after treatment of earlier stages. The results are not in agreement with those reported by numerous other workers.

803 Farquhar, G.P. APPEARANCE OF DOMINANT LETHAL MUTATIONS IN Drosophila melanogaster DURING COSMIC FLIGHT ON SPO-SATELLITE. p. 394-9 in STP-MT-65-78, s.d. Translation. A significant increase in frequencies of dominant lethal mutations in spermatozoa of male D. melanogaster occurred during a satellite flight. Data indicate that the increase was the result of rocket vibrations rather than radiation dose. (From NASA 17:1-8, 1960, 35280).

804 Pellicer, C. QUELQUES RESULTATS SUPPLEMENTAIRES CONCERNANT L'INFLUENCE DES RAYONS GAMMA SUR LES CHRYSAIDEES ET LES OEUFS DE LA TERNE DE LA PARIS Eupiptia kuehniella Z. Rev. Agric. 15, 1 (1963) 335-59. En irradiant des chrysalides adultes (15 d.) avec 1500 r rad, il est possible d'obtenir des males stériles et agressifs. Par contre, à l'âge de 9 j les rayons y occasionnent un rattrapement des altes, le pourcentage d'éclosion et la durée de vie sont fortement réduits et la tendance à l'accompagnement est atténuée. L'influence des rayons y (1000-2500 rad) sur embryons est fonction de l'âge des embryons. Les individus n'ont pas d'une façon à une dose identique. Les influences sur la fécondité sont héritées, la fécondité étant très probablement tributaire de plusieurs gènes. Les spermatozoïdes sont plus sensibles aux mutations que les oocytes. Les moyennes d'éclosion des populations P1 sont plus élevées dans des croisements entre lignées normales et irradiées qu'en irradiation. On trouve chez les femelles irradiées, au stade embryonnaire 2 zones de stérilité : l'effet d'une dose de 7800 rad est plus prononcé chez ses embryons de 4 g (pas d'œuf) que sur les embryons de 3 g (présence d'œufs mais absence d'éclosion). Au point de vue pratique, il est plus facile de rentabiliser et de traiter des œufs que des chrysalides. Les œufs ont plus la possibilité d'induire chez les chrysalides et chez les embryons des mutations (du type dominant dans le cas de la terne) qui provoquent un certain degré de stérilité.

805 Peartley, J.B., Jeffette, D.J., Statham, J.R., Bull, J.O. SOME EFFECTS OF GAMMA RADIATION ON THE LESSER GRAIN BEETLE (Sitophilus oryzae L.), TROPICAL WAREHOUSE BEETLE (Cucroa Uvaria L.) AND THE CIGARETTE BEETLE (Leucinodes leucocephala F.). ARB-X-4093, United Kingdom Atomic Energy Authority, Research Group. Europe Research Div., Wantage, Berks, England. 1962. 29 p. Various effects of γ-radiation on 4 stored products pests, which infest grain and cereal products in varying degrees, were examined with particular emphasis on susceptibility to radiation sterilisation. R. DOMINICA, described as the most destructive pest of grain, and L. seriicata, occasionally found infesting cereal products, are effectively sterilised by the dose (10,000 rad) evaluated for the control of large populations of grain weevils. C. castanea and P. interpunctella, principally pests of dried fruits, but occasionally imported on infested cereal, are more resistant to radiation sterilisation. 10,000 rads is unlikely to be completely effective for their control. (Auth.)

806 Pecher, P., Venkataram, J.M. L’EMPLOI DES RADIATIONS ÉTUDE PARTICULIÈRE DE LA PARIS, 17, 1 (1963) 8-47-84. Divers modes de développement ont été étudiés par l’emploi diverses endroits où les modifications biologiques c

807 Proverbs, M.D., Newton, J. POTENTIAL OF THE CODLÉ CANAD, Ext. 94, 7 (1968) 1. The reproductive potential o V. ira rabbit male mothers with 5 normal male and 12 female when 50 irradiated the normal insects. Eight-irradiated normal female mothers were used to feed so. Spore from intestines. (Auth. summary)

808 Proverbs, M.D., Newton, J. MOTH BY GAMMA RADIATION. Fully developed pupae of the y-radiated and the emerged of mature larvae offspring of the 5 normal females, and 50 irradiated the normal insects. Eight-irradiated normal female mothers were used to feed so. Spore from intestines. (Auth. summary)


Divers stades de développement de certains coléoptères infestant des soies, en particulier, S. granarius, ont été étudiés par l’emploi des radiations Co\(^{60}\), 1000-20 000 rads. La radio-stérilité a été observée chez les mâles et les femelles des sous-races infestant les soies infestées. Les auteurs considèrent que ces modifications histologiques et cytologiques de l’appareil sexuel dues aux radiations ionisantes.


The reproductive potential of the cooling moth, Capucapora pometella, was measured for 40% of the potential male and female moths (exposed to male and female moths) were caged in the laboratory with normal male and female moths. The results showed that when both 50 irradiated (250 000 rads) males and 50 irradiated (200 000 rads) females were added to the normal insects, eighty-nine per cent of the normal female offspring of normal males were males; the male offspring were essentially non-existent. The female offspring were totally normal. The results were compared with those obtained in control experiments.


Fully developed pupae of the cooling moth, Capucapora pometella (L.), were exposed to 40000 rads of \(\gamma\)-rays and the emerged adults caged with normal moths over dwarf apple trees. The average number of normal larvae per cage that developed when each cage was supplied with (a) 5 normal males, 5 normal females, and 5 irradiated male moths, (b) 5 normal males, 5 normal females, and 50 irradiated male moths, and (c) 5 normal males, 5 normal females, and 50 irradiated female moths were: 6.0 in (a), 16.8 in (b), and 10.3 in (c). In another experiment, in which the number of normal moths remained the same, the number of irradiated males of each sex was increased from 50 to 100, the average number of mature larvae that developed in each cage was 0.7, 3.0, and 5.3, respectively.


When male pupae, within 1 d of adult emergence, were exposed to 40000 rads of \(\gamma\)-rays (Co\(^{60}\)-source) dominant lethals were induced in about 80% of the pupae without affecting adult emergence, mating or adult longevity. Similar effects followed irradiation of 12-24 h old male moths. Further tests on radiosensitivity of different stages are reported. Experiments on mating among different sets and ratios of irradiated or control males are also described under laboratory and some under orchard (cage tests) conditions. Results indicate that the sterile male technique may be a promising method for the control of the cooling moth, Capucapora (\(=C\)yclia) pometella (L.).

870 Rasulov, F. K. ВЛИЯНИЕ ГАМА-ЛУЧЕЙ НА СТЕРИЛЬНОСТЬ КАРАПРИНС. Химико-

871 Rasulov, F. K. ACTION DES RAYONS \(\gamma\) SUR LA STÉRILITÉ D’UNE NOCTUIDE DU COTON (GENRE \(\Lambda\)ephyrns exiguus), Bihl. Phytophysio. 30 (1985) 43-44. The moth, \(\Lambda\)ephyrns exiguus, is a cotton pest. Eggs, larvae and pupae were subjected to \(\gamma\)-radiation from a Co\(^{60}\)-source at 25°C for (total dose 3000-11 000 r., at 25°-27°C and a humidity of 65-75-.

Irradiation with 3000 to 5000 r. does not prevent larval development and does not inhibit larval feeding. Exposure to 7000, 9000, 11 000 and 13 000 r. permitted only a small number of larvae to reach maturity. Irradiation of male and female cottons with 2000 r. resulted in 36% sterility in males, at 5000 r. 49%, 7000 r. 59%, and 10 000 r. 100%. Complete sterility was evident in females following exposure to 4000 r. 

Total sterilization of males and females was obtained with a dose of 7000-11 000 r. The life spans of mature moths from irradiated male cottons was 4-5 d. for non-irradiated, 5-8 d. 227

Preliminary experiments are described on radiosterilization of pupae. Adults of both sexes were rendered sterile when 2-4 day-old pupae were exposed to 5000 r. Longevity appeared normal, and neither aggressiveness nor mating behaviour of young males was affected. Rate sensitivity was also determined and results tabulated for 40 r, 70 r, 100, 150 and 250 r/min. In tests with caged fly populations the almost total sterilization at the 50 r 1 overhanging rate was of unusual interest.


Experiments were conducted on radiosterilization of male houseflies. The females of Musca domestica are monogamous, so that all the females mating with sterile males lay sterile eggs. Tests with 24-25 r 1-rays showed that the most satisfactory method of sterilizing male houseflies consisted in irradiating the pupa with 3000 r 7 to 3 before emergence. The mortality of the irradiated pupa was not appreciably increased and the flies emerging from them were normal in appearance, viability, longevity, and sexual activity. When the irradiated pupae were mated with normal females, sterility was 100% complete. However, there was a slight tendency for females mated with irradiated males to mate with normal males. Sterile males successfully competed with normal males in search of females, and when they were present in overwhelming numbers succeeded in mating with most of the females, leaving them sterile.


An attempt was made to investigate damaging effects of x-rays (2000 r) on the number of blood cells of silkworm larvae on the 2nd day of the 6th instar. A marked decrease in hemocyte counts was observed. The extent of this drop is not connected with the sex of the larvae.


Marked differences in radiation-induced mutation rates for different stages of gametogenesis have been observed in the silkworm, both for visible recessive mutations and dominant lethals. Maximum mutation incidence is observed in spermatozoa and mature oocytes. In mature oocytes the observed mutation rate is several times as high as in oogonia. By the specific locus method with egg-coloured mutants it was found that induction rates rise linearly with increasing radiation doses applied to oogonia; with mature oocytes, however, they increase rapidly with doses of power > 1. This suggests that most of the mutations induced in oogonia may be accompanied by gross chromosomal aberrations, aberration-bearing cells being eliminated subsequently in the long course of gametogenesis. Mortality was measured at various developmental stages of the P1, from irradiated oogonia and irradiated mature oocytes. 1900 r and 3000 r 1-rays were given. A considerable percentage of the P1 individuals from irradiated mature oocytes were found to be eliminated during the embryonic and larval stages, especially in the earlier stages.


Three developmental stages of the olive fly were exposed to y-radiation from a Co r source and the sterilization dose determined. For 4th-instar larvae the sterilizing dose was 2000-2500 r, for pupae 11 000-18 000 r and for adults 10 000-18 000 r. Mating studies showed that sterilization persisted throughout the life of the adults. The effect of dose on emergence was studied with 4th-instar larvae and pupae. For the larvae the dose was exposed to 500-2000 r at 300-rad intervals, while the pupae were exposed to 8000-15 000 r at 5000-rad increments. Maximum emergence was obtained when 5-6-day-old pupae were irradiated. Significant fluctuations occurred at all dose-rates. (From auth.)


In insects, pre-adult mortality caused by "dominant lethals" in X-rays may be either gone or chimerous if instead of the gametes whether in both types of experiment in the genotypes and/or phylogenetic evolution. During the last 10 years we have shown that the exact dose of X-rays can be found for different strains of the same species. This work has been done with cold, non-ionizing radiation. The importance of the results is that the effect of different X-ray doses on different genotypes can be detected as a physiological effect.

817 Walker, J.R. EVALUATION BY X-RAY INDUCED STERILITY.

Records on emergence from 4 showed that the 1st day of males occurred in females of the sex ratio t 1 males and females in the control mating was not indicated that 1 males were present in females of the sex ratio. A rsted in 25-26 hatched back the d with unirradiated males under 10% percent of the dose hatched back the control males back the d. In the experiment the d with unirradiated males was under 10% percent of the dose hatched back the d with irradiated males. The percentage of the d with unirradiated males was under 10% percent of the dose hatched back the d with irradiated males.


When unirradiated virgin females (Hilber) treated 1 d after an exposed compared equally with the unirradiated females and male compared significantly with unirradiated females of both sexes to sex: males were more susceptible to treatment, younger pupae hatched back the d when unirradiated females were exposed.

819 Whitting, P.W. R-LOCUS PA.

In the weev species, the deleterious factors, e.g. lethals, haploid males and, therefore, diploid males, a mutant type male lethal is crossed to d and heuv diploid females are paternal lethal only. By use c can be identified. Any theorems on the lethals, each

In insects, pre-adult mortality of the progeny of irradiated parents is thought to result from radiation induced "dominant lethals" in the genome of the maternal or paternal gametes. These "dominant lethals" can be either gene or chromosome mutations. Similar radiation effects (e.g. embryonic mortality) are found if instead of the gametes the progeny (e.g. young embryos) is irradiated. This raises the question whether in both types of experiments pre-adult mortality is the result of "dominant lethals" (i.e. alterations in the genome) and/or "physiological effects" (i.e. effects in cell components other than chromosomes). During the last 10 years we have accumulated quite a number of experimental results on inseminated Drosophila eggs, X-rayed after depapsulation in the stage between completion of meiosis and beginning of first cleavage. Most data (e.g. differential radiosensitivity of cell parts with or without a nucleus, the one hit dose action curve for mortality and recessive lethals, influences of oxygen during irradiation, etc.) were consistent with the assumption that the most important radiation effects are alterations in the genome which behave like dominant lethals (probably of a one hit type predominately). However, new results (experiments with cold post treatment and the analysis of radiosensitivity of eggs and embryos with different chromosome constitution) indicate that at least some of the radiation effects have to be considered as "physiological effects".

WALKER, J.R. EVALUATION OF CONTROL OF EUROPEAN CORN BORER, Ostrinia nubilalis (Hübner), BY X-RAY INDUCED STERILITY. (a) Abstr. 25 (1965) 781.

Records on emergence from 4 groups of untreated European corn borers larvae, involving 11,560 individuals, showed that on the 1st day of emergence 50% of the moths were females. After the 1st day of emergence, males outnumbered females with a gradual shift to more females during the latter part of the emergence period. The sex ratio of the moths studied was approximately 50% males and 50% females. Sexing studies indicated that corn borer moths had a low to moderate fecundity level. In cages containing eight males and eight females only 87.7% of the females mated. Also only 58-80% of the eggs deposited by females in the control matched hatches. Exposure of 1-day-old male moths to 30,000 r. resulted in 73% egg hatch when they were mated to untreated females. The irradiated males competed equally with untreated males for virgin females. A male of 1 irradiated males to 4 untreated males to 8 untreated females resulted in 81.4% hatch of the deposited eggs. The survival of the irradiated males compared favourably with untreated males under laboratory conditions. Exposure of pupae to x-rays resulted in a reduction in the percent of egg hatch as the dose was increased. Female pupae were more susceptible to the effects of irradiation than male pupae. The percent of egg hatch varied with the age of the pupae at the time of treatment, younger pupae being more susceptible to irradiation than older pupae. (Auth.)


When untreated virgin females were mated to male moths of the European corn borer Ostrinia nubilalis (Hübner) treated 1 day after emergence with 25,000 r. of x-rays, only 13% of eggs hatched. Irradiated males competed equally with the untreated males for females. Moths caged together at a ratio of 8 irradiated males to 4 untreated males to 8 untreated females resulted in 36.4% hatch of eggs. Survival of the irradiated males compared favourably with that of untreated males under laboratory conditions. Exposure of pupae of both sexes to x-rays resulted in a reduction in % egg hatch as the dose was increased. Female pupae were more susceptible to irradiation than males. The % egg hatch varied with age of pupae at treatment, younger pupae being more susceptible to irradiation than older pupae. (Auth.)


In the wasp Mummecia, the complex locus, R, after irradiation-induced mutations, frequently contains deleterious factors, - lethals, male steriles, or female males. Only the last can be transmitted by haploid males and, therefore, homologues of lethals or of male steriles must be determined by use of diploid males, a mutant type aberrant for these loci. Normal diploid females heterozygous for one mutant lethal are crossed to diploid males heterozygous for another. sperm of diploid males are diploid and hence diploid females are sire, one-half of which carry a lethal from each parent, one-half, the parental lethal only. By use of proper eye colour tags, diploid F2 males carrying two different lethals can be identified. Any theoretically expected type of eye colour in diploid males not found, indicates homology of the lethals, such males being inviable. Among 63 pairs of 31 genes bearing lethals (or male
sterility) only one combination proved variable. The fact that most deleterious changes caused by mutation are non-homologous, affecting different vital processes, indicates great complexity of this single locus. R. "Self-tests" were made by the same method as used for tests of lethals from separate mutations. As expected, the diploid males homozygous for the lethal were in no case viable. Comparisons are discussed between the R locus of Mormoniella and the "super-genes" of polymorphic species as also the induced complex genes of Dro sophila and microorganisms. (Auth.) RA : 41 ; 1961, 8719.

Weilgus, F.E. X-RAY INDUCED "DOMINANT LETHALS" IN INSULINATED EGGS OF Drosophila.
(9) EXPERIMENTS WITH DIFFERENT STAGES BETWEEN INSEMINATION AND END OF SECOND CLEAVAGE

The nature of x-ray induced mutability in insulinated Drosophila eggs has been studied by analysing the recombination in different stages of pre- and early cleavage stages. The earlier sensitivity was found during late anaphase/early telophase of cleavage II and each cleavage division analysed so far. Sensitivity was lowest when the cell was in interphase. The dose curves for the different stages were greatly in shape and slope. The one bit curve for eggs containing all stages between cleavage and beginning of cleavage (see 916) could be shown to result from superposition of different non linear dose effect curves. This result invalidate the strongest argument supporting the hypothesis that radiation induced mutability is of a one bit type. It has been shown by various authors that insect embryo developing from irradiated gametes can die at different stages of development. In Habrophanum drosophila lethal syndromes seem to result from different kinds of nuclear damage as shown by Von Bonsel (1941). Different lethal syndromes can also be distinguished after irradiation of insulinated Drosophila eggs. The independence of the relative frequencies of different syndromes after irradiation in specific stages of nuclear divisions and the close dependence of the different syndromes have been recorded. The results indicate that irradiation induced genetic effects alone can hardly explain all the facts.

Wishki, N. GAMETOGENESIS IN THE SUGAR CANE BOBER MOTH (Hestena saccata) (F.)

The gametogenesis of the moth was studied cytologically, in order to gain general information on the plastrality and means of obtaining sterile males by irradiation. The following stages require to be irradiation: (a) to affect spermatogonia and early spermatocytes; 7-15 d old larvae; (b) to affect all stages of spermatogonial; larvae > 15 d old, to affect spermatogonias; pupae.

See also:

854 The action of radiation and other mutagenic agents (1) in inducing sterility in Drosophila females, and (2) in controlling the action of specific genes responsible for suppressing uncontrolled growth. (Gias, 1961)


878 Irradiation of the saw-toothed fly. (LeChesne and Hopkins, 1962)

865 Inhibition of oviposition by females of Gryllus assimilis (F.) induced by radioactive males, utilizing L-methionine-14C. (Abdel-Malek, 1961)

467 Inhibitory effect of L-methionine-14C on oviposition by females of the cotton leaf worm, Prodenia lutea (F.), induced by radioactive males. (Abdel-Malek, 1963)

470 Effects of beagned Pu50 on fecundity, fertility and life span of Habrophana (Hymenoptera: braconidae). (Refman, 1962)

472 The genetic and developmental effects produced by irradiated in Drosophila. (Ginsb, 1960)

475 Certain biological effects produced in the boil weevil by tagging it with F3+ (Mayer and Bruzel, 1961)

581 Radiation induced viability mutations in the honey bee. (Lee, 1963)

915 X-ray induced viable mutations in Habrophana. (Whiting, 1963)

916 X-synapsis transmission of Drosophila melanogaster. (Waxner, 1963)

921 Contra, in radiation-induced mutation rates of different mutagenic stages. (Whiting, 1963)

1960 Mutagenic sensitivity of sperm, spermatids, spermatocytes, and spermatozoa of Drosophila melanogaster. (Chandler and Beamer, 1963)

1292 Effects of x-ray irradiation in Drosophila virilis at different stages of spermatogenesis. (Clayton, 1962)

1016 Spermatogonial tests of the alloxan and its bearing on the radiation induced sterility. (Sato, 1961)

1023 Considerations on the various stages of gamete transmission. (Moyser, 1960)

1048 The relationship of the sex of the mother to the radiation induced sterility. (Moyser, 1960)

1047 The effect of radiation on the development of the male and female gametes. (Moyser, 1960)

1048 The influence of sex on radiation-induced sterility. (Moyser, 1960)

1049 The effects of radiation on the development of the male and female gametes. (Moyser, 1960)

1050 Further observations on the effects of radiation on the development of the male and female gametes. (Moyser, 1960)

1051 Studies on the effect of radiation on the development of the male and female gametes. (Moyser, 1960)

1052 Enhancement of radiation sterility. (Moyser, 1960)

1053 The effect of radiation on the development of the male and female gametes. (Moyser, 1960)

1054 The influence of sex on radiation-induced sterility. (Moyser, 1960)

1055 The effect of radiation on the development of the male and female gametes. (Moyser, 1960)

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1060 The effect of radiation on the development of the male and female gametes. (Moyser, 1960)

1061 The effect of radiation on the development of the male and female gametes. (Moyser, 1960)
Considerations on the changes in observed mutation rates in the silkworm after irradiation of various stages of gametogenesis. (Tatsina, 1961)

Synaptic modification of dominant lethal frequencies after irradiation of the Drosophila testis. (Thompson, 1962)

The relationship of radiations and environmental changes in oxygen concentration for biological damage in the immature germ cells of Drosophila virilis. (Alexander, 1968)


Biological damage in the mature sperm of Drosophila virilis in oxygen and nitrogen with different dose intensities of gamma rays. (Alexander and Bergsjoahl, 1962)

The response of pre-meiotic and post-meiotic germ cells of Drosophila to dose fractionation and changes in partial presence of gases. (Alexander, 1962)

influence of sex-ratio during gamma irradiation of screw-worm pupae. (Baumhoover, 1963)

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Enhancement of radiation-induced sterility in insects by pre-exposure to CO2 + air. (La Chance, 1962)

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The effect of X-rays on the gametogenesis of the grain weevil Sitophilus granarius L. (Cockerham, 1963)

The effect of X-rays on the gametogenesis of the grain weevil Sitophilus granarius L. (Cockerham, 1963)

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Further studies on two types of dose-rate dependence of radiation-induced mutation rates in spermatogonia and oocytes of the silkworm. (Tatsina and Kondo, 1960)

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The effect of X-rays on the spermatogenesis of Peromyscus maniculatus. (Medlin, 1961)

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Preliminary studies on the effect of X-rays on Tribolium castaneum. (Sokoloff, 1963)

Irradiation experiments with Tribolium. (Sokoloff, 1961)

Effects of radiation on insects. (La Chance, 1962)

Effects of gamma radiation on various stages of three fruit fly species. (Balock et al., 1965)
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The application of nuclear energy to agriculture. (Moh, 1965)

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Could this be death to the codling moth? (Proverbs and Newton, 1961)

Effect of gamma rays on insects. Progress on the use of induced sterility for the control of the codling moth. Carpispora pomonella (L.) (Lepidoptera: Olethreutidae). (Proverbs, 1961)

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Travaux de recherches utilisant les isotopes et les rayonnements nucléaires en entomologie appliquée en France et dans les pays associés. (Ponsin, 1965)

1-A-3 RECESSIVE MUTATIONS, VISIBLE MUTATIONS, SURVIVAL AND SEX RATIO EFFECTS


Dr. Newton Morton's observation that irradiated sperm produces a shift in sex ratio significantly larger than expected has resulted in our doing several large-scale experiments to determine underlying mechanisms. Males (v dyg) receiving 5700 r and corresponding controls were mated either to ec4 B Ins w6 ec6 (Bas-M-5) females or to v f reversed somatic females needing the Y chromosome for survival. Mating (1) yields the sex-linked recessive lethal, the second gives the induced sex ratio shift, found to be two or more times greater than expected from the lethal frequency. Dominant lethality, detrimental but nonlethal mutations and mosaicism were considered as possible causes for the discrepancy. In the sex ratio sex, loss of X or Y chromosome results in procytic deathly possible unusual sex chromosome dominant lethality should not be great enough to produce the observed shift. Mating the F1 penetrants males to compound X females produced the normal sex ratio cases, indicating that detrimental mutations were not the cause. Mating about 1000 F1 females from nonlethal Bas culima produced an F2 lethal rate corresponding to the control. Furthermore no lethals reversed. Therefore, lethal gonadal mosaicism was not coping with any appreciable extent. If these factors play little role in producing the observed phenomenon, it seems likely that the sex ratio shift depends almost exclusively on sex-linked recessive lethality. At a possible hypothesis, some induced mutations may be measurable. In the male flies preferably, females might be reared than in the female flies. On this hypothesis the agent responsible for repair may be the unirradiated X. Alternatively, recessive mosaicism without gonadal mosaicism resulting from early segregation in a two or more stranded chromosome structure remains a possibility.

(See also Rec. Genet. Soc. Amer. 30, 2161, 58.)

Wild-type males of the Canton-S stock were irradiated with one of the following doses: 3000, 9000, or 18000 r. Each dose was delivered in two half-doses separated by a 24-h interval. For a 15-d period after irradiation, the males were supplied regularly with excess virgin females to exhaust the supply of germ cells which were post-gonial when irradiated. After 15 d, the males were singly mated with Bsc/O-X-Y females. A single heterozygous Bar-eyed daughter from each B-1 male was subsequently selected for the presence of a sex-linked recessive lethal. The use of only one offspring from each irradiated parent eliminates the problem of dealing with chimeras of cells descended from the same treated gonial cell. Our preliminary study demonstrated that 80% of the lethals obtained at 3000 r were recovered in each chimeras. Confirmatory crosses were carried out on all lethals. Our criterion for lethality was the appearance of 10% or less of the wild-type class of males. The results to date are in remarkably good agreement with the rule of linearity of mutation rate to dose, as previously attained for spermatocyte cells. The data from two experiments are presented.


An increase in biological damage in sperm treated in inseminated females was observed after treatment with either x-rays or y-rays. Recovery mechanisms cannot account for the high sensitivity to neutron treatment. The absence of recovery mechanisms was indicated by equal percentages of biological damage observed in the first and second day after treatment with 2 MeV neutrons in air or with 14 MeV neutrons in nitrogen. The possibility of a post-radiation enhancement of radiation damage was observed when mature sperm were treated in inseminated females with x-rays in the presence of N₂ gas. The data indicate that an explanation for the increase in damage sensitivity of mature sperm treated in fertilized females involves more than one factor, the relative importance depending upon the type of radiation and conditions at the time of irradiation. The neutron data show that the chromosomes change in some way to become more sensitive to radiation injury after fertilization. The x-ray data indicate that there may be differences in recovery occurring in genetic damage in sperm treated in males and inseminated females and that there is an increase in chromosome breakage which is associated with the increased sensitivity. There is also a correlation of an increase in chromosome breakage and the presence of oxygen and a possible post-radiation enhancement of radiation damage which may be associated with the presence or absence of O₂. (From auth.)


Irradiated second chromosomes in wild-type D. melanogaster males were scored for induced lethal frequencies when transmitted to male and female progeny. No difference was observed between these two groups, and it has been concluded that the sex of the zygote which receives the irradiated chromosome does not influence the frequency of lethal mutations recovered. (Auth. summary.)


Females were examined for the relative proportion of whole-body versus fractional mutations induced by x-rays (3000 r) in post-metamorphic stages, in the X-chromosome of their male parent, at 14 visible loci. Parallel studies were made in a chemically treated and an untreated series. In the x-ray series, 83% of the mutations appeared to be whole-body, the remaining 17% being fractional. By contrast, in the chemically treated series and in the untreated (spontaneous) series, the percentage of fractional was relatively high (20-87%). The implications of these results are discussed. In all 3 series the mutant tissue of the fractionals as a rule seemed to involve half of the body, as far as could be determined upon external examination of the fractionals, and this is discussed.

All irradiations were confined to the larval stages of Daphnia longispina (Neop) over the period from 5-0 d after propagation, i.e., after placing the females with host coconuts of the sawfly Neodiprion lecontei (Pritch.). The genetic effects of acute (1000 r at 1000 r/min) and chronic (100 r at 10 r/h) exposure from x-rays and Co⁶⁰ respectively were investigated. The difference in mutation rates for eye-colour mutations with type of exposure proved to be small (~1.2) and not significant. Such factors as species differences, the masking effect of differential survival, the comparatively high dose rate (10 r/h) in chronic irradiation, or differences in the stages of development during irradiation may account for the small difference observed in Daphnia, as compared with those observed by other workers for Drosophila and Habrobracon.


The investigation is carried out on the wasp Daphnia longispina.


Genetic studies with D. melanogaster are centred upon the influence of dose rate and dose fractionation on recessive lethal mutation induction by ionizing radiation. Results so far agree with previously published findings by other workers with the mice (Russell) and thymus (Tatima and Kondo) that there is evidence for repair or recovery from genetic radiation damage.


After x-ray treatment of ey¹⁵¹¹ females of D. melanogaster with doses of 3, 4, 5 and 6 hr respectively 30 chromosomes with recessive lethals and 11 with semi-lethals were found. In all cases these 41 mutant chromosomes were crossed with each other. Two chromosomes contained two lethals each. Among the 40 mutations so more than 25 occupy one locus; the others are small deficiencies: 18 at least comprise 3 loci, 4 each 3 loci, and 2 four and 16 respectively. By aid of these overlapping deficiencies a part of this chromosome could be mapped over a range of about 25 loci including the locus of cl. Among the induced lethals two clusters were found: one consisted of 5 mutations induced in a spermatogonium and occupying probably one locus, the other was composed of two lethals, which gave a positive result in the alistic test, but proved to be overlapping small deficiencies including the locus of cl.


A cytological map of D. hydei, one of the species of the rhabto species, is presented together with some cytological observations, including the descriptions of three x-ray-induced rearrangements. A mutant A (Antispedia) is a dominant autosomal character located on the 2nd chromosome, lethal in homozygous condition. The autosomal dominant mutant, l (Lobus), is characterized by almost complete female sterility; homozygotes are lethal. The D (Dorsos) stock contains males in both of which some of the small campaniformia on the wing are converted into conspicuous bristles; females are seldom affected. The map of D. hydei is compared with the existing map of D. hydei Rowlatt; in addition to the large standard rearrangements, a number of small differences are indicated. On the basis of rearrangements, two of the linkage groups are attributed to definite chromosomes.


225
A study was made of the sex- and oocyte (first meiotic prophase) lethal rates obtained were 3400 to give approximately the data for the X-ray avoidance experiments. The low yield of viable females, including the mutants, is not correlated with the X-rays. When the latter are used, first meiotic prophase is not a measure of sensitivity, however, plenty insensitive (zero aberrations)

599


X-ray experiments of 3 kinds: termination in this species. Oocytes to assess an irregular elimination from the embryo differentiate secondarily into males.

580


Some preliminary observations appear on the abnormally of the hypothalamic cell character appears in all larger from the following stocks: Apis, A. Experiments with x-rays fail to induce the same effect as discussed, as.

581

Edlingoow, G.W., Rape, J.H. Y-SUPPRESSED LETALS IN E. A.

An investigation was made to measure the 5-5 technetium, using the 1212-17.75 at 43257 of the 5 -5 relationships to recessive lethal.

582


A study of the frequency of the utilization of special sex-linked recessive lethal in 100,000 crosses in D. melanogaster and 1000 crosses in D. simulans. Differences in radiation effects on viability, a sex-ratio factor, and response to different temperatures were found amongst the 3 species.

583


586


Evidence is presented to show the distribution of the majority of x-ray-induced mutations at the dumpy locus are gene mutations not associated with multibreakage events. Complete mutations (those affecting the entire body) form a mixed class of breakage events and gene mutations. The mutation frequency of the dumpy gene was not altered when sperm bearing a pre-existing dumpy mutation were used for irradiation. Gross mutation detected at the dumpy locus is 1/10 of that of the dumpy locus. Criteria are evaluated for determining the true gene mutation frequencies at both loci. The results of the x-ray analysis of the dumpy locus support a theory of mutagenesis proposed by Muller, Carson, and Schaefer (1961).

527


Three morphologically similar strains of Drosophila were compared. Virgin females (100) of D. willistoni, D. simulans, and D. melanogaster were exposed to a Coγ source for 8 min 8 sec so as to receive 3000 r. Differences in radiation effects on viability, a sex-ratio factor, and response to different temperatures were found amongst the 3 species.

531


FOR TEXT
A study was made of the sex-linked recessive lethal and visible mutations induced by X-rays in the sperm and oocytes (first meiotic prophase) of \textit{S. coprophila}. For sperm irradiated at 2000, 3000, and 4000 r the lethal rates obtained were 0.6186, 0.6303, and 0.5948 respectively. Sperm and oocytes irradiated at 4000 r gave approximately the same lethal rate, 0.6348 versus 0.6371. On the basis of the experimental data the following hypotheses have been made: (1) the rate of change is not to the mutagenic effects of X-rays. The low yield of visible mutations obtained repeatedly in this genus can be attributed to a number of factors, including the unusual mode of inheritance and sex determination found in these flies. (2) There is no correlation between the induction of chromosomal aberrations and the induction of sex-linked recessive lethals. When the latter are used as a criterion of sensitivity to X-rays, the response of sperm and oocytes (first meiotic prophase) are not significantly different. When chromosomal aberrations are used as a measure of sensitivity, however, the sperm are found to be highly sensitive whereas the oocytes are completely insensitive (zero aberrations). (From auth.)

940 Di Pasqua, A. \textit{THE "BROWN SPOT" CHARACTER IN \textit{Drosophila melanogaster AND THEIR RESPONSE TO X-RAYS.}}


Some preliminary observations concern a new character of \textit{D. melanogaster} consisting in brown spots appearing on the abdomen of the females, some days after birth are reported. The brown spots are restricted to the hypodermal cells of the pleura. Size and number of spots per individual are variable. This character appears in all isogenic chromosomal combination involving the second chromosome, devoid of which fails to show spots, and which fails to show spots, an effect seen upon some generations after the establishment of the isogenetic. Treatment of larvae and pupae with X-rays fails to induce the spots in the males, but increases the size of the spots. A possible cytoplasmic effect is discussed, as well as the connection between brown spots and tumours. (Auth.)

941 Edington, C.W., Spies, I.J., Rease, J.D. \textit{THE FREQUENCY-DOSE RELATION OF X-RAY-INDUCED Y-SUPPRESSED LETHALS IN Drosophila.}}


An investigation was made to determine the frequency-dose relations of total sex-linked recessive lethals as measured by the \textit{S} strain technique and the two major classes of lethals, orthodox and Y-suppressed, of which they are composed. It was found that orthodox lethals increase linearly with increasing dose. Y-suppressed lethals, which behave for the most part as \textit{Y}-type position effects and constitute a large fraction (85\% at 1000 r. 70\% at 4000 r) of total lethals in all doses studied, increase more rapidly than expected on the basis of linearity. When orthodox and Y-suppressed lethals were combined, it was shown that the frequency-dose relation of total lethals deviated significantly from linearity. The significance of these dose-response relationships to recessive lethal origin has been discussed. (Auth.)

942 Edington, C. \textit{A STUDY OF GENET AND CHROMOSOME CHANGES INDUCED BY IONIZING RADIATIONS IN Drosophila melanogaster.}}


A study of the frequency of radiation- and chemical-induced fractional mutations in \textit{Drosophila} is in progress. The utilization of special screening techniques allows the detection of F-1 females that are mosaic for sex-linked recessive lethal mutations. The mosaic females give rise to cultures in the F-2 generation that are scored as non-lethal cultures; however, an additional mating of the daughters present in these non-lethal cultures shows that some of the daughters are homozygous for an induced lethal while their sisters are hemizygous for the normal allele of the lethal. The race of proportion of females that are hemizygous for a lethal from a mosaic F-2 mating can be used to estimate the probable number of basic stands in the chromosome of \textit{Drosophila}. In addition, studies are continuing on the investigation of the effect of the number and distribution of chromosome in the X chromosome of \textit{Drosophila} on the frequency of x-ray induced X-autosome translocations.
Falk, B. VIABILITY OF Drosophila HETEROZYGOTES FOR IRRADIATED CHROMOSOMES. Science 159, 3396 (1968) 1418.

Numerous lines were prepared such that they were originally homozygous and cotogentic for their second and third chromosomes. Except for heterozygosity for the recessive marker B on their third chromosome. Half the lines had their ve+ allele chromosome irradiated with a dose of 84-900 r, given to the spermatogonia. By backcrossing these lines to a cotogentic stock, homozygous for ve, for a number of generations, viability could be measured. Viability of control homozygous lines was compared with that of the lines having one irradiated chromosome superposed on the same otherwise homozygous background. Viability of heterozygotes having one irradiated chromosome on a largely heterozygous background was also measured. Although many recessive lethal as well as detrimental mutations were induced, no increase in the average viability of the irradiated lines could be demonstrated as a result of the heterozygosity caused by the radiation-induced mutations.


It was intended to investigate whether induced mutations when in heterozygous condition and unselected can increase the average viability of an otherwise homozygous genotype. The design of the experiment was such as to afford every chance for an induced increase in viability to be detected. More than 40 lines were prepared, each having an irradiated third chromosome marked with the gene ve, carried along with a ve+ marked chromosome (cotogentic except for the ve locus and its vicinity) - with the ve-marked chromosome before its irradiation, and homozygous as well as heterozygous with respect to the second chromosome genes. A similar number of control lines, identical except for the irradiation, were also selected. The irradiation delivered to the treated lines comprised 6 doses of 300 r each, given to males at 3-d intervals. The irradiated males were kept for 15 d after the last irradiation before deriving from them the offspring studied, so that practically only sperm that had been irradiated at spermatogonial stages was utilized. The reduction of viability caused by the presence in heterozygous condition of radiation-induced mutations ranged from 0.6%. Results also support the notion that non-lethal deletions are on the average relatively more dominant than lethals. The maximum increase in viability was found to be even lower than the minimum increase possible according to Wallace (Radiations, Genes, and Man, Henry Holt and Co., New York 1958) in which he found an average increase of 3.5% in the viability of lines heterozygous for radiation-induced mutations. The possibilities of inducing many overdominant mutations and maintaining them in a population are discussed.


Irradiation is known to induce many mutations deleterious to homozygotes and hemizygotes. The effect of these mutations in the heterozygous state (especially of the very common class, with only slight effects on viability in homozygotes) is of major importance for their survival and for the dynamics and evolution of populations. It has sometimes been suggested that x-ray-induced mutations would be neutral in heterozygotes, or might even confer increased fitness on highly inbred individuals' hemizygotes for them. The X-chromosome of Drosophila melanogaster is under study to determine, quantitatively, the viability of heterozygotes for x-ray induced mutations in spermatogonia and spermatogonial. The average degree of expression in the heterozygotes (dominance) of the deleterious effects detected in the hemizygotes has been calculated. Preliminary results confirm previous observations that the deleterious effect of x-ray induced mutations is also detectable in the heterozygotes. This seems to be so even for the range of mutations only very slightly affecting viability of the hemizygotes. A more detailed study on the correlation between the effect of a mutation on viability in the hemizygotes and that in the corresponding heterozygotes might lead to a better insight into the dynamics of natural and irradiated populations. Special attention is being paid to mutations which might, at least under certain conditions, improve viability.


The daughters of x-irradiated males and unirradiated control males were mated individually to 5 types of males of Drosophila melanogaster. The viability of males hemizygous for the irradiated chromosome and of females heterozygous for the irradiated chromosome corresponded to the corresponding control ratios. While the viability of males hemizygous for irradiated chromosomes was always reduced, the viability of females heterozygous for irradiated chromosomes was either reduced or increased, depending on the type of mating. Insufficient differences between matings. To the irradiated chromosome were used chromosomes. The observed viability of the heterozygote reports on differences in mutable mutations were also caused by I.


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on the type of mating. Intraculture competition differences were demonstrated to be responsible for the difference between mating types. The heterotic effect was observed whenever the females heterozygous for the irradiated chromosomes were able to replace the decline in the number of males heterozygous for irradiated chromosomes. The observed heterosis was therefore spurious, in that it was not in fact the effect of a viability of the heterozygote superior to that of either homozygote. It is suggested that previous reports on differences in viability between types of crosses or on differences of flies heterozygous for induced mutations were also caused by intraculture competition. (Abb.)


Drosophila males were irradiated with an x-ray dose of 2000 r and mated according to a design that permitted the determination of viability effects in both the heterozygotes and homzygotes carrying the irradiated X-chromosomes. Apart from the irradiated lethals and semi-lethals, the milder quas-normal viability mutations could also be detected in the heterozygotes for irradiated chromosomes. In crowded cultures, when deleterious mutations caused a decline in the number of males heterozygous for the irradiated chromosomes, the remaining genotypes competed for the available space. If the efficient competitors were heterozygous for an irradiated chromosome as well, the induced viability effect was offset in the final outcome by that advantage in competition. The heterozygotes for irradiated chromosomes thus exhibited a spuriously increased viability as compared with their controls which carried unirradiated chromosomes. When intra-culture competition was kept at a minimum it could be demonstrated that the induced mutations had an adverse effect on the viability of heterozygotes. The heterozygotes carrying semi-lethal mutations were the more seriously affected. The heterozygotes for quas-normal chromosomes were considerably less viable than the controls, their viability being reduced at least as much as that of heterozygotes for lethals.

Fattig, W. D. A CHROMATOGRAPIC AND SPECTROPHOTOMETRIC INVESTIGATION OF FLUORESCENT SUBSTANCES OCCURRING IN CERTAIN EYE-COLOR MUTANTS OF MORGANTHIA VITREOSA (Walker).

A x-ray induced eye-color mutant, w., which produces oyster-eyes in adult M. vitreosa has been shown to occur at the 8-t locus. Within the 8-t locus it occurs in a clonor other than 5, and probably occurs in the O-clonor. One and two-dimensional chromatography reveals that 8-t locus mutants, and scarlet, do accumulate a blue-green fluorescent compound, designated 4b. This compound is present, but is not accumulated, in wild type eyecolor. Although phenotypic complementation occurs between 8-t and scarlet, chromatin complementation does not occur either in vivo or in vitro. Two possible explanations for these results are presented. The black (b) mutant of M. vitreosa accumulates 2 fluorescent substances. Hypotheses to explain these accumulations are proposed. In all, 9 fluorescent compounds occur on chromatograms of M. vitreosa extracts. Ultraviolet absorption spectra for 8 of these substances are presented. One of these substances is found in both M. vitreosa and Drosophila, and has not been reported in Drosophila before. (From abst.)


The total decrease in viability in irradiated chromosomes can be separated into two components which will be called the lethal (L) and detrimental (D) genetic loads. The D : L ratio was found to be 0.25. This is a low value, but in much better agreement with the recent studies than the earlier ones. The present results together with those of others suggest that the initial D : L ratio is much lower than reported by Timoshoff-Rosenvald and Khodad. The reasons for this discrepancy are not clear, but the newer results remove much of the basis for Greenberg and Crow's suggestions. (See their published work, as cited in the thesis.)

Friedman, L. D. X-RAY INDUCED VIABILITY MUTANTS IN DROSOPHILA MELANOGASTER. (Abst.) Genetics 66, 8 (1961) 665.

In order to determine the relative importance of lethal vs. detrimental mutations Muller-S (Base) and wild type males segregating from the same culture were irradiated with 1000, 2500, and 7000 r. These were mated with Base+ females from the same culture, and the F1 heterozygous females mated individually with 25 males which are the same as Base except for the absence of Bar. The F1 male progeny were counted, and the rate of + to Base when the base chromosome had been irradiated was compared with those where the + had been irradiated. The lethal frequency was 0.2 = 0.0001 r for the base chromosome
and 250/1000 r for Caenon-5, a significant difference - Early studies by Timofeeff-Ressovsky and Kerkis showed a high fraction of the total genetic load to be due to detrimental, whereas the more recent work of Kafer showed a smaller fraction. Our results in close agreement with Kafer, the ratio of the detrimental to the lethal load being 0.125. In our studies a lethal was defined as having less than 10% of the normal viability. The results indicate that either very few detrimental mutations are induced or that individuals they have very minor effects.


S7T "yellow" mutations induced by x-rays in scute chromosomes of different germ cells were genetically analyzed to determine their qualitative structure. Order of the locus is assumed to be 31, y, 20, and 13. The symbol y indicates the normal allele while indicates an affected or deficient locus, the locus involved being indicated by the position of the symbol. An additional lethal (if present) somewhere to the right of 67b is symbolized as in the 6th position. The following are structural frequencies of the "yellow" mutations x-ray induced in oogonia, oocytes, and mature sperm, respectively: + + + + 4, - - - - 1 (total 5); - - + + 4, - - + + 1, - + + + 3, + - + + 3, + + - + 3, + + + - 1 (total 35); + + - + 4, + + - + 1, + + + + 3, + + + + 1, - - - - 2, - - - - 2 (total 67). All (4) (4) chromosomes of oogonia and oocytes "yellow" were tested for translocations involving the 4th chromosome (Cas 4). None of the oogonia "yellow" were capped by Cas 4 (IVY). Two of the oocytes "yellows" (symbolized - - ) were capped by Cas 4 (IVY). Mature sperm "yellows" were tested for the 2nd (II), 3rd and 4th chromosome tips. Twenty-two cases were found. Tips from 12/11/22 exceeded all other autosomal tips deceased. All yellow half-translocations were deficiency half-translocations. The structure of the chromosome "yellows" in scute chromosomes is dependent upon whether the x-ray dose (even 30 spontaneous "yellows" were classifiable at either minute on gross structural changes) or the germ cell stage. The means by which x-ray induced (and possibly spontaneous) breakage and intragenic mutation can be separated is still not available. A consideration of the frequency, functional and structural types of chromosomal breaks and their intersections may yield a more realistic and unifying approach to transmitable changes (both forward and back) than the concept of intragenic mutation.


Young scute Bar males were x-rayed at a relatively high dose, 5000 r. Four post-treatment matings, or broods, were made every 24 h and consisted of treated males and virgin females containing the sex-limited markers, yellow body color, and autosomal markers, eosin eye, dumpy wing, and elit eye. Immature females from each of the four broods were transferred several times into fresh bottles. The treated males were removed from the fourth brood after 24 h and were discarded. Consequently, if females were derived from eggs that had been fertilized by 1-d old, 2-d old, or 3-d old sperm from time of treatment. Exceptional yellow daughters were recovered among the expected F2 Bar females. Simultaneous controls were run, and the total induced frequency was corrected. The total frequency of exceptional yellow females from each (not all) of the 4 broods was always focussed in the same direction, i.e., below the expected frequency for linearity (frood 1), above the expected frequency for linearity (frood II), and below for frood III. However, the totals of yellow mutants (from all 4 broods) induced in y tarc (-8) chromosome of mature and newly mature sperm by 5000 r were found to exhibit approximately a linear dose- frequency relation as reported for lower x-ray doses (Frye, 1969). Possible mechanisms as to why the curve continues to rise are discussed. (From above.)


Minute bristle mutations, dominant mutations which occur at > 50 loci in the Drosophila genome, served as the basis of scoring. Both parents were irradiated with 5 r, so that the effective dose to the offspring was 10 r. A highly significant reduction in the number of progeny from the irradiated parents, amounting to 1.3% was found; other visible mutations were in excess, though not significantly. It may be tentatively concluded that an acute dose of 5 r produces mutations, at a rate linearly proportional to the effects at 1000 r and 2000 r, in the mature genets of both sexes.
Y-RAYS OF ACUTE CHROMOSOMES


different germ cells were genetically considered to be 112, 12, 10, and 0.
The observed frequencies of the "yellow" effectively: $-a - a$, $-a - b$, $-a - c$ (total 36); $a - a - a$, $a - a - b$, $a - a - c$ (total 5); $a + b + c = 1 - 2$, $a + b + c = 1 - 2$, $a + b + c = 1 - 2$.
of oogonia and oocytes were found in the oogonia "yellows" were $a++$ were capped by Catt.
Two other cases were not classified as either male or female. All yellow half-translocations detected in non-rich chromosomes are not.

THE MUTAGENIC EFFECT OF A 5-n Dose of X-RAYS.
The effects of the irradiation on the life span of two different mating regimes.


Results are summarized from a study on the effect of a 5-s dose of x-rays on the induction of mutations in D. melanogaster. Results are also summarized from tracer studies on metabolic pathways involved in the formation of brown-eye pigment and the suppression of tumour genes in D. melanogaster.


Studies of the competitive mutagenic effects of ionizing radiations on males and females of D. melanogaster are described. Sex-linked recessive lethal mutations were induced in nitrogen, x-rays and oxygen at doses of 100, 1000, 5000, and 10000 f. The frequencies of mutations obtained in spermatogonia were uniformly about 1/3 higher than the frequencies obtained for the same dose and condition of atmosphere in mature oocytes. The relative frequencies of recessive autosomal lethals in mature male and female germ cells were identical with the relative frequencies of sex-linked recessive lethals. In studies of point mutations and deficiencies involving specific loci, the rates in the male germ cells exceeded those in the female germ cells by a proportion equal to that found to apply to autosomal and sex-linked recessive lethals. Fertility was lost in both males and females when they were x-rayed as 86- to 90-day larvae and breed upon emerging as adults. Females recovered their fertility rapidly but the males did so at a much slower rate. A study was also made of the effects on the life span of two different mating regimes.


differences in spontaneous mutation rate. It is stated that little work has been done on the effects of sub-30 r doses, especially regarding the existence of a threshold and accumulative effects. The experiments were carried out on X-10 and X-20 (D-18 and D-20) Drosophila lines, differing considerably in spontaneous mutation rate. Spontaneous and induced lethals were detected by the Mallory-5 method. Co60 y-rays were delivered at 2.81 r/min. Experiments with high-speed neutrons began in May 1960, using a 1500 keV reactor, the dose intensity being 150 r/h. The results refer only to experiments with D-30 line. The authors found that 5-r doses of radiation increased the frequency of recessive lethals in sperm and spermatids and repeated radiation produced a cumulative, mutagenic effect. The relative frequency of recessive lethals per radiation induced by repeated 5-r y-radiation agrees with the data of other authors using higher single doses. The mutagenic effect of high-speed neutrons is 1.5 to 2 times greater than that of y-rays. Spermatozoa had a higher mutation rate than sperm, with both types of radiation. No threshold effect was demonstrated and it is suggested that, should a threshold be detected, it will be specific to the type of radiation, type of mutation, stage of gametogenesis, and the organism. The danger to human germinal cells of low doses of y-rays, and especially, high-speed neutrons is stressed. There are 3 tables. (Auth.)

Green, M.M. COMPARATIVE MUTABILITY OF WILD-TYPE ISODALLIES AT THE WHITE LOCUS IN DROSOPHILA MELANOGASTER. Genetics, 3. 3 (1960) 402-61.

The frequency and type of x-ray induced mutations at the w locus in the Canton and Oregon wild-type stocks was studied. No differences in the mutation rates were found. A significant difference was found in the mutation rates of recombinationally separable segments of the w locus. (Auth.)


The induction of back mutations by x-rays was studied using 7 independent sex-linked mutants in D. melanogaster and irradiating attached X females. Significant increases in the back mutation rates of the mutants y-, sc- and w- were found. No evidence was found that the back mutations were caused by recombination events or mutations in independent suppressors. Counting over tests indicates that the back mutations are not associated with chromosome rearrangements. The problem of x-ray induction of back mutations is briefly discussed. (Auth.)

Green, M.M. BACK MUTATION IN DROSOPHILA MELANOGASTER. II. DATA ON ADDITIONAL YELLOW AND WHITE MUTANTS. Genetics 47 (1963) 407-12.

Further attempts to obtain x-ray induced mutations at the yellow and white locus in D. melanogaster are reported. Of five independent white mutants tested, only w- yielded back mutants. Of the five yellow mutants studied, a single apparent reversal of the x-ray induced mutant w- was found. The relationship of these data to previously reported back mutation data in Drosophila are discussed. (Auth.)


A cytological study has been made of 2 groups of sex-linked recessive lethals induced in spermatocytes of D. melanogaster by high and low intensity x-irradiation, the 2 dose-rates varying by a factor of 50. Although aberrations are found to be slightly more frequent in the high dose-rate group, no significant difference between the 2 series is apparent in this respect. The result of this cytological analysis is considered in relation to the question of an intensity effect in Drosophila. (Auth. summary)


Progress is reported in studies on the genetic effects of x-radiation in Drosophila. Data are presented on radiation damage, as measured by mutation rates at specific visible autosomal loci, due to germ cells of two species of Drosophila. Emphasis was placed on the comparative mutation rates of genes in different stages of maturation at the time of radiation exposure. (NSA 18:1988 (25746))


Effects of radiation were studied on male germ cells of different age at the time of irradiation. '71 to 0-7 females per mating, '67 females per mating. In mutant incidence at the same rate. Different loci apply to the third chromosome and cytotypically.

Hannah-Alava, A. MUTATIONS AT SPECIFIC LOCUS IN DROSOPHILA MELANOGASTER. At the November 1, 1961 through Ap. The brood procedure was used to create progressively from brood to brood. The lowest number of flies from 4 to 7. The results were found.

Hannah-Alava, A. RATES OF MUTATION IN DROSOPHILA MELANOGASTER. At the Sixth International Congress on Radiology, Silver Spring, Publ. Co. The effect of radiation damage in Drosophila was determined by spermatogenesis. Males, treated with a recently reported method, some were inspected for phase mutations at the specific time. In the other chromosome, course of extraction and detection 3 types of mutation in the first (4-6 and 8-8 d). As the lower to be higher in spermatids and (6-10 d) was characterized by broods (11-12, 13-15, and 15 in different stages of maturation.


The brood pattern of recovery. Minutes in all chromosomes in melanogaster males of two groups: 12 third chromosomes newly formed genotype for detecting in age and in Exp. II 24-48 h, sequential broods derived from irradiated and control series in incidence of mutations in the maturation response were not period of excessive mortality (6 males). The length of the time of radiation of the early gonial greater extent than efficient visible phenotype.
Effects of radiation were studied in terms of mutation rates at specific, visible, autosomal loci induced in male germ cells of different species of Drosophila, particularly with regard to different physiological states at the time of irradiation. The most satisfactory bracod pattern proved meeting individual males successively to 7-10 females per mating, on the 1st, 5th, 7th, 10th, 12th and 14th day post-irradiation. A total of 61 recessive mutations at 8 loci were recovered in the experimental series, none in the controls. The differences in mutation incidence at the different loci is great enough to suggest that the loci are not mutating at the same rate. Different loci appear to have different mutation rates in different broods. The mutations in the 3rd chromosome were analyzed cytogenetically. 14 mutants at the in loci are being tested cytogenetically.


The effect on radiation damage, as measured by mutation rates at 10 recessive autosomal loci in D. melanogaster, was determined using the brood procedure to relate the temporal to the spatial pattern of spermatogonial. Males, treated with 3000 r x-ray, were mated individually and sequentially to females with a recessively marked third chromosome, and the 2nd offspring heterozygous for the marked chromosome were inspected for phenotypic variants. Each variant was tested genetically for its heritability. As mutations at the specific third chromosome loci were mimicked by phenotypic dominant mutations and minutes in other chromosomes, mutation rates for these two types were also determined during the course of extraction and verification of the mutations at the specific loci. The rates were high for all 3 types of mutation in the first brood (1-3 d following treatment) but were highest in the next two broods (4-6 and 6-8 d). As the lowest fecundity was in the third brood, the rate of visible mutations appears to be highest in spermatids and probably also certain stages since in the mature sperm. The fourth brood (8-10 d) was characterized by a considerable decrease in mutation rates for all 3 types. In the following broods (11-13, 13-15, and 15-48) the mutation rates dropped progressively suggesting that spermatogonia in different stages of maturation may have different sensitivities to radiation.


The pattern of recovery of mutations was determined for three different types of visible-dominants and Minutes in all chromosomes and recessives at specific third-chromosome loci in the progeny of D. melanogaster males of two genotypes: wild-type, Oregon-BS, males (Exp.1) and males heterozygous for 12 third-chromosome recessive markers (Exp.2), mated singly and sequentially to females of an appropriate genotype for detecting mutations at specific loci and/or crossovers. The males in Exp.1 were 2-24 h of age and in Exp.2 24-48 h of age at the time of treatment (3000 r x-rays) and initial mating. The sequential brood descendants from these males, mated up to 34 d, totalled 94 (281) and 46 (95) F2 offspring for the irradiated and control series respectively. Except for the first brood (1-3 d) in which there was a lower incidence of mutations in the progeny of the older males than the younger males, the curves of induced mutation response were not significantly different in the 2 experiments. The broods following the period of excessive sterility (8-12 d) 115 mutations were recovered from 46 (95) offspring of the irradiated males. The slopes of the curves in the premeiotic broods (11-24 d) suggest that one of the consequences of irradiation of the early germ stages is elimination of the germ cells with potential visible mutations to a greater extent than elimination of germ cells with either induced crossovers or recessive lethal with no visible phenotype.


The effect on radiation damage, as measured by mutation rates at 10 recessive autosomal loci in D. melanogaster, was determined using the brood procedure to relate the temporal to the spatial pattern of spermatogonial. Males, treated with 3000 r x-ray, were mated individually and sequentially to females with a recessively marked third chromosome, and the 2nd offspring heterozygous for the marked chromosome were inspected for phenotypic variants. Each variant was tested genetically for its heritability. As mutations at the specific third chromosome loci were mimicked by phenotypic dominant mutations and minutes in other chromosomes, mutation rates for these two types were also determined during the course of extraction and verification of the mutations at the specific loci. The rates were high for all 3 types of mutation in the first brood (1-3 d following treatment) but were highest in the next two broods (4-6 and 6-8 d). As the lowest fecundity was in the third brood, the rate of visible mutations appears to be highest in spermatids and probably also certain stages since in the mature sperm. The fourth brood (8-10 d) was characterized by a considerable decrease in mutation rates for all 3 types. In the following broods (11-13, 13-15, and 15-48) the mutation rates dropped progressively suggesting that spermatogonia in different stages of maturation may have different sensitivities to radiation.


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Two methods have been used to study the frequency of various kinds of lethals induced by X-radiation of Drosophila oocytes in late meiotic metaphase. The first method involved the study of hatchability of eggs laid by X-irradiated virgin females and by others which were X-rayed as virgin and then mated to untreated males prior to the egg-laying period (doses from 100 r to 1750 r). The second method involved tests of F1 virgines which had developed from X-irradiated oocytes which were later fertilized by untreated sperm (doses of 800 r, 1000 r or 1500 r). Comparison and analysis of the two methods indicate that the lethals detected by the first method are a mixed group, which includes recessive lethals persisting in heterozygous conditions among the adult F2 females, and a group of lethals which express themselves when heterozygous in larval and pupal stages.


Results are reported from studies on the relation between the dose rate at which radiation from a Co60 source is delivered and its effectiveness in inducing lethal mutations in eggs of Drosophila melanogaster. Results are included from preliminary studies on dose rate effectiveness of neutrons in inducing lethals in eggs of Drosophila, the relation between the rate of x-rays and the frequency of non-fusion, non-insertion in the germ cells of Drosophila females, and the genetic aspects of somatic damage induced by irradiation in Drosophila. Data are tabulated on the frequencies of recessive lethal induced with the X chromosome of Drosophila. A list is included of publications by staff members during the period covered. (NSA 35: 1961, 23288)

Iyer, P.T. FURTHER TESTS OF MUTATION FREQUENCIES IN SUCCESSIVE SPERM RECORDS AFTER 1 hr OF GAMMA RAYS. (Abstr.) Genetics 49 (1961) 673.

Virgin Oregon-R/hs males, irradiated at 48-60 h after eclosion, were mated singly to 6 vg so females daily. F2 males were tested for Y, S and 3 chromosome translocations. A marked peak in frequency (10-15%) occurred in days 5 and 6, sperm, with < 1% in days 7-12. Oregon-R/ruc/ruc males irradiated at 0-12 h showed a similar frequency pattern except that the peak (15%) appeared in day 7 sperm. That the radiation age by itself did not cause this pattern change was shown by testing irradiated 0-12 h, 48-69 h and virgin Oregon-R/ruc/ruc males. Each age group showed a pattern like the 48-69 h/Oregon-R/ruc. Simultaneous tests of 0-12 h Oregon-R/ruc/ruc and Oregon-R/ruc/ruc test in progress. For tests of the T frequency in early vs. late-emerging F2, males of irradiated males, files from non-eclosed males at day 3 sperm (74-h laying period) were collected daily. The frequency was only half as high in F2 males emerging on day one (roughly 2% of the total F2 male batch) compared to later days none of which differed from each other. Parallel X-linked mutation frequencies in semilabile F2 females collected daily and tested by Buzz showed no differences between days. F2 samples are routinely taken in standard mutation rate test here when more than 95% of the files have emerged.


In order to obtain mutants with a view to establishing linkage groups in A. gambiae, about 275 males were exposed to a dose of 1000 r X-rays. This was done using 185 kv, mA 5 x 10 mm 18 sec. These males were mated with unexposed, unfertilized females from the same colony, and the F2 and F3 females examined. Several females had wild type 3-handed palp. All females, Taxonomically this.

Kahl, A. GENETICAL STU (in German).

5 sex-linked, 1 partially sex-produced by x-rays. A link, and genes in other Drosophila.

LaChance, L.R., Hopkins, D. 73R7.

A search was conducted to fix 3 sources: (1) untreated lab progeny from irradiated flies Bombus impatiens (Coquerel); 71 !ibrivius. 2 are sex-linked re bred for sex-linked genetic data are presented to.


The spectrum of viability results from irradiating sex chromosome in viability of diploid was calculated that one or in testing the same dosage on by irradiating sex in the r to sense in the spermatheca detected in haploid prop of.

See also TID-4600, (Abst.) BI.


Results of experiments on part through of the abdomen any other body region does not week. Apparently, irradiation division of the digestive cells This is concluded that variation the length of time different adult median to irradiation.


The frequency of recessive disease as compared with ree diploid worker. (See TID-480.) Viability of propyges was data colonies. The spermatheca 1 and viability were studied in season. Results showed that at least one or more dominates of each dominant test. The average reduction in o bimodal distribution, present tabled 1 or more recessive in 0.5. Emphasis was also pla
examine. Several females were found with 4 distinct bands on the palps as compared with the normal wild type 3-banded gauze. As examination of 266 females of the same colony showed no such 4-banded females. Taxonomically this 4-banding is characteristic of the variety A. gambiae melas.

877a) 


5 sex-linked, 1 partially sex-linked and 33 autosomal genes are recognized from new mutations, mostly produced by x-rays. A linkage map for the X-chromosome is presented. Homologies between these genes and genes in other Drosophila spp. are discussed. (TID-8299, 5454)

878 


A search was conducted to find mutants useful for marker stocks. Flies scanned for mutations came from 3 sources: (1) unselected laboratory-raised flies, (2) progeny from irradiated normal parents, and (3) progeny from irradiated flies inbred for 3 generations. Nine mutations are described for Cochliomyia hominivorax (Coquerel), 7 a dominant, 6 affecting wing characters, 1 body colour, and 1 oral vibrissa. 2 are sex-linked recessives, 1 affecting body colour and 1 affecting wing venation. Pertinent genetic data are presented for each mutant stock.

879 


The spectrum of viability mutations ranging from dominant lethals to detrimental in haploids that resulted from irradiating sperm from a single haploid male was studied in the honey bee. From the decrease in viability of diploid progeny following irradiation of the spermatheca of the parental queen, it was calculated that one or more dominant lethals were induced in 60.6% of the sperm cells. In a separate test using the same dosage on an unrepaired queen 60.6% dominant lethals were found. The values obtained by irradiating females in the spermatheca-hermes of queens with 5000 r of 25 kV X-rays were equal to 2500 r when applied to sperm in the spermatheca of males. Reciprocal mutants with incomplete dominance were detected in haploid progeny of F1 queens. See also TID-4640, 744a, 51042.

880 


Results of experiments on partial-body irradiation of queen honey bees show that irradiating the segments III through V of the abdomen produces the same lethal effect as whole-body irradiation, whereas irradiating any other body region does not produce a significant amount of radiation deaths during the following three weeks. Apparently, irradiation of segments III through V of the abdomen prevents the replacement by cell division of the digestive cells lining the ventriculus, and the queen then starves for lack of proper digestion. It is concluded that variations in the normal rate of cell division in the ventriculus of various insects and in the length of time different species can go without food can explain the great variation in resistance of adult insects to irradiation. (NSA 15:1962, 7799)

881 


The frequency of recessive detrimental mutations observed in the haploid drone honey bee was investigated and compared with recessive and dominant lethal mutations detected in the haploid and diploid worker. (See 880). A single queen was irradiated by a drone homozygous for 3 genetic markers. Viability of progeny was determined, and hybrid daughers bearing the genetic markers were scored in colonies. The spermatheca of the queen was then irradiated with 3000 r kV X-rays. Morphological defects and viability were studied in progeny and grand-progeny. A total of 96 pairs was then tested during one season. Results showed that 98.5% of the sperm cells receiving radiation (out of 3980 tested) contained at least one or more dominant lethals. Correcting for the saturation effect on the assumption of independence of each dominant lethal, an average proportion of 0.94 dominant lethals were found per genome. The average reduction in embryonic viability was 2.2%. The post-embryonic viability ratio showed a bimodal distribution, presumably due to point mutations. Forty percent (31/77 pairs) of queens tested contained 1 or more recessive lethals. Correcting for the saturation effect the frequency of recessive lethals is 0.61. Emphasis was also placed on the reduction of mutations in offspring of queens so that
mutations could be detected in the queen's haploid progeny. By means of partial body irradiation it is now possible to give doses as high as 5000 r to oogonial cells, and additional work on effects of dose fractionation on queen viability and sterility is in progress.


It has been observed that males of Drosophila melanogaster that carry a reciprocal translocation between the X chromosome and chromosome II or III are frequently sterile. X chromosome inversions and interstitial translocations, on the other hand, do not generally lead to male sterility, thus the sterility is not attributable to break-associated mutations or position effect, but is dependent on reciprocal translocation as such. The experiments to be reported were designed to answer two different questions: (1) What proportion of sex-linked male-sterile mutations are associated with T(X;A)'s? (2) What proportion of T(X;A)'s are male-sterile? A sample of 120 sex-linked recessive male-mating changes was induced with Co-60 γ-rays and put into balanced Stock. Each of these lines is being tested for the presence of a T(X;A) by three criteria: (a) Drosophila chromatin analysis, (b) Incidence of primary non-disjunction of the X chromosomes in T(X;A)/PAM females, and (c) Linkage analysis. The results to date suggest that approximately 60% of all sex-linked recessive male sterile strains are associated with X-autosome translocations. A sample of 160 T(X, 2)'s and T(X, 3)'s was induced by X-rays in mature sperm and recovered from cross-fractions of the irradiated males. Of those which survive as males approximately 75% (88/116) are male-sterile.


Early results are agreed to have the lowest x-ray-induced mutation rate of all germ cell stages of adult D. melanogaster. However, a recent study has disagreed concerning whether their rates are alike in both sexes. Our present experiments have investigated the frequency of second chromosome recessive lethals induced in early gonial of both sexes x-rayed simultaneously with 4000 r (100 kV, 240 r/mu). Lethals induced in colocalized chromosomes carrying 31-m,s-b-c-en, of flies heterozygous for Curly-Oster, were detected by "chiasma-curve sensitivity" tests improved since Muller's Drosophila Inform. Serv. description. Individualized identified young females and males, breeding for 2 d just before irradiation, produced control groups denoted "TFC" and "TMC", respectively, and, after 10-12 and 15-20 post-irradiation period of active breeding, produced experimental groups denoted "10FX," "15FX" and "15M X", respectively. As another control, "15M C", progeny were taken from other males, unmated, after breeding them as long as those irradiated. Determination of induced lethal rate was made usually accurate by allometric tests of lethals derived from the same parent before and after irradiation, some spontaneous mutations being thereby excluded as "unspecified" experimental rate. Allometric tests also disclosed "clustering" within experimental or control sibships, thus permitting more accurate standard error determinations (Muller 1961, GSA Records).

Harmonically weighted mean frequencies (Muller 1961, Am. Nat.) of six such experiments, gave, for "unspecified" control TFC (2159 chromosomes tested) 0.014 ± 0.01% TMC (7918) 0.007 ± 0.01% TFC (8718) 0.004 ± 0.01% TMC (7918) 0.007 ± 0.01%. For "specified" experimental controls 10 FX (1658) 6.3 ± 0.7% 15 FX (1658) 5.5 ± 0.69% 15 MX (2628) 7.8 ± 1.0%. These results, which for oogonial concur with our previous X chromosome results, show no significant sex difference.


The sex-ratio changes in the progeny of males irradiated at different stages of their germ cell in D. melanogaster were investigated. Using the haploclitic Oregon-R wild strain, male flies of 4-6 h-old were irradiated with 1000 r, 1000 r, and 3000 r and were crossed with the same wild type females of about 3-4 d-old. The sex-ratio shifted to the linear level in the group where progeny came from males of 4 to 3 d after irradiation. Each class sex-ratio was depressed in proportion to dose and the coefficient was 0.0537 per 1000 r on the average. (NSA 18: 1962, 114 (Also published as abstract in JACD 131, 1961)).


Miller, L., Lohbecke, R., Eschhuya Heldemirella. FOR LC Groups of Escherichia Heldemirella 2 x-rays and both wings of each type of mutants (SS 4) show the square of the dose, whereas fo...


The background of the problem of induced mutations are press.

Nelson - Brea. W.A. A STUDY of sex pre-determinants. Life cycle and the behaviour o spring (% of each sex) followed ages indicated a differential s laying patterns of treated fem. the sensitivity of ovaries at ratio of the total surviving off females (31-39%) of control fe males previously treated with a sex element (10%) or not at a development of the ovariolos, crypsis at the time of fert.
A reciprocal translocation between chromosome inversions and isometricity by which the sterility is not achieved on reciprocal translocation as such. This: (1) What proportion of the X-ray translocations, A. males and females approximately 75% (33/112) of X-RAYS IN ISOGONIA. Drosophila.

RADIATION RATE IN ISOGONIA OF D. melanogaster. of all germ cell stages of adult D. melanogaster are alike in both sexes, chromosomes recessive lethals induced (p. 246/246). Inactivation induced females for early-Oster, were described. See description. Induce irradiation, produced control lines 10-4 post-irradiation period of 77K and 135M, respectively. As radiated, after breeding them as long 8h usually occurs by albinism test of spontaneous mutations being there-paramanomaly "cloning" within the error determination (Muller 1952, Am. Nat.) of six each equal: 10.0 ± 0.196, TMC (1948) 10.0 ± 0.203, 7.5 ± 0.196. For older, occurs with our

Rahi, H., Ichida, H. A SHIF TS OF SEX PERIOD IN D. melanogaster, preliminary note. INVESTIGATION OF ATOMIC RADIATION. December stages of the germ cell in D. melanogaster. of four A-hold were irradiated; the sex of the cell stage. The sex-males of 6 to 8 d after irradiation. Increment was 0.2979 per 1000 r on the average. (NSA 14:1955, 11248)


568 Nelson, R.E. A STUDY OF SEX PREDOMINANCE IN THE MEALY BUG Pseudococcus cinni. (Hem.) J. Exp. Zool. 22 (1929) 365-377. An investigation of sex-pre-determination was initiated in an attempt to elucidate the mechanism of sex determination in this and other species of the hemipteroida section of the superfamily. The life cycle and the behavior of the mealybug in culture on potatoes are described. Survival curves of offspring (of each sex) following pre-mating irradiation (1000 and 5000 r X-rays) of mothers of various ages indicated a differential sensitivity of eggs which were to yield either male or female offspring. Daily laying pattern of treated females indicated that laying of the female prior to mating changed the nature of the sensitivity of ovaries at the time of treatment to X-ray-induced lethality and thus altered the sex ratio of the total surviving offspring. Whereas young females readily supported the development of triploid females (81-85%) of control females through utilization of polar body fusion nuclei when they were mated to males previously treated with high dosage y-irradiation (5000-10,000 r) aged females did so to a lesser extent (10%) or not at all. It is believed that the sex of the embryo is determined by the stage of development of the ovaries, i.e., (1) the stage in motion of the ovary, and the nature of the egg cytoplasm at the time of fertilization. (From author summary)
after emergence) are fed on this irradiated medium. The flies are allowed to breed and parent flies are killed about 7 d later. The male flies which emerge out of the larvae fed exclusively with irradiated food are then used for conducting M-0 tests on normal culture medium for further P1 and P2 breeding. The experiments have been repeated thrice. Sex-linked recessive lethals have been found only in the families derived from the irradiated medium (6.4%). A wide range of phenotypic changes was a striking feature of the F2 families from the irradiated medium cultures (their frequency ranging from 0.13-0.37% against 0.021-0.569% in control on population basis). Some of the mutant flies, viz., only wings, yellow body, and another with dominant wing mutation were found to be bred true. A few changes like half thorax, reduced abdomen and absence of neck belong to the non-inherited group of abnormalities of Morgan (Bridges and Sturtevant 1895) they were observed only in the irradiated medium series. The implications of these studies will be discussed.


Gynogenetic females are known to develop after heavy doses of paternal irradiation in Plannococcus citri (Risso). In attempts to induce gynogenetic 90.000 rads (from a Co60 source) were administered males of Plannococcus puerulus, T. citri and C. cochlearis; and Pseudococcus gahani Green, and 70,000 rads to Pseudococcus obscure Oeh. The first two attempts failed. However, gynogenetic Plannococcus citri males were mated to irradiated P. gahani males.


The lower efficiency of low-dose-rate irradiation on the induction of mutations in immature germ-cells, as discovered by W.L. Russell and his colleagues in the mouse, has not been demonstrated conclusively in other higher organisms. Some reports of studies in Drosophila and Drosophila claim a dose-rate effect, but in each case there are reasons for doubting an exact parallel with the phenomenon in the mouse. An early experiment by the present author gave some evidence for a dose-rate effect in spermatogonia of Drosophila but this result, however, could not be confirmed. The present paper deals with a combination of these dose-rate studies, comparing dose-rates of 0.5, 0.2. 5.0 rads/min. Information was obtained on the induction of second chromosome recessive lethal mutations in spermatogonia and other germ-cell stages in the testes. There was no evidence of a dose-rate effect in any of these male germ-cells.


Adult males of D. melanogaster were treated with 3001 r x-rays and then mated individually to virgin females during the whole period of fertility of the male to obtain sequential broods from cells in successively younger stages of spermatogonia at the time of irradiation. Studies were made of second chromosome lethal and viable mutations in the broods, following the period of maximum sensitivity, i.e. the third brood (6-8 d after irradiation). Clusters were detected by cross-testing mutations from the same male for identity. Using the total size of clusters (as measured by the number of identical mutations found) and the relative size of clusters (calculated as percentage of identical mutations from the total tested in a brood) as a criterion, the spatial pattern was related to the temporal pattern of early spermatogenesis. The results suggest that mutations occurring in the young spermatogonia are available much earlier than has been supposed previously. The sperm available at the time of highest fecundity following the sterile period seem to originate from primordial cells. The data suggest that the secondary gonads at the time of irradiation have a rather limited period in the brood pattern.


Intersexes were found in a culture containing progeny of an unmated female which had arisen from the cross of cy-MN females with x-rayed wild-type males. Genetic evidence indicated that the intersexuality was due to mutation, and not to chromosomal aberration. The intersexes showed a gradient from anterior maleness to posterior femaleness, and were less masculinized than similar types reported in Habronema juglandis. (Autth.)
MUTATION RATES AT LOW LEVEL ERADIATION

Preliminary results of studies in D. melanogaster led to the conclusion that there is a linear relation between mutation rates and radiation dose down to 8 r. Sex-linked recessive lethal mutations were used as indicators of mutation induction. No evidence was seen of a threshold dose in genetic effect for doses of x-radiation down to 8 r. (NASA 16:1962, 11427)

(Also published as abstract only, in Japanese, in Japan. J. Genet. 36, 1961, 396)

MUTATION RATES AT LOW LEVEL ERADIATION

The study was aimed at testing whether a linear relationship (down to 8 r) holds for sex-linked recessive lethals in Drosophila. Methods and materials used were based on data obtained by Spencer and Stern (1949). A wild-type Canton-S strain was used which was inbred before the experiment and again every 4 months. About 400 one-week-old males were irradiated together in each experiment. The doses used were 8, 15 and 25 r. The results are based on 50,000 chromosomes.


larvae of D. melanogaster were irradiated with X-rays to induce somatic crossing over resulting in genetically marked mosaic areas. Mosaic sternopleurums were associated with mosaic melanomas in frequencies compatible with random association. Association of melanoma sternopleurum and mosaic legs was significantly more frequent than accounted for by chance. It is concluded that the sternopleurum is always derived from the ventral, not from the dorsal, disk. Apparently differing results of earlier authors are re-interpreted in terms of embryonic indetermination as contrasted to larval determination of prospective imaginal areas. (Auth.)


The prime object of this project is the relationship between radiation and mutation rate. Much effort is on spontaneous mutation rates, the analysis of which includes small point mutations as well as chromosome aberrations. Work in progress is concerned with further studies of the inverse mutant, induction of mutations and mitotic crossing over by heat shock, and problems of fertilisation in Drosophila melanogaster.


An increase in the rate of mutation has been found in D. melanogaster reared on a basic medium that was irradiated with a sterilizing dose (150,000 rads) of Co60 y-rays. In Muller-6 lines, sex-linked recessive lethals occurred only in the F2 progenies of the male test flies obtained from breeding the parent flies on irradiated medium, while visible changes occurred in experimental cultures from both the control and irradiated media. The frequency of sex-linked recessive lethals was 0.58, 0.50, and 0.8% in 3 independent experiments. Visible changes were 8-8 times more frequent in the irradiated series than in the controls. (Auth. Summary)


The mutant strain of the silkworm, w3w3, which exhibits a completely transparent larval hypodermis and white eggs was obtained by x-ray treatment in 1964. The gene w3 belongs to the Xth linkage group, and crossing experiments show it to be allelic to w3 on chromosome Xth. Amounts of uric acid and isoxanthopterin produced in the hypodermis of larvae homozygous for w3 and w3 and of their hybrids were measured by a paper chromatographic method. The amount of uric acid in the hypodermal tissue of the w3 homozygous larvae is only 1/100 of that found in the w3 larvae and 1/10 of that found in the w3 larvae. It is characteristic of the w3 mutant that its amount of uric acid and isoxanthopterin are much smaller than in any other known mutant strain with transparent larval hypodermis. The change in amount of isoxanthopterin in the hypodermal tissues after injection of 2-amino-4 hydroxypyridine into the larval body cavity was investigated; the normal amount of isoxanthopterin reappeared after 1 h. It may be assumed that uric acid and uric acid newly produced in the hypodermal tissue penetrate into the body cavity, passing through cell membranes, and that the permeability of the substances is controlled by w3 or w3.


A number of larvae showing the NI phenotype were obtained by irradiation (5000 r x-rays) of T 1 g HP, g HP, g HP individuals. The 8 NI types, Ni, Ni*, and Ni*, were investigated. From crossing experiments, it is assumed that Ni mutants are caused by deficiencies in the part of the 14th chromosome which includes the eye locus and that the order of their relative lengths for the 3 types is Ni > Ni* > Ni*. It was observed that embryos homozygous for Ni* 1 die at a far more advanced stage than embryos homozygous for NI and that the development of the embryos homozygous for Ni 1 advances still a little further. Thus, it can be seen that the extent of the deficiency in each of the three NI mutants relates to the stage at which the respective homozygous embryos die. Spontaneous NI type mutation occurs very rarely. However, it may be said from the present experiment that the frequency of the mutation increases strikingly as a result of irradiation with x-rays and that the extent of the deficiency in each of the NI type mutants is not always the same.

(Author's summary)


The effects of radiation damage, as measured by mutation rates at specific visible autosomal loci, upon the male germ cells of **Drosophila** was studied with special emphasis upon comparative mutation rates of mutants in different stages of maturation at the time of radiation. Information on the loci pattern, and data on the kind and futility of mutations as related to this specific loci pattern are summarized. A clearly defined reduction in number of offspring was found to occur in the 3rd brood (548 8 d following radiation) although the number of offspring was also considerably reduced in the 2nd brood. The data point to a difference in mutation patterns as well as mutation rates for the 3 types of mutations. The number are large enough for the 1st 2 broods to make it highly probable that the difference between the loci at specific loci, and the phenotypic dominance is more than just a quantitative difference. In respect to the general period, it appears that the mutation rate of the Males is considerably higher than the other types of mutation. It is also suggested that these may be a difference in mutation rates in gonadal cells in different developmental stages at the time of radiation. (NRA 16:1699, 1965)


After gaining 500, 1000, and 1 generation. The estimation was number of chest hair. **The de** (Aber. Japan Med. 21 (May 1)

917 Yamaoka, Y., Kitagawa, O. NEMO, 12 (1962) 110.

Effects of x-irradiation upon b increase was observed. The number was observed to be 1000, 1000, and 1 generation. The number was observed to be 1000, 1000, and 1 generation.

The doubling dose for polyge mutations, i.e., lesionization: somatic and spermatogonial units from selection experiments, p 0.001 per generation, respect

Dominant lethal, recessive lethal, and visible mutations occur in similar percentages in primary oocytes of Habrobracon x-rayed in a resting stage, first mitotic prophase (LD₅₀=15000 r), and in a sensitive stage, first mitotic metaphase (LD₅₀=400 r). After comparable doses, 78.00% and 1100 r respectively. (Auth.)


The frequency of new lethal mutations was measured in chromosomes from isogenic sources which marked the whole length of the second chromosome pair of Drosophila melanogaster for the detection of crossovers simultaneously. Control hemizygotes and sister given x-ray doses of 1800 or 4000 r provided chromosomes tested by the Sturtevant technique of Muller. Furthermore, each recessive lethal was further tested to determine the location of the new lethal, particularly as to whether it was in a region of crossing over or was outside any nearby region of exchange. In the chromosomes of eggs laid in the 1st d post-irradiation the frequency of new recessive lethals decreased from a high of 9.9±1.1% in the 1st 4-d period to 4.7±0.76 in the last 2-d period. These same chromosomes showed an increase in crossovers chromosomes available for testing, but only during the 2nd and 3rd breeding periods. Neither the crossovers nor the lethals were linearly related to dose. Five fifths of the higher dose received during 4/5 of the maximum time of treatment produced less than 4/5 of the crossover frequency and of the lethal frequency of the 4000 r group. In spite of the 2 parameters changing in different directions with time the contingency Chi square showed an excess of chromosomes both lethal and crossover in the same region only in the spindle region and in a mild arm region. Studies were made of the mean viability and of its variability among the many non-lethals and lethals of the experiment. Viability was less after either of the irradiation doses. Variability was greater, as expected, among irradiated chromosomes and among crossovers chromosomes. The immediate vicinity of the spindle attachment is evidently a very special region of the chromosome in regard to its response to externally administered irradiation. (Auth.)


Four 1-2-d-old males of C. pipiens were irradiated with a dose of 4000 r x-rays. While the normal eyes of the larvae, pupae, and adults appear pigmented dark brown to black, the mutation r causes a red eye colour in place of black. This mutant was isolated from F₁ cultures of 5% of the irradiated males. It could be demonstrated that r is inherited as a recessive, shows full penetrance and no variability of expression. Although white-eyed mutation is also sex-linked the two factors could be shown not to be multiple alleles.


After giving 500, 1000, and 1500 r to Drosophila the induced mutation rate was calculated from the regression. The estimation was 8.7×10⁻⁷ r⁻¹ for the number of abdominal hairs, and 3.5×10⁻⁷ r⁻¹ for the number of bristle hairs. The doubling dose were estimated at 80 r for the former and 30 r for the latter. (Abstr. Japan Med. 25 (May 1962) No. 53)


Effects of x-irradiation upon bristle numbers in Drosophila were remarkable for increasing variances but no increase or decrease was observed for the means. This suggests that the chaeta characters in Drosophila are controlled by neutral genes and the cause of variance increase must be due to induced polygenic mutations. The doubling doses for polygenes involving the chaeta characters were estimated by the two different methods, i.e., lognormalization and selection. They are estimated to be 58 r and 22 r respectively for abdominal and antennal bristle numbers from the lognormalization experiment and to be 38 r on an average from selection experiment. Providing the spontaneous variance increase rates of the traits be 0.905 and 6.001 per generation, respectively. (Auth.)
See also:

471 Effects of irradiation on the Mediterranean meal moth Ephelia kuehniella Zeller, cultured on Sr^90-spiked food. (Selman, 1975)

474 A non-random distribution of lethals induced by irradiated thymidine in Drosophila melanogaster. (Kaplan et al., 1962)

475 The genetic effects of labelled DNA precursors. (Kaplan et al., 1963)

477 Mutagenic effect of C^14 and 32P labelled DNA precursors injected into Drosophila melanogaster males. (Steinberg, 1966)

478 The induction of minute mutations in Drosophila with thymine-labelled thymidine. (Sokolowska and Kvetank, 1965)

479 Cytogenetic studies of x-ray and ingested 32P induced sex-linked recessive lethals in Drosophila melanogaster. (Wagena, 1965)

756 The effects of radiation on the genetic systems of organisms in relation to their physiological and biochemical systems. (Alexander, 1965)

759 The effects of radiations on the genetic systems of organisms in relation to their physiological and biochemical systems. (Alexander, 1965)

760 The effects of radiation on the genetic systems of organisms in relation to their physiological and biochemical systems. (Alexander, 1965)

770 The induction of mutations in spermatocytes of Drosophila melanogaster with x-rays. (Chadley, 1965)

776 Irradiated parasitic wasp, the effect on progeny production and sex ratio. (DeBach and White, 1965)

800 Sperm transfer, storage, displacement, and utilization in Drosophila melanogaster. (Lefevre and Johnson, 1962)

801 Induction of mutations and cell killing in irradiated Drosophila melanogaster. (Ohmed, 1964)

803 Genetic sensitivity and differential killing in irradiated Drosophila melanogaster. (Ohmed, 1963)

804 Induction of mutations and killing of cells in irradiated spinaeulagi of Drosophila. (Ohmed, 1965)

807 Some effects of gamma radiation on the reproductive potential of the Colorado potato moth, Carpocapsa pomonella (L.) (Lepidoptera: Otobiiniidae). (Proverbio and Newton, 1963)


919 8-locus factor homologies in Monoscella. (Whitting, 1965)

920 Genetic recovery mechanisms and fast neutron treatment of mature sperm treated in males and fertilized females of D. melanogaster. (Alexander, 1961)

922 Patterns of spontaneous and radiation induced mutation rates during spermatogenesis in Drosophila melanogaster. (Ives, 1965)

925 Radiation sensitivity in different stages of spermatogenesis in Drosophila melanogaster. (Kvist, 1962)

926 On the nature of sensitivity changes in oocytes of Drosophila melanogaster. (Park, 1965)

927 A comparison of mutation rates in male and female post- and premeiotic germ cells of Drosophila. (Sparf, 1964)

928 Radiosensitivity during spermatogenesis in Drosophila melanogaster. (Staegg, 1965)

929 Consideration of the changes in observed mutation rates in the silkworm after irradiation of various stages of gametogenesis. (Takeuchi, 1963)

932 A comparison of visible mutation rates in Helobasmin eggs x-rayed in first meiotic metaphase or prophase. (Whitting, 1962)

934 Dependence of the frequency of occurrence of recessive sex-linked lethals mutations in Drosophila spermatogenesis on the fast-neutron dose. (Abelova and Lapkin, 1963)

1042 Radiosensitivity in nitrogen and air. (Ito, 1962)

1043 The effects of X-rays on Drosophila (Capps, 1961)

1052 Radiation of the sex-liner, and melanogaster. (Mills, 1963)

1053 Further observations on melangaster. (Chang, 1963)

1054 The effects of chlor am x-rays in Drosophila melanogaster. (Falk, 1962/3)

1056 Mutation treatment effect. (Falk, 1962/3)

1059 Modification of the ratio of mutation rate. (Falk, 1962/3)

1065 The oxygen effect in Drosophila (Hornegber et al., 1964)

1066 The effects of develop spermatogenesis. (Yeretzian et al., 1965)

1078 On the genetic effects of x-rays in Drosophila melanogaster. (Falk, 1964)

1079 Preliminary report on the effects of x-rays on Drosophila melanogaster. (Falk, 1965)

1080 Differential yield of x-rays in Drosophila melanogaster and its strains. (Falk, 1965)

1081 Changes in the mutagenic high temperatures. (Falk, 1965)

1085 Drosophila melanogaster. (Falk, 1965)

1086 Effects of variable dose treatments. (Falk, 1965)

1087 Interaction of x- and utt gaster. (Falk, 1965)

1088 The frequency of mutants. (Falk, 1965)

1089 The mutational spectrum. (Falk, 1965)

1089 Preliminary report on the effects of x-rays on Drosophila melanogaster. (Falk, 1965)

1090 The effect of x-rays on Drosophila melanogaster. (Falk, 1965)

1091 Differential sensitivity of D. melanogaster to various x-rays. (Falk, 1965)

1092 Dose-rate and the induction. (Falk, 1965)

1093 Radiation intensity and dose. (Falk, 1965)

1094 The genetic response of Drosophila melanogaster. (Falk, 1965)

1095 Protective action of per-Teichman, 1963)

1096 Effect of periodic fast exposure. (Shimoni, 1963)

1097 Repair and differential sensitivity. (Takumi, 1963)

1098 Modification of the genetic fractionation of the dose. (Takumi, 1963)

1120 Dose-dependence of the dose. (Takumi, 1963)
Radiation sensitivity in sperm treated in males and immature females of Drosophila with x-rays in nitrogen and air. (Alexander and Berenboim, 1965)

The effects of nitric oxide on radiation damage in Drosophila virilis and Drosophila melanogaster. (Capps, 1951)

Reduction of the sex-linked recessive lethal frequency in Drosophila melanogaster by argon, nitrogen, and methane under pressure. (Chang, 1961)

Further observations on the relation between gas pressure and the x-ray damage in Drosophila melanogaster. (Chang, 1962)

The effects of chloramphenicol, streptomycin and penicillin on the induction of mutations by x-rays in Drosophila melanogaster. (Clark, 1960)

Nitrogen-treatment effects on recombination-induction patterns in Drosophila melanogaster. (Furth, 1961)

Modification of the radio-induced mutability in Drosophila by 2,4-dinitrophenol. (Fitz-Niggli, 1961)

Preliminary results of combined effects of oxygen and low temperatures on mutations induced by x-rays in Drosophila. (Gascuel et al., 1965)

Effect of fractionating doses on the rate of x-ray-induced mutations in Drosophila. (Guyard et al., 1961)

Study on the effect of azido-ethylaminourea on x-ray-induced mutation rate in Drosophila melanogaster. (Hanes, 1961)

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The effects of developmental temperature on mutational response to gamma rays in Drosophila spermatozoa. (Ivins, 1965)

On a change in the spectrum of somatic mutations in Ephesia kuehniella Z. by temperature treatment before irradiation. (Lohboemer and Oltmanns, 1963)

Oxygen-effect on mutation-rate induced in different stages of spermogenesis in Drosophila melanogaster by 51-MeV electrons and 180-x-ray. (Weil and Obschonka, 1963)

Differential yields of mutations from the first and second matings after irradiation of mature sperm in Drosophila melanogaster. (Dowson, 1963)

Changes in the mutational spectrum of somatic mutations in Ephesia by pre-treatment with low and high temperatures. (Miller, 1965)

Are chronic and acute gamma irradiation equally mutagenic in Drosophila? (Miller et al., 1963)

Effects of variable dose-rates on radiation damage in the rust-red flour beetle Tribolium castaneum Herbst. (Nair and Subramanyam, 1963)


The frequency of mosaic mutations induced by gamma rays and neutrons. (Oster et al., 1963)

The mutational spectrum with special reference to the induction of mosaicos. (Oster, 1963)

Preliminary report on the effect of cyanide on the rate of x-ray induced mutations in Drosophila melanogaster. (Pflaum et al., 1962)

The effect of x-ray treatment combined with air, nitrogen, or oxygen in Drosophila melanogaster studied on sex-linked recessive lethals. (Pozzi et al., 1962)

Differential sensitivity of spermatozoal stages of Drosophila melanogaster to x-ray irradiation in O2 and N2. (Pozzi et al., 1962)

Dose-rate and the induction of mutation in Drosophila. (Porzionato and Motheby, 1963)

Radiation intensity and the induction of mutation in Drosophila. (Porzionato and McIntosh, 1965)

The genetic response of radiation spermnasia to different types of radiation treatment. (Reddi, 1963)

Protective action of penicillin against mutagenic effect of x-rays in Drosophila. (Shiamali and Teshibana, 1965)

Effect of penicillin feeding on the reduction of radiation induced mutation rate in Drosophila melanogaster. (Shiamali, 1963)

Repair and differential radioresistance in developing germ cells of Drosophila males. (Sobei, 1963)

Modification of genetic radiation damage in Drosophila by post-treatment with nitrogen and fractionation of the dose. (Takes and Sobei, 1961)

Modification of the x-ray induced rate of sex-linked lethals by nitrogen post-treatment and fractionation of the dose in Drosophila melanogaster. (Takes, 1963)

Dose-dependence of radiation-induced mutation rate in Drosophila melanogaster depending on the stage sensitivity of the irradiated germ cells. (Teut, 1965)
A study of dose-dependence of radiation-induced mutation rates in Drosophila melanogaster, allowing for the degree of maturity of the germ cells. (Taub, 1962)

1152 Dose dependence of the frequency of radiation-induced recessive sex-linked lethals in Drosophila melanogaster. (Taub, 1962)

1153 Dose dependence of the frequency of radiation-induced recessive sex-linked lethals in Drosophila melanogaster, with special consideration of the stage sensitivity of the germ cells. (Taub, 1969)

1154 The relationship between dosage and mutation rate in x-radiation of Drosophila spermatozoa. (Ulich, 1965)

1156 Partial irradiation of Drosophila spermatozoa by x-rays. (Ulich, 1966)

1157 The correlation of the ratio of lethal to visible mutations with that of whole-body to fractions induced by x-rays and chemical mutagens. (Browning and Altenburg, 1961)

1158 Genetic interaction as a factor in determining the ratio of visible to lethal mutations in Drosophila. (Browning and Altenburg, 1961)

1159 Comparative genotoxic effects of the mutagenic locus in Drosophila melanogaster. II. Mutational mosaicism induced without apparent breakage by a mutagenic chromosome instability agent. (Cahanes and Oster, 1962)

1171 Some mutations in the mdh locus. (Caspari, 1963)

1173 Mutational response of Halobacterium salinarum in metaphase and prophase to ethyl methanesulfonate and nitrogen mustard. (Lubbers and Bresl, 1963)

1179 Rates of formvar and reverse mutation in Drosophila after exposure to mustard gas and x-rays. (Roberts, 1962)

1915 Irradiation experiments with Tribolium. (Kolotilof, 1961)

1916 Genetic studies of Drosophila strain differences in sensitivity of the mutant to the mutagenic action of x-rays. (Ward et al., 1962)

1921 Prepubertal effects of x-ray-induced, euploid and near-euploid mutants in heterozygous condition in Drosophila melanogaster. (Baucom, 1961)

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1926 Developmental effects of x-ray induced euploid and near-euploid mutants in heterozygous condition in Drosophila melanogaster. 1. Delay in egg hatching and larval delay prior to pupation. (Baucom, 1961)

1927 The influence of age and mating patterns before and after irradiation on the incidence of induced mutations in Drosophila melanogaster. (Leaves, 1961)


1929 Oxygen dependence of the lethal and mutation rates induced by x-irradiation of Drosophila spermatozoa. (Wange, 1961)

1934 Resistant to x-rays of a normal and a HCN-resistant stock of Drosophila melanogaster. (Leaves, 1962)

1931 A comparison between natural lethal and lethal induced by radiation in populations of Drosophila pinedesi. (Pavan, 1963)

1932 Selective genetic loads due to lethal and detrimental genes in irradiated populations of Drosophila pinedesi. (Chung, 1962)

1937 Persistence of lethals in irradiated natural populations of Drosophila pinedesi. (Marques et al., 1963)

1941 Heterogeneous effects of induced lethal genes on pre-adult viability in Drosophila melanogaster and their persistence in experimental populations. (Ohtsuka and Kitagawa, 1961)

1943 Mutational recurrence or genetic compensation of lethals in Drosophila melanogaster and irradiated populations. (Sagoo and Cordero, 1963)

1946 Genetic effects of radiation: a comparative study between natural lethals and lethals induced by radiation in population of Drosophila pinedesi. (São Paulo, Brazil, Universidade, Faculdade de Filosofia, Ciências e Letras, 1963)

1948 Experiments on mutation processes in populations. (Teoponova, 1962)

1941-2 The investigation of the genetic structure of populations. (Wallace, 1961, 1963)

1947 Control of insect populations through genetic manipulation. (LaChance and Kupfing, 1962)

917 Abbassian, R., Burch, A.B. ' Drosophila melanogaster. Genes Four different genotypes of D. melanogaster show significant differences in sensitivity to x-rays. The mutants are classified as recessive, dominant, and intermediate. The authors also describe the effects of x-rays on the fertility of the flies. (Author summary)


Detailed review article concerning the effects of x-rays on the chromosome structure and the in vitro and in vivo processes, including the role of oxidative stress in modifying abscission frequencies. (References are cited)

918 Abrahamson, S. CHROMOSOME AB (1962) 325-326.

Factors influencing the productivity of Drosophila melanogaster, an invasive species at irradiation, etc. The role of chromosomes produced by x-rays.


Fast neutrons of an average of 5 MeV from a female, inactivation of the x-rays. Males were mated to females separately. Sex-linked lethals were observed. The results for sex-linked lethals in the 1st day and 8.5% (34/413) of the 2nd day (7) were obtained for the 1st day and found for the 2nd day at 7.8% (34/413). The transmission values of 14.1% (21/148) of x-rays were not significant or consistent with changes in genetic recovery mechanisms after neutron inactivation. The results indicate that the males in greater chromosome sensitivity to explain the increase.

920 Alexander, M.L. DETECTION IN MATURE AND IMMATURE GS.

Translocations of spontaneous origin. Results for the spontaneous translocations.
I-A-4 CHROMOSOME ABERRATIONS
(BREAKS, CROSSING-OVER, TRANSLOCATIONS, ETC.)

General


Four different genotypes of D. melanogaster were x-irradiated at 350 r during the 1st, 2nd, and 3rd larval instars. Treatment with x-rays resulted in a 3-fold increase in the frequency of somatic crossing over, evidenced by incidence of abdominal malformation. This effect was influenced by genotype and the post-irradiation period. No mosaic spots were detected in the wings, even after irradiation. It is concluded that if somatic crossing over occurs in the wing anlage, it does so at an extremely low frequency. (Author summary)


Detailed review article concerning the large variety of biological material, and divided into sections dealing with chromosome and chromosomal type aberrations, general theory of aberration production, the exchange hypothesis, chromosome stickiness and sub-chromatid aberrations, the relation between aberration structure and the mitotic and meiotic cycles, relative radiosensitivity of different organisms, cell types, and stages in cell development; factors affecting the distribution of aberrations within and between nuclei and chromosomes; the relative efficiencies of different ionizing radiations; the oxygen effect and the importance of oxidative processes in aberration production, and other physical and chemical factors modifying aberration frequencies. Results obtained from studies on insects are also included. More than 600 references are cited.


Factors influencing the production of chromosome rearrangements by x-rays in early embryos and oogonia of Drosophila melanogaster are investigated, among them strain, fractionation of treatments, age of females at irradiation, etc. The results are discussed. Data on the frequency of detachments of attached-X chromosomes produced by different modes of treatment are tabulated.


Fast neutrons of an average of 3 MeV energies were utilized to test for increases in sensitivity in mature sperm after female insemination. Mature males and inseminated females were treated with 500 rads of neutrons. Males were mated to Muller-6 females or by mated females and the 1st and 2nd day's tests were separated. Sex-linked lethals were scored by the Muller-6 method and translocations tested with bw st. The results for sex-linked lethals induced in sperm treated in inseminated females were 8.6% (6/72) for the 1st day and 8.3% (6/72) for the 2nd. For treated males, the percentages of lethals were: 1st day 8.3% (4/49) and the 2nd day 8.5% (11/123). For translocations in the female was, 9.8% (47/479) were obtained for the 1st day and 9.8% (68/683) for the 2nd. For treated males, 9.2% (33/699) were found for the 1st day and 7.9% (45/575) for the second day. By treating males with 1500 rads of neutrons, translocation values of 14.2% (20/142) were observed for the 1st day and 11.8% (20/171) for the 2nd day. Chi-square values were not significant for the 1st and 2nd day comparisons. The absence of significant or constant changes in genetic damage in the 2nd day as compared to the first indicates the absence of recovery mechanisms after neutron treatment. Combined values for both days were significantly higher in the female than in the male tests. This increase in genetic damage after sperm insemination shows greater chromosome sensitivity to beamage since recovery mechanisms were not observed and will not explain the increase.


Translocations of spontaneous origin were detected from unirradiated females in certain strains of D. viridis. Results for the spontaneous translocations were similar in appearance to the expected results if clones of
translocations were recovered from irradiated spermatogonia of males. Additional testing was necessary to separate spontaneous translocations originating in females from induced translocations in males. The method of separation is also applicable to separation of induced translocations of maternal and paternal origin when inactivated females are irradiated. Spontaneous translocations in females involved different chromosomes and therefore offer an evolutionary source of genetic variability of translocations. (NSA 17: 1623, 1963)


It is common to distinguish between two forms of meiotic non-distinction: at first and second division respectively. This is a gross simplification. There are many possible mechanisms resulting in non-distinction, some of them are recognizable by their genetic effects. An analysis of spontaneous females in Drosophila, produced by x-rays, has been made in an attempt to determine the modes of non-distinction, in fact, operating in their production. Although the results are ambiguous, some definite conclusions can be drawn.


The effect of x-rays in dose from 1000 to 9000 rads on crossing-over between the X-chromosomes of the female was studied, using the markers: ec, ov, st, y, r, f, and car. X-rays produced little or no effect on crossing-over in eggs laid during the first 5 days after treatment but produced a strong depression of crossing-over from day 6 onwards, which was maximal on days 7 and 8. Analysis of the individual segments revealed that the region most sensitive to the depression was those furthest from the centromeres. The segments nearest to the centromere actually showed a significant increase in crossing-over, with a maximum effect at 9000 rads. (from abstr.)


For the detection of translocations Drosophila males, 1-2 d old, of the stock Berlin-Wild were irradiated (100 kV; 1.7 mm Cu) and mated each with one homozygous ec female. In intervals of 3 d each male was repeatedly mated with a fresh virgin female. In this way 3 broods were won. All ec-X males of the F2 were tested with a special stock to prove the translocation character. In the broods X¥V (strip spermatozoa) the translocation rates increase with dose. They are in general agreement with dose-effect curves increasing with an exponent of 3/2 dose. The relative values of the rates of all dosage in these broods are: brood I=1.0; II=2.0; III=4.9. IV=1.0 showing a clear broad pattern. The corresponding values for sex-linked recessive lethals from experiments with the same wild stock under the same conditions for 3 broods are: brood I=1.0; II=2.1; III=1.1. For the recessive lethals of chromosome IV we have found at 5.0 rads: brood I=9/912=0.32%; II=6/713=0.85%; III=1/312=0.32%. In both cases the maximum for recessive lethals lies on brood III. So the results show different broad patterns for translocations and recessive lethals, respectively. In brood V (late spermatogonia during irradiation) in the translocation experiments the experimental findings are: 1.6 kr: 6/8973=0.01%; 3.0 kr: 7/7780=0.09%; 4.5 kr: 3/6425=0.04%; 6.0 kr: 4/4328=0.09%. It is not possible to construct a dose-effect curve of the type mentioned above which is in agreement with these values. It seems reasonable to construct a dose-effect curve going through the point 1.5 kr. Then the low mutation rates at higher doses may be explained by germinal selection, i.e., all chromosome fragments which have not undergone a recombination or restitution before the next division are eliminated. Subtraction of the experimentally determined mutation rates from the estimated curve gives a curve for the action of germinal selection running parallel to the theoretical dose effect curve in the investigated dose range. Final results concerning recessive lethals of chromosome IV in brood V show an increase of this type of mutations in late spermatogonia (6.0 kr: 2/654=0.29%; 4.5 kr: 1/320=0.34%) indicating that recessive lethals are not affected by this kind of germinal selection. (from abstr.)


A method for producing marked Y chromosomes by irradiating intestinal translocations between an XY chromosome and some other element in the genome has been used and a series of marked Y's recovered.

The most useful markers in these Y's, which carry sting. The current best estimate of summary

Broese, G.E., Jr., NICOLL, R. NEW SOME IN Drosophila. (Abstract) The irradiation of females of the meios. Of those 5 started before testing, was complete. The rate of involvement of the techniques and were not too low in the Y break. We recovered in very unequal (by) from the chutes. Novitskii (1961) found 11 males. The coefficients a Zero of the 538 results on the 4 derived terminal markers. X. Perhaps most of the desulfurization with the Y requirement.


In the locoal chromosome: chromosome set becomes to development. At spermatozoa chromosomes with live form sperm. Schneider H. and H. Scholer: the Schuler's hypothesis in the male emb. Schneider's hypothesis of the male treatment, both to effect of maternal age on chromosomal as well as on it.
Additional testing was necessary to 10 conduction in males. The 11 locations of maternal and paternal 12 mutations in females involved different 13 stability of translocations. (NSA 17:

205


Brouseau, C. P., Jr. Irradiation of females of the constitution \( y^+ X y^w y^+ y^w X y^+ y^w \) with 800 r of \( \alpha \)-rays yielded 159 detachments. Of these 87 carried \( y^+ \), 38 were \( y^w \), 20 carried neither marker and 22 were sterile or were lost before testing was completed. The detachments that carried neither marker were tested further for evidence of involvement of the Y in the exchange and none was found. These are probably autosomal detachments and were not tested further. The remaining of the detachments were tested to determine the location of the Y break with respect to \( y^+ \) and the fertility factor. Complementary detachments were recovered in very unequal numbers. The exchange resulting in a detachment produces an asymmetric dyad from which the shortest element is recovered most frequently. This is similar to those cases in which Novitski (1951) found no exchange break, and it is likely that this is another case of the same phenomenon. The coefficients of non-randomness for 3 classes of detachments are: 0.78, 6.36, 0.71. Fifty-five of the 115 breaks at 46.15 were between the most distal fertility factor of the arm involved and the X-derived terminal marker. Another peak of breakage occurs in the portion of \( Y^w \) that is homologous to the X. Perhaps most of the exchanges that produce detachments occur in synapsed homologous regions and detachments with the Y might be induced crossovers rather than translocations.

906


In the lecanoid chromosomal system, as exemplified by the mealwig, Flanococcus cincta (Ross), one chromosome set becomes heterochromatized during embryogenesis of the male and is maintained as such during development. At spermogenesis, the first division is equational for both the euchromatic and heterochromatized chromosomes which are segregated from each other in the second, only the euchromatic derivatives form sperm. Schrader and Huggins-Behrends suggested that the heterochromatic set is genetically inert and Hughes-Behrends suggested that it is of paternal origin. Radiation studies were undertaken to test the Schrader's hypothesis. After paternal irradiation, the induced aberrations appear in the heterochromatic sex of the male embryos while they occur in the euchromatic set after maternal treatment. Hughes-Behrends' hypothesis of the paternal origin of the heterochromatic set is therefore confirmed. After maternal treatment, both sexes demonstrate increasing dosage but the results are complicated by the effect of maternal age on the sequence in which the two sexes switch out because the species and dosage as well as on normal progression. (From auth. summary.)

907


The frequency of induced non-disjunction in female germ cells has been estimated on eleven successive days following irradiation with X-rays. Doses of 1, 4, 8 and 16 krad have been used and the results indicate a non-linear dependence both for females (XY:Y) and male (XY:XY) exceptions. Over the first 6 d, the frequency appears to increase with the square of the dose. In spite of the frequency of male exceptions being 4-5 times as great as that of female exceptions, the slopes of the dose-dependence curves are closely similar. After day 6, when the female and male exceptions have equal incidences, the dose-dependence departs even further from linearity.

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929


In the meal bug, Planococcus citri, following high dosage paternal irradiation (50,000 to 100,000 rads), the survivors are mostly female (about 30 to 40% of the unirradiated control value) whereas very few males survive (about 9% of control values). After lower doses of paternal irradiation (10 rads), however, few to no females survive while the normal number of males (never less than the control values) survive.
The females developing after high dosage P.I. are gynogenetic and are triploid or diploid or 3N/2N or 2N/M mosas. The cytology of X4 embryos following 90 000 r.p. is described in comparison with data from embryos following lower doses (8000 r.p.) of P.I. and unlabeled controls, to illustrate the chromosomal mechanisms leading to the production of gynogenetic females and the probable reason for lethality of X4 males after heavy P.I. It has been shown that triploid females stem from a father nucleus of the first and second polar bodies. This triploid polar nucleus, which normally participates in the formation of a polyplid sector in the young embryo, undertakes a successful embryogenesis in many embryos when the syngene nucleus is unable to do so because of the heavily damaged paternal complement of chromosomes. Since the chromosomes are characterized by holokinetic activity, the irradiated paternal set manages to divide with the maternal complement but did not always segregate as successfully. Restriction divisions of the syngeneic nuclei led to haploid, hyperhaploid, diploid and polyplid nuclei. Most of the diploid gynogenetic females probably originate from diploid nuclei of syngeneic origin although it is possible that a few diploid females and the 2N/M mosas females develop from polar bodies. (Author.)


When females of the meal bug, Panoroccus citri, are mated to males previously irradiated with heavy doses of γ-rays (30 000 to 120 000 r.p.), the progeny is mostly female. These X4 females are gynogenetic, with unknown chromosomes. Detailed cytology of 17 such gynogenetic females showed triploids, diploids, and 2N/M and 2N/M mosas. Most of the embryos produced by triploid mothers were aneuploid and those degenerated before gastrulation. Regardless of aneuploidy, male embryos showed the typical locoanoid heterochromatization of the paternal set of chromosomes. Just prior to degeneration, the heterochromatin in the aneuploid male embryos showed endomitotic splitting while the heterochromatin did not. Among the progeny of 3N/2N x 3N/2N matings, only males with 5 euchromatic 45 heterochromatic chromosomes and females with 10 or 15 euchromatic chromosomes were found. A search for adults with 5 heterochromatic + 10 euchromatic chromosomes among the progeny of triploid mothers was unsuccessful. Chromosomal variables such as aneuploidy of the euchromatic set, haploidy and fragmentation are discussed in relation to the problems of heterochromatization of the paternal set and sex determination in this species. (Author.)


A series of spontaneous and x-ray-induced mutants at the rosy locus (3-50, 4) were subjected to recombinational analysis through the use of a crossover-selector system (Whittinghill 1960). Males from a balanced stock, m(2) m(3), M44 ty /+ x w/xw cellphone. were mated to two series of females: (a) M34 Ddx /+ rY+/+ x w/+, 5B U bathrooms and (b) M34 Ddx rY + /+ x w/+, 5B U bathrooms. Due to homologous lethality associated with the markers, M44, 2Bd, 9B, and 5B, all offspring of these crosses die except 1/8 of the crosses between M34 and Ddx, 1/4 of the crosses between 2Bd and U, and 1/2 of the crosses between Ddx and 5B. Visible offspring represent only 5% of all syngenes. The remaining 95% die as larvae or pupae. From a set of such crosses most adult offspring are phenotypically rosy. The sporadic rY individuals consistently found in one of the two crosses in a set testably carry appropriate markers indicating their origin as crossovers between separable sites within a complex locus. The double mutant types, expected in the cross that does not yield rY individuals, have not been distinguished. These separate sites within the rosy locus have been established: (rY, rY, rY, rY, rY). Significant failure of recombination has not been observed. Map distances, estimated at 5X (44 of rY recombinants) x 100/600 (total surviving offspring), range from a high of 0.05 to a low of 0.004. An improved selective system with increased percent killing and some egg mortality has replaced the above system in current experiments. All mutant reported here are complementary for eye colour and xanthine dehydrogenase activity. Current data support the existence of a simple complementation group.


When distorting males in the segregation-distortion (SD) strains of Drosohila were x-ray-irradiated, they produced a larger fraction of chromosomes showing recombination than the SD region than controls. The SD effect on the homologue was concluded to be a chromosome break because of the ability to rejoin with a radiation-induced break. (A 57 1963, 17826.)

933 Debiuz, M.P., Kanesawa, Q.L. CHROMOSOMES. p.890-89 in 5

The genetic consequences of the analysis of non-differentiation of sex compared with data on female space flight with the exception of the syngeneic effect were evd (NSA 37 1963, 30253).


935 Fry, S.H. CONCERNING THE CHANGES IN THE TELLO W R. Totals of yellow mutants, x-ray ascendant 0-2 and 2-4 after the mutation. The presence or absence of genetic changes of the type "breakage" yellow animals are only means and "true" changes significantly below linearity with d. Hence, the linear dose-frequency presumptive components. At a given frequency of 0 minutes of sex, total minutes included those correspondences between the minutes and minutes y extinction of minutes versus time was more homogenous criteria is more likely to be in the mutants, and others are mini.


The problems of minute chromosomes changes of the yellow locus in the 0-2 and 2-4 after irradiation) yellow females occurred in relation in order to determine the sex locus were conducted on 90% of 20 various structural and/or phen or breakage yellow associated with x-ray was deduced from the frequency- produced in the course of a single experiment. In the course of these effects the corresponding groups classified as "mi" the classes taken together and x-ray

937 Goldschmidt, L., Larr, R.S. BE BRAKE IN STRUCUTRAL DETER... Proceedings of XI International C. S.I., Ed. Oxford, Pergamon Press Males of D. melanogaster carry given an x-ray dose of 5000 r. the males, and all breedings induced in the X-ray induced aberrations was b
in tripod or diploid or 3N/2N or 2N/1N and in comparison with data from others, to illustrate the chromosomal behavior of males in the presence of X-rays in the same chromosomes and their behavior in the formation of a polytene nucleus, is to understand the consequences of non-disjunction of chromosomes. Since no dysomorphic bands are recognized in this case, dysomorphic chromosomes and the parthenial sex may not be present in this case. A few additional notes (Auth.)

11. PATERNAL EMBRYOS IN THE GENUS LUCANID S WILLIAMSON


Males of D. melanogaster carrying the Cy (II) mutation and their structurally homogenous daughters were given an x-ray dose of 5000 r. The salivary glands were examined in larval offspring of both groups of males, and all breaks induced in euchromatic sections of the entire chromosome set were located. The rate of induced aberrations was higher in the F1 produced by Cy fathers. The hatchability of eggs fertilized
by irradiated males of both groups was studied in order to compare the brood patterns and the overall rates of "dominant lethals" induced during the premeiotic stages up to the first mitotic anaphase. It has been suggested that the loop configuration in the heterozygous bivalent facilitates non-homologous contact and thus promotes abnormal restitution. A more comprehensive hypothesis proposes that each of two perfectly synapsed homologues provides a "split" for the normal restoration of its partner. Hence synapsis per se will interfere with the normal repair of breaks. On this assumption the structural heterozygosity of one bivalent, promoting synapsis in non-homologous elements, may be responsible for the increased production of abnormal restitution in the entire chromosome set.


An analysis of the control of developmental parameters encoded by the mutant gene Hairy-wing 49s was undertaken. This gene, in addition to causing the formation of chaetae on the wing veils, controls the formation of extra macro- and microchaetae on the thorax. In homozygous condition it causes the thorax to be disproportionately wider at the level of the meso- and metathoracic regions and controls the formation of numerous extra microchaetae in the meso- and metathoracic regions. The number of rows of chaetal chaetae is greatly increased and numerous extra macrochaetae are present. The heterozygote does not show this disproportionately increase in width and, while it has an increase in the number of chaetal rows, does not show any significant increase in microchaetae density in the metathoracic region, and possesses fewer extra macrochaetae than the homozygote. By means of genetic mosaics, produced by inducing somatic crossing-over in heterozygous larvae with X-irradiation, a developmental analysis of the differences in differentiation in the tissues of the Hairy-wing homozygous genotypes was performed. X-irradiation causes Hairy-wing heterozygotes to express themselves in a homozygous-type fashion.


Two loci, ma-1 and ry- necessary for xanthine dehydrogenase activity were studied for dosage effects utilizing deficiencies and duplications induced for this purpose. Rather than assume that the known ma-1 and ry- mutations are deficient for all gene activity, true chromosomal deficiencies were produced by X-irradiation. Comparisons of 1, 2 and 3 doses of ma-1 in the female or 1 and 2 doses in the male indicate that there is no increase in specific enzyme activity with dose. On the other hand, comparisons of 1, 2 and 3 doses of ry- in the male and female reveal an increase in enzyme activity that is roughly proportional to dose. Since dosage of ry- is limiting, whereas that of ma-1 is not, the final concentration of xanthine dehydrogenase is shown to depend on the number of doses of ry-. The implications of these findings with respect to the hypothesis of dosage compensation and to the mechanism of control of enzyme and protein concentration are discussed.


Preliminary results of genetic studies on D. melanogaster are presented. Analysis of data on 46 males mated singly, sequentially, and daily after the 7th day, or until the male died, for 24 days after treatment with 5000 r X-irradiation, indicated that induced crossovers occurred in one breed as pseudocrossovers, and that crossovers beginning the 12th or 13th day after irradiation and initial mating may continue for a number of broods. (NSA 17:1963, 89599)


Following exposure of germ cells of female D. melanogaster either to 5000 or 4000 r of X-rays, induced exchanges involving proximal or distal regions of the X chromosome were detected in females. The results support the view that X-ray-induced recessive lethal mutants in oocytes typically arise as the result of events which involve only a single strand of a tetrad.


Recessive lethals from 16 Mev electrons are distributed among the sperm of different males according to Poisson expectation, even though some lethals are due to position effects following chromosomal realignment. It is pointed out that the usual recessive lethal studies are not likely to furnish readily

943 Chelsky, L., Lacty, MOTHER MATURITY SPERM. (2) Drosophila

Assuming (1) that proximity of b and (2) that a bias which occurs in the mother sperm, only n in orientation at meiosis, and results indicate, however, that the precisely influenced by any other

944 Herskowitz, L. N. SPONTANEOUS (Abstr. 317570) p. 89 in "Praxes TID-43889. Division of Technics. The broad purpose of the propose and the factors involved in the p mutation occurring spontaneously in its differentiation, and in new balanced lethals which were non-disjunction or severe multi-spontaneous and x-ray-induced x-mutational events will be studied adenine available if or is not restricted in adenine, the effect spontaneous and/or x-ray-induced pentadiol on x-ray-induced mut

945 Hughes-Schmider, S., Schmider, 32-59.

To induce chromosome breakage program were irradiated with 100 demonstrated by the ability of cell generations of spermatogonial also capable of meliotic mitosis, for the meliotic restriction of kin other Homoptera. Single parent supported by the observation that azo-xyling. (NSA 18:1962, 95699)

946 Ire, P. T., Nishikawa, G. R. COMP PRODUCED BY r-IRRADIATION

Translocations (T) chromosome males and crossover from days 5 to 10. Tests showed homozygous derived from days 6 and 8 sperm two chromosomes, with 2.7 T I over chromosomes appearing in 1 and 10 sperm were recessive to The lower lethality in crossover y chromosomes suppress exchange sites (Paterson and S) lethality arises from this bia by the irradiation. (Rafter com divergent induced mutation from male and normal female crosso distribution.

200
critical evidence on the positioning of sperm chromosomes. A study of II-III reciprocal translocations was performed, using 1500 x-rays. Sperm samples from different single ejaculates were examined. Subject to the correctness of the authors' premise restricting the joining of ends produced by x-ray breaks to those located closely, the results do not indicate that the chromosomes in the different sperm are arranged in an otherwise-random fashion.

Burkitt, L.H., Lacy, Mother, Stannius, Baumlz, R.G. ARRANGEMENT OF CHROMOSOMES IN MATURE SPERM. (2) Drosophila Inform. Serv. 37 (1963) 89.

Assuming (1) that proximity of broken ends derived from x-ray breaks of mutation favors cross-over, and (2) that a bias which occurs in orientation of chromosomes at meiosis also results in an orientation bias in the mature sperm, only males were utilized whose sperm chromosomes were all similarly stained in orientation at meiosis, and males whose sperm chromosomes are not stained in such a way. The results indicate, however, that the arrangement of overlapping chromosomes in the sperm head is not appreciably influenced by any orientation which chromosomes may have had during meiosis.


The broad purpose of the proposed programme is to learn more about the phenotypic effects of mutations and the factors involved in the production of chromosomal breakage, chromosomal rearrangement, and point mutation occurring spontaneously and induced by radiation in a given cell type, including different stages in its differentiation, and in several cell types. Attempts will be made to construct stocks containing balanced lethals which when mated together result in the death of all progeny during the egg stage, unless non-disjunction or reverse mutation occurs. If such stocks can be constructed, they will be used to study spontaneous and x-ray-induced non-disjunction and reverse mutation of recessive lethals. Various mutation events will be studied, following x-ray or no x-ray treatment of developing eggs, when the mutation available is or is not restricted in the diet of larvae autotrophic for adenine. Using a diet restricted in adenine, the effects of adding other purines or adenine to the diet will be studied upon the spontaneous and/or x-ray-induced mutation rate. Several experiments are planned to study the effect of penicillin on x-ray-induced mutations of various loci.


To induce chromosome breakage, adult males and females of Eucnemis servus, P. trittigmus, and Solobea popillia were irradiated with 150 to 750 x-rays. The diffuse nature of the break points demonstrated by the ability of chromosome fragments to reassociate themselves mitotically through many cell generations of spermatogonia. Free fragments, when not immobilized by the effects of radiation, are also capable of mitotic mitosis. In a helicoidal, rather than a telenostic, nature was thus demonstrated for the mitotic division of the kinetochore activity to chromosome ends; normal for Heteroptera and certain other Hemiptera. Simple fragmentation as a factor in the evolution of compound sex chromosomes was supported by the observation that fragments of the X chromosome co-orient with the Y in a typical teleo- and go pairing. (NSA 16: 1962, 1049).


Translocations (T) of chromosomes 2 and 3 were derived from days 5 and 6 sperm of Oregon-R/nears males and crossovers from days 8 and 10 spem, using an exhaustive clading schedule at 25 C after two hr. Test showed homologous lethality in 46 of 102 T, and in 34 of 105 non-T second chromosomes also derived from days 5 and 6 spem. The estimated lethality due to a T is 0.38 of a lethal for each of the two chromosomes, with 2.7 T lethals to one non-T lethal per chromosome. In contrast 11 of 141 crossover chromosomes appearing in males and ten of 172 non-crossover sibling third chromosomes from days 5 to 6 10 sperm were recessive lethals, the difference in these two frequencies being significant (P = 0.004). The lower lethality in crossovers versus Ts and the absence of a comparable increase in proportion of lethals in crossover chromosomes support the views that induced crossovers and Ts are genetically different at their exchange sites (Patterson and Stone 1964) and that both result from induced chromosome breakage then lethality arises not from this breakage but probably from a position effect of genes not themselves affected by the irradiation. (Earlier comparable studies were rendered uninterpretable by the later discovery of widely divergent induced mutation frequencies at different spermatogonial stages.) A difference between induced male and normal female crossing-over is still apparent in their very different proportions of crossover distributions.
Kurz-Mosch, E. UNTERSUCHUNGEN ÜBER DIE VERTEILUNG DER BRUCHSTELLEN NATÜRLICHER UND STRAHLENINDUZIERTER CHROMOSOMENABERRATIONEN BEI Drosophila subobscura COLL. (Studies on the distribution of breakage sites of natural and radiation-induced chromosome dislocations in Drosophila subobscura Coll.) Chromosoma 22 (1961) 286-309. (In German)

Cytologic analysis of radio-induced dislocations was studied in salivary gland chromosomes of the F1 larvae produced by mating irradiated male flies with normal females. The males, 30-d-old individuals of the Klaudt strain, were irradiated with 5000 r. Examination of the salivary glands of 64 F1 larvae revealed a total of 74 translocations and 90 inversions in 92 larvae. On the basis of previous studies, dislocations corresponded to 224 breakage points. The percentage of dislocations in the sperm (24.94) is 1.37%) was lower than that obtained in previous experiments on other Drosophila species, at the same radiation dose. The distribution of the 224 radio-induced and 102 natural breakages was considered on a statistical basis, and the results discussed critically. On the basis of small chromosome segments, 3 autosomes were found to show a significant deviation from random distribution.


It has been found that, after the irradiation of adult males, there is a difference in the sperm samples which show the highest frequencies of lethals and translocations, and those which show the highest frequency of XO males. A set of experiments were carried out to investigate this discrepancy. Twenty-four-hour old males, of the genetic constitution X(9)(y)(9) X(9)(y)(9) Y, were treated with doses from 0-3000 r. A broad pattern of five 2-4 broods was used, with 6 females per male per brood. The F1 sexed for XO males, non-disjunction females, and sex ratio. The highest frequency of XO males was found in sperm sampled on the 7th-8th days after irradiation, presumably corresponding to young spermatocytes, and this was not accompanied by any comparable increase in the number of non-disjunction females. From the structure of the ring X, it is suggested that most breaks will result in loss of the chromosome. This is supported by the fact that the same dose of irradiation produces more XO males from the ring X than from a rod X. The dose effect curve for the production of XO males is a straight line, one-hit event. A comparison of this dose effect curve with that of the change in sex ratio gives further evidence that XO males are mainly produced by loss of the X chromosome. A hypothesis to explain the different peaks for the 2 types of breakage-involving effects, XO males and translocations, is discussed.


Genetic effects of radiation on mature Drosophila sperm are discussed. It is concluded that single breaks that occur too far from another break to interact with it, if they occur, do not remain open, do not form dominant lethals, and thus by a process of elimination most remain. Where there are two broken strands within a site, three types of interstitial rearrangement are possible: (1) they may reunite to form a chromosome unchanged except for mutational, i.e., X chromosome, (2) they can rejoin to produce an acrocentric ring and a rod deficient for the region included in the ring, or (3) they may remain to form an inversion. Interstitial rearrangements and the situation where, within a site, there are two different arms are also considered. Two such breaks may reunite, they may rejoin to produce a dicentric and an acrocentric, or they may form reciprocal translocations. Translocations between the X chromosome and the autosomes are used to illustrate how the genetic effects of aberration may affect the validity of scoring procedures. (NSA 17:1963, 25013)


Data are presented on the x-irradiation of sperm in pure Q2, air, or in nitrogen mustand, followed by washing within the first 24 h. Data on the effects of dose fractionation on the induction of point mutations and chromosome breaks are also included. The results cannot be interpreted as proving the occurrence of a recovery process in sperm irradiated in a stage supposedly rather well supplied with oxygen. The need for dealing with well-defined cell stages is heavily stressed by the author, in view of the otherwise inevitable heterogeneity to results.


The frequency of genetic early and late spermanges x-irradiation and x-rays: 8156


A preliminary report on in Drosophila subobscura p. the distribution of the broken versions and translocations


Megastral analysis has not been determined yet in Drosophila. The crossing-over values in the localization of a given pumpos to a certain centromere, male. Established on the

Manna, G.K., Masumar INDUCED CHROMOSOMES X-rays induced X-chromosome has been studied. The bar and "mixed" typed at and at 240 r of x-rays. This breaks of the X-chromosome served not only in C-popu- lation of breakages at a certain centromere that the frequency of radiation, (Auth.)

Nakasako, T., H. FIAS CAN ON THE CELL AND ABNORMALITIES IN GRASSHOPPER. THE FIRST DIVISION AS (Auth.)

Nakasako, T., H., Makino AND CHEMICALS ON THE CONTINUATION OF CHER GRASSHOPPER SPERMATOGENESIS.


The frequency of genetically detectable translocations was determined in spermatozoa, spermatocytes, and early and late spermatozoa in irradiated male D. melanogaster. The males were exposed to 5000 r of X-radiation and mated to 10 females. Results were presented in tabular form. (NBA 18:1 1964, A108)


X-ray induced X-chromosome breakages at the diplophase stage in the grasshopper, Grasshopper, Pararesus has been studied. The breakages of the X-chromosomes have been classified as "chromode," "chromome," and "mixed" type breakages and their frequency distributions have been recorded at 20 r of X-rays. The frequency of breaks is directly proportional to the dose used. The radiation breakages of the X-chromosomes are not as random, and regional localizations of the breaks have been observed not only in 2 species but also in 2 other species of different genera. A difference in the frequency of breakages at a given dose among the different species has also been observed. Our data show that the frequency of radiation induced X-chromosome breakages is much higher than that of the autosome. (Auth.)


Some of the Chironomus tentans Fair. larvae collected from White Oak Creek and the Clinch River have unusual folded vesical gills. A subsequent cytogenetic study showed the salivary gland chromosomes of the C. tentans population contain what appears to be a relatively high frequency of chromosomal aberrations. These populations from areas contaminated with radioactive waste effluents have not been compared with

858
other local populations not exposed to these effluents. The radiation from radionuclides sorbed on the river and creek bottom sediments is 20 to 3000 times that of natural background. The larvae are also exposed to a heterogeneous mixture of chemicals in the effluent released to the environment. The mutagenic effect of chemicals is estimated when compared with the effect of ionizing radiation. (Auth. summary).


The chromosomes contributed by the father to the zygote of male mealy bugs become heterochromatic at late blastula. This complement does not itself form gametes. However, the present results indicate a decided influence of this set on fertility of the male and cannot be considered genetically inert. Following high dosage γ-irradiation of fathers, a certain bulk of heterochromatin (based on linear measurements of the holokinetic episome), no matter how damaged, must be present for the survival of the sons, and a presumably less affected set must be present for the sons to be fertile to any extent. With increase in dosage there is a quantitative reduction of fertility of the sons based on the production of fewer normal functioning sperm. This is due to a gradual onset of rearrangements in spermatogenesis at all doses, but an increased total effect with increase in dosage. (Auth.)


Note follows upon some opinions expressed by the author and taken up by Benes and Goldschmidt (1941). After some comments, Novitski describes an experiment in which Drosophila melanogaster females, heterozygous for the inversion rough (Genetics 41, 1946, 558), were X-rayed with 1800 r. Male progeny were examined for loss of the position effect. Of some 38,000 progeny checked, 6 cases of reversion were found which appeared, after exhaustive investigation, to be precise inversions, genetically indistinguishable from a normal chromosome.


Females heterozygous for the most reversional inversion were X-rayed, and their progeny examined for reversion of the phenotype. Six were found which, by both genetic tests and cytological examination, appeared to be precise inversions of the roughest inversion. It is suggested that the inversion loop formed in the heterozygote facilitates breakage and reunion in the vicinity of the break point of the original inversion. (Auth. summary)


Irradiated populations of Drosophila were analyzed for the existence of chromosomes or lines represented in the gametes of a heterozygote with a frequency greater than the expected 50%. Such phenomena have been referred to as cases of meiotic drive when the bias is found in some aberration of males. Chromosomes were tested that had received light doses of radiation each generation for about 200 generations. The genetic tests consisted of back-crossing heterozygotes for chromosomes derived from the irradiated populations and for stock chromosomes carrying mutant genes to the mutant stock in order to detect any deviation in the progeny from the expected 50% of each type. Of 1664 tests these were 2 instances in which the chromosomes derived from the irradiated population were recovered in significantly more than 1/2 the progeny, and where this deviation persisted after repeated testing. (NSA 1961, 2337)


Males, 0-24 h old, heterozygote in the 2nd chromosome for b vs wg bw, were exposed to x-ray doses of 500, 1000, 2500, and 4000 r. They were bred with b vs wg bw females, and the cross-over found in the descendents of the 7th to the 21st day after irradiation were determined. Results are tabulated and their significance discussed in detail.


Two main hypotheses have been put forward as explanations of induced crossing-over in Drosophila. One is that the chromosome fragments produced by irradiation are stimulated to form crossing-overs by the non-irradiated chromosomes; the other is that the irradiated chromosomes are stimulated to form crossing-overs by the non-irradiated chromosomes. The main evidence for the first hypothesis is the observation that the frequency of crossing-overs is a function of the dose of radiation. The main evidence for the second hypothesis is the observation that the frequency of crossing-overs is a function of the dose of radiation. (NSA 1961, 2337)


The effect of X-rays and chemical mutagenic agents on the development of Drosophila was studied. The results of these experiments showed that the frequency of crossing-overs is a function of the dose of radiation. The main evidence for the second hypothesis is the observation that the frequency of crossing-overs is a function of the dose of radiation. (NSA 1961, 2337)

Studies on the induction of crossing-over in male D. melanogaster chromosomes following exposure to various dose rates and fractionated doses of X-rays showed the existence of a stage of greatest sensitivity during spermatogenesis. A significant decrease of induced crossing-over in the centromeric region was observed after exposure to fractionated doses. The possible relation between radio-induced crossing-over and chromosome breaks is discussed. (NSA 17: 1965, 25709)


Two basic hypotheses have been put forward to explain the appearance of "clusters" of crossovers in some male offspring, following irradiation. Cluster induction was measured in males irradiated with different and fractionated doses in order to obtain some indications of cluster origin. If clusters are produced by a single ginal crossing-over cluster zone should not be affected, which it would be if produced by many crossings-over induced in equally sensitive cells. If the time during which the cells are sensitive is shorter than the interval between different treatments, the single dose-effects should not sum up. A pilot experiment was therefore performed in which males heterozygous b on yg. 0-94 k r old, were irradiated with 500 k, 4000 r and 4600 r delivered in 15 h by 500 r doses (180 kV, 5 mA, 5 mm Al, 500 r/min). The males were mated with 8 females each, on 1, 3, 5, 6, 9, 12, 15, 16, 18, 24, 30 and 36 days after irradiation. In the following experimental results "cluster" is defined as a group of crossovers — occurring in a single individual — lying outside a Poisson distribution. These events are the induced crossovers-over that can be referred to the same male according to the number and type of crossovers found in its offspring after restoration of fertility (in our case after the 12th day from irradiation). In the sample of 93 males irradiated with 500 k there were no clusters in the offspring of 17 males, which produced crossovers whose frequency-distribution was of the Poisson type; in the sample of 25 males irradiated with 4000 r, clusters appeared in some of the 46 males which produced crossovers. Even with fractionated treatments clusters have been obtained, but in this case the distribution is more in agreement with the Poissonian type. Moreover, in these two last treatments, the number of males producing crossovers was lower than expected. It thus appears that during spermatogenesis cells show a "sensitive stage" for induced crossing-over. In consequence of the synchronization of maturation, there could be at the same moment several cells in that stage, but, on the other hand, it may be that none of these cells is present in some males at the moment of irradiation. This could show up by giving a high dose of radiation, even in fractionated treatments, if the "sensitive stage" is longer than the interval between the different fractions. A low dose, on the contrary, should not induce a sufficient number of breakages in sensitive cells to produce enough crossing-over to form a cluster. (Part abstr.)


X-rayed and chemical mutagen-treated larvae of Drosophila have been shown to exhibit an increase in preleminated mortality and a decrease in the life-span of the surviving adults. This phenomenon, essentially akin to the premature ageing observed in irradiated mammals, has been shown by several genetic tests to be based on chromosomal loss (Ottes 1969, Müller and Gans 1959). One of these involved the use of males containing a ring-shaped X-chromosome. Since ring chromosomes are more prone to lose following breakage than normally-constituted chromosomes, males hemizygous for the former are more susceptible to mutagen-induced life-shortening. — Direct cytological observation of this damage would offer additional confirmation for our interpretation based on the breeding results and a simple method for testing other agents as possible mutagens. — By utilizing a combination of techniques recently introduced by E.S. Lewis (Drosophila Inver. Serv., 34) for demonstrating the mitotic chromosomes of Drosophila larval ganglia and a lacto-acetate cresyl-fast green stain developed by Rudkin and Kanter (unpublished) we have been able to obtain preparations with 15-20 figures per ganglion in which the full complement of chromosomes can be clearly analyzed (Ottes and Balaban, Drosophila Inform. Serv., 37). Preliminary observations have yielded results completely in agreement with the genetic tests, i.e., the relatively high susceptibility to loss following irradiation of ring-shaped chromosomes as evidenced by their breakage and frequent involvement in anaphase bridges. Such effects can also be observed following exposure to relatively low doses of X-rays. — Also this method has been successfully applied to the somatic chromosomes of the housefly.

967 Ober, L.L., Pooley, E., THE EFFECT OF ACCESSORY CONDITIONS ON X-RAY INDUCED NON-

968 Oenthal, W., THE GENETIC BASIS OF SOMATIC DAMAGE PRODUCED BY RADIATION IN THIRD INSTAR

Somatic damage to larvae can be attributed to loss of chromosomes via the breakage-fusion-bridge-loss
process. Females have a higher radiosensitivity than males through all dosage ranges tested, the differential
sensitivity being expressed throughout the subsequent life of the flies until death of the whole irradiated
population. (Note higher radiosensitivity with heterozygous deficiency in one of the second chromosomes.
The radiosensitivity of the autosomes is roughly twice that of the X chromosomes. The presence of a single
X in females heterozygous for it and for a defined non- or in males, leads to a higher radiosensitivity then
in flies having a normal red-X in place of the ring. The effect of post-treatment with Ni increases the
differential sensitivity to a level 2.5-10.2 higher than in the irradiated non-treated larvae. A simple model
is developed explaining the action of radiation in producing somatic damage all through the life of the fly
(unpublished maflerical model). The present results leave no major role for the cytoplasm or other
non-chromosomal components in the causation of somatic radiation damage in Drosophila larvae. Genetic
effects other than breakage by radiation could at most play a minor role in the effect described.

969 Puro, J.A., THE BROOD PATTERN OF X-RAY INDUCED CROSSING-OVERS IN Drosophila melanogaster
MALES. (Abstr. 5, 4.0) p.69 in "Genetics Today. Proceedings of XI International Congress of Genetics,

The pattern of induced crossing-overs in D. melanogaster males was studied using a hybrid stock of 12
recurrent markers in the third-chromosome. Adult males, after treatment with 3500 x-rays, were mated
 singly and sequentially (at 5- or 5- d intervals for the first three broods and daily from the 7th to the 24th
d) to females of an appropriate genotype for detecting crossovers. Purity and fecundity of the treated
males, after decreasing to the lowest level on d 8, had a marked recovery on day 10 followed by a small
depression on days 11 and 12; no differences between the experimentals and controls were found for any
of the rest of the broods. The number of tested F1 offspring obtained 51 864 from 46 treated and 55 718 from
11 control males. With rare exceptions, proven crossovers were first detected on the 9th d but the highest
incidence was on the 15th d after treatment. Clusters of crossovers, many of which continued in several
broods, began on the 11th or 12th d. The evidence from the continuing crossovers-clusters substantiates the
hypothesis proposed by the author (1962) from clusters of recurrent third-chromosome lethals, that the
repeated postautonous gonad - on average 5 in number per male, lasting the entire span of the second
clones - are responsible for the recovery of sperm production to the control level by the 12th d. Furthermore
it appears that the high incidence of crossovers, on the 15th d, is the result of induction of crossovers
in definitive (secondary) gonad.

970 Ray-Chaudhuri, S.P., INDUCTION OF CHROMOSOME ABERRATIONS IN THE SPERMATOCTYES OF
GRASSHOPPERS. Nature 4, 1 (1965) 41-68.

X-ray-induced abnormalities in metaphase and anaphase cells are described for meiotic cells of male
grasshoppers (Gonostoma pyramidatum). Independence from dose-rate but a dependence on the wavelength
was observed. Different irradiating temperatures (4°C and 37°C) had no effect. An attempt was made to
compare abnormalities produced by x-rays with those absorbed from a Rb. A series of experiments are mentioned
in which diester bridges are used as an index of radiation damage to chromosomes (pre-treatment with
sodium ascorbate, verene (ethylendiaminetetraacetic acid), and cyanometannine) (1964).

971 Saru, M., UNUSUAL CROSSING-OVER IN THE BAR REGION OF Drosophila melanogaster. Influence

Unusual crossing-over in the Bar segment of D. melanogaster, giving rise to reversed B+ and BR, were
used in a study of induced crossing-over to reveal the possible presence of clusters. High temperature (31°C for
48 hr), x-rays (4000 e and 2500 e), and EDTA (a chelating agent known to deprive the organism of calcium)
were used as enhancing treatments. Frequency of crossing-over in the region 7-6 was registered and
compared to the frequency of unusual crossovers in the Bar segment. High temperature and the higher
x-ray dose were found to be effective in raising the frequency of crossovers. The lower x-ray dose was
without effect and the EDTA treatment was dubious but seemed to enhance the frequency to a small extent
in the later broods. Since a significant increase in crossing-over frequency has been observed without the
simultaneous presence of clusters, it is inferred that induction of gonial crossing-over with subsequent
multiplication of the crossovers product is not the cause of the enhancing effect of the treatments. The
enhancing effect can be supposed perhaps as an earlier leptotene. 5-1

Differences between sensitivity found to reflect the relationship call stage treated. It was conclu-
ding between various stages to which type of aberration is: very short intervals during x-ray.

973* Sengis, A., EFFECTS OF X-RAY DEVELOPMENT. Nuclear 11

Embryos of Drosophila melanogaster older 3rd-larval form in gas,
and Matpulichthodes made from old 3rd-larval larvae irradiated at the age of 4-6, 1
meats of Silvanna were done for x-rays. The nature of the thal.

974 Sliwaska, H., ORIGIN OF RE

R, a type of duplication when the sister chromatid, are indu-
capable of introducing R's with for the origin of R's from a c,
on x-ray and formaldehyde-in
analysis of the effects of four

975 Sokoleff, A., STUDIES ON F.

In one series of experiments 1-
1970 e/min through a 1 mm corre

to the number of irradiation results in a mixed
for irradiated females is comp;

976 Strollo, V.A., RADIATION IN Drosophila melanogaster.

In Drosophila melanogaster,
enhancing effect can be supposed to work directly on the recombination process during pro-miotic interphase or earliest leptotene, 5-10 d before the delivery of the eggs. This probably holds both for high temperature and the effective x-ray dose. Whether the INDRA effect is exerted in the same manner and at the same time cannot be decided until the treatment becomes more exactly time-limited and quantitative.


Differences between sensitivity patterns for various types of induced genetic damages were compared and found to reflect the relationship between the different mechanisms at work in producing damages and the cell stage treated. It was concluded that these exist not only a marked difference in sensitivity to irradiation between various stages of spermatogenesis in Drosophila, but also a difference in sensitivity according to which type of abbreviation is studied. It is also obvious that the changes in sensitivity are delimited to very short intervals during spermatogenesis. (NSA 16:1362, 1746B)


Embryos of Drosophila melanogaster (4-6, 10-12, and 16-18 h old), larvae (52-94, 56-90 h old) and older 3rd-instar larvae were irradiated with 0.5/100 r x-rays. Chromosomes from the salivary gland, midgut, and Malpighian tubules were examined in smears or in smears-carbohydrate preparations made from old 3rd-instar larvae and pupae. In salivary-gland chromosomes preparations from larvae irradiated at the age of 4-6, 10-12, 16-18, and 24-26 h some structural abnormalities ("partial rearrangements") of almatations were observed. They could be regarded as partial inversions, translocations and deficiencies. The nature of these rearrangements is discussed.


R, a type of duplication where a segment of one chromatid is inserted next to its homologous segment in the sister chromatid, are induced by x-rays at a very low frequency and some chemical mutagens are capable of inducing R's with a high frequency. Attempts were made to deduce the mechanism responsible for the origin of R's from a cytological study of different types of R's and their relative frequencies, based on x-ray and formaldehyde-induced R's in Drosophila melanogaster. Four types of R's were found during cytological analysis of the effects of formaldehyde food, and all can be explained by a mechanism which requires two breaks in a still undivided chromosome; after splitting of the chromosome, these breaks result in two pairs of isochromatid breaks. Depending on the type and the number of new junctions, different types of R's are formed. All of them are accompanied by the same complementary deficiencies (CD). In order to result in a R with complementary CD, the breaks have to fulfill special conditions. A proposed model for the origin of repeats suggests that these may arise more readily from chromosome breaks which remain latent (potentially) until separation into sister chromatids. This is in excellent agreement with the fact that formaldehyde, which produces mainly potential breaks, yields a high frequency of R's, while x-rays yield very few. (From NSA 16:1362, 1746B)


In one series of experiments 14 males and 9 females (genetically R 9/14) were exposed to 3200 r of x-rays (970 r/min through a 1 mm Al filter). The irradiated beetles were mated to a number of g/s that corresponds to the number of x-rays, and their progeny reared in the same incubator as the controls. Irradiation results in a marked drop in productivity, especially in females. The frequency of crossing over for irradiated females is comparable to that obtained for the controls. On the other hand, Old, a trait for homogeneity for other traits that suggest the increase in crossing over in the males as a result of irradiation is real. With irradiation, crossing over is increased in frequency in the male but not affected in the female. It is modified by age but, probably only in the male.


The question of whether the radiation effect is confined only to the recorded genetic effect observed under ordinary conditions or whether there are in the cells potential changes revealed only upon additional treatment is discussed. The frequency of primary non-disjunction of X-chromosomes was followed up for Dro sophila irradiated with 3000 r and subsequently exposed to +7°C during 5 h after various time intervals. It is concluded that the phenomenon of radiation after-effect upon the disjunction of chromosomes does exist. (Auth.)


Sperm stored in females, which can be considered the most homogeneous germ-cell stage available in Drosophila, were irradiated with 150 kV x-rays, at 0.67/min. The statistical test based on weighted regression analysis showed a significant decrease from linearity for the dose-range from 0-0.5 kr (λ=0.70), while there is a high degree of significance for the linear term (F=6.60). The experimental points can be fitted by the equation y = 0.971+1.16 x (γ-translocation frequency in percentage, x = exposure in kr). Results of work using γ- and neutron radiation are considered. It appears that in the low dose-range, neutrons are much more efficient in the production of two-break chromosome aberrations than x- and γ-rays.


Virgin females were aged from 1-29 d before exposure to 1000 r of γ-radiation. Yellow body (y) was used as the non-disjunction marker on the X chromosome. There was a 7-fold increase in the frequency of exceptional flies among the progeny of irradiated females compared with the controls. There is no evidence of an increased rate of non-disjunction with aging in the absence of radiation. In the irradiated series there is a positive correlation between the rate of non-disjunction and maternal age. (Auth.)

**Wolff, S. CHROMOSOME BREAKS INDUCED BY RADIATION IN Drosophila.** *Genetics,** 37 (1949) 580-588.

**Wolff, S. CHROMOSOME BREAKS INDUCED BY RADIATION IN Drosophila.** *Genetics,** 37 (1949) 580-588.

**Wolff, S. THEORETICAL KI S.** p. 60-1 in "Research and Development of Technical Information" Expressions for the yield of these give very good fits to the data in the intermediate range. (Auth.)

**Zimmerman, S. GENETIC STUDY OF CROSSTANDING IN Drosophila melanogaster.** *Genetics,* 51 (1965) 409-413. Evidence is presented that x-t stage in spermatocytes D. melanogaster female progeny that received a crossover and the other
MANY NON-DISTRIBUTION OF X-

A second genetic effect observed under the
unusual conditions previously used was fol-
lowed up for a longer period of time. The
experiment was designed to study the
alleles of the X-chromosomes.

ACTIONS OF THE X-CHROMOSOMES

ON TRANSLATION FREQUENCY IN
In J. Rad. Biol. 7, 4 (1985)

Some germ-cell stage available in
the testis of the normal mouse,
the dose-range from 0-5.5
from (Fe-100). The experimen-
tal frequency in percentage, x
sensed, it appears that in the low
break chromosome aberrations

THE RATE OF NON-DISTRIBUTION

-5.5:

radiation. Yellow body (Y) was used
leuk cell increase in the frequency of
the controls. There is no evi-
dence of radiation, in the irradiated
and normal ages. (Auth.)

In the irradiated

studies on the viability of irradiated
were defined, and a search was
made for cases in which the chromo-
osome is found to be unique
abilities, but there is no evi-
dence that the tests involving the X-
chromosome assignment. (NBA 17:1965,

1986

Wolff, S. CHROMOSOME BREAKAGE AND REJOINING IN IRADIATED SPERM OF Drosophila. (Abstr.)

Genetics 45, 6 (1960) 540.

1986


Cells were either labelled by a short treatment with H2-thymidine and then x-rayed, or x-rayed and sub-
sequently labelled. Cells were sampled as they reached metaphase at successively later times and scored for the type of chromosome or chromatin of aberration present and whether labelled. The fact that the chromo-
some breaks as though double in the very early part of DNA synthesis even though the majority of the DNA is not added to the chromosome until later suggests that the protein moiety rather than the nucl
cide acid contributes to the linear continuity. Experiments in which attempts had been made to label the chromosomal proteins during duplication were unsuccessful because labelled amino acids are incorporated into nuclear proteins throughout interphase, making it impossible to distinguish those cells in which the protein was doubled.

1987


Expressions for the yield of two-hit exchanges have been derived. The theoretically expected values from these give very good fits to existing Trademonti, Drosophila, and human chromosome data without necessitating the incorporation of extraneous factors to account for the shape of the curves.

 bibitem 6. GENETIC EVIDENCE OF X-RAY-INDUCED EXCHANGES OCCURRING AT A FOUR-
STRAND STAGE IN Drosophila SPERMATOCTYES. J. Hered. 52 (1961) 294-6.

Evidence is presented that x-ray-induced exchanges between X and Y chromosomes occur at a 4-strand stage in spermatoocytes. The evidence consists of the recovery of certain exceptional female progeny that received both of their X chromosomes from the irradiated male parent, one of these being a crossover and the other a non-crossover chromosome.

160 x-autosomal translocations has been obtained of which 78 are T(X; Y) 58 T(X; Y) 58 T(X; Y).

Our cytological studies are now under way to determine whether a correlation can be found between the break-points on the chromosomes and sterility. Evidence from these studies will lead to the hypothesis that any interruption in the continuity of the X-chromosome would lead to sterility. This has not been con-

confirmed by the analysis of half of the sample of translocations.

The x-irradiation response of primary spermatoocytes of the immature testes of D. melanogaster was investigated employing a genetic scheme which made possible an immediately classifiable distinction in the offspring between nonfunction of X and Y, and exchange between X and Y in the treated male. (NIA 18:1963, 5547)

See also:

109 Territorial and fresh-water ecology — radiation effects on Chiroxysma sensus. (Auerbach, 1965)
121 Radiotoxic effects on biota. (Monton, 1961)
122 Radiation effects on biota — estimated radiation dose received by Dippera with life stages in bottom sediments. (Monton, 1965)
177 Radiocarbons and the genetic mechanism: cytophysics and genetics of alienated metals in nucleic and chromosomes. (Steifened and LaCharme, 1960)
479 Cytogenetic studies of x-ray and intact induced sex-linked recessive lethals in Drosophila melanogaster. (Wako, 1969)
753 Endocrine radiation and the induction of chromosome mutations in the germ cells. (Ray-Chaudhuri, 1961)
760 The effects of radiations on the genetic systems of organisms in relation to their physiological and biochemical systems. (Auerbach, 1965)
770 The induction of mutations in spermatoocytes of Drosophila melanogaster with x-rays. (Chudley, 1962)
787 Genetic and direct effects of gamma radiation on Drosophila. (Tien, 1965)
824 The role of recovery mechanism and oxygen effects upon changes in radiation sensitivity in sperm treated in mature males and fertilized females of Drosophila. (Alexander, 1965)
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892 The correlation between radiation-induced male sterility and reciprocal translocation in Drosophila. (Lindsley et al., 1960)
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1092 Effects of x-ray irradiation in Drosophila virilis at different stages of spermogenesis. (Clayton, 1962)
1093 A cytogenetic study of the effects of x-irradiation on Aeolus aegypti. (Rai, 1963)
1097 The relation between the rate of induced translocations and treated cell stages in flies of Drosophila melanogaster. (Savages, 1969)
1098 The relation between x-ray sensitivity and stages of development of treated cells in spermatids and spermogonia of Drosophila melanogaster. (Savages, 1969)
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1385 Chromosomal aberrations level environmental radi (Rai, 1963)
1390 Chromosomal polymorphi (Rai, 1963)

"Immediate" effects appear as cell death. Neurogenesis (growth) of richness appears to depend on earlier the stage, the smaller the low doses. Irradiation-induced in cells occurs completely. Chroma ability of a cell to survive functionally...
NITROGEN-TREATMENT EFFECTS ON MEIOSIS-INDUCED PATTERNS IN DROSOPHILA MELANOGASTER.

(FAULK, 1968/3)

ABER AND MIXING AS PROTECTION AGAINST RADIATION-INDUCED CHROMOSOME ABERRATIONS IN DROSOPHILA.

(MÜLLER, 1965)

DIFFERENTIAL EFFECTS OF RADIATION ON THE FIRST AND SECOND MEISSES OF DROSOPHILA MELANOGASTER.

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THE GENETICAL RESPONSE OF DROSOPHILA SPERMATOCYTES TO DIFFERENT TYPES OF RADIATION TREATMENT.

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(MARTIN, 1962)

X-RAY-INDUCED CHROMOSOME ABERRATIONS IN DROSOPHILA MELANOGASTER.

(MILLER, 1965)

METASOMAL MALFUNCTION IN DROSOPHILA MELANOGASTER.

(CARTER, 1962)

THE IMMEDIATE CYTOLOGICAL EFFECTS OF IONIZING RADIATIONS.

(CARTER, 1962/3)

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(CARTER, 1962/3)

THE IMMEDIATE CYTOLOGICAL EFFECTS OF IONIZING RADIATIONS.

(CARTER, 1962/3)
Review article. Since Choristoneura fumiferana De Geer has no diapause it is a particularly convenient grasshopper. Interest has been centred on nuclear mitosis and on the effects of different kinds of radiation on mitosis and on the structure and behaviour of various parts of the dividing cell. The techniques described can be adapted to different kinds of radiation. In X- and γ-ray experiments the cells may be irradiated within the intact egg chorion and made into a hanging-drop preparation selected interval of time later, or they may be irradiated in a hanging-drop. For α-particles it is necessary to substitute thin mica for the cover glass. For γ-irradiation the embryo is orientated with the ventral side downward against a rubber hydrochloride membrane forming the bottom of a small dish containing culture medium and treated by inserting a 100 μm Bakelite plate beneath it. After irradiation the embryo is mounted in a hanging-drop for observation. For ultraviolet radiation a quartz cover is substituted for the glass cover, and the mica sheets on one side of the midventral line of the embryo are shielded with film or black paper to serve as controls. The advantages and shortcomings of the method are described, also the effects of ionizing and ultraviolet radiations. 26 references.


Review article. Results obtained with Drosophila, Drosophila, and Habronema are emphasized, with references made to relevant data on Hymenoptera, Apis, Silvia, and Bombus. As the basis for comparison between stages and species, radiation-induced dominant lethal rates are used, whereas available evidence to broadly divided into sections on spermatogenesis, and oogenesis, with some mention of the oxygen effect in a brief paragraph at the end. Close on 82 references are given, ranging from 1932 to 1961.


Mutations in the chromosomes of non-irradiated ova of Drosophila fertilized with male gametes in non-irradiated chromosomes suggest a possible prolonged preservation and transmission of energy from one structure to another. The effect is not peculiar to the particular structure of the chromosome whose mutations occur. Contrary to observations on irradiated chromosomes, the effect (which had been subjected to 2300 r, 336-334 r/min X-rays) is greater when sperm rather than spermatids have been irradiated. The general effect of radiation (sum of mutation frequencies in irradiated and non-irradiated chromosomes) is the same for irradiation of sperm or spermatids.


The frequency of dominant lethals on repeated irradiation of Drosophila sperm and spermatids was studied to elucidate the reversibility of physiological damage and the mutagenic effects of repeated low dose radiation. Male flies of Algerian and Teared mosaic (544 old) received (1) 2500 r in one dose or 3x800 r at 1/2 h intervals, and (2) 400 r and 1200 r in a single dose or 3x400 r at 1 h intervals. In (1), since no difference was discerned between single and repeated doses, the initial dose interval was increased to 3 h and the doses were changed to 1200 r maximum and 400 r minimum. As anticipated, repeated radiation did not affect the frequency of dominant lethals to the sperm. In spermatids the rate fell by 4.6%, suggesting recovery of the damaged chromosomes. The absence of effect after repeated radiation is not considered a decisive refutation of Russell's hypothesis. A linear relationship between dose and the frequency of dominant lethals is shown to exist up to 1000 r, and the similarity in the frequency pattern of dominant and recessive lethals is pointed out. The spontaneous spermatid mutation rate ratio increases with dose reduction, changing from 5.4 to 1000 r to 3.5 at 400 r and to 2.5 at 20 r. Small doses exert, therefore, a large effect on spermatids. These effects are discussed in relation to cell size and the length of the various stages of spermatogenesis. The danger of damage during very short, but highly radioactive stages is emphasized. There are 3 tables. (Auth.)

Moulting in the insect Rhodius, under Hemiptera, is initiated by a single meal of blood. After the meal, and in response to a stretching stimulus from the abdomen, mesenchymal cells of the insect brain produce a hormone that activates the cockroach gland, which produces the moulting hormone. Whole-body irradiation was found to delay initiation of division in nymphs. Exposure of 2000 r from a 5-MeV X-ray machine was given. Results of studies on 6th-stage nymphs irradiated over the abdomen only indicate the spontaneous reversal of a portion of the latent radiation damage. Reaction mechanisms involved are discussed.


To determine the precise relationship between the delayed expression of radiation injury and the time of onset of post-irradiation cell divisions, the effects of irradiation on the epidermal cells of the body-sucking insect Rhodius are being studied. Cell divisions in the epidermis underlying the outer cuticle of this insect occurs only at 6 after feeding on blood and the divisions are essentially synchronous throughout the whole epidermal layer. Thus it is possible to irradiate in the non-dividing state and then force the cell divisions to occur at any desired time after the exposure by allowing the insect to feed. (From abstract.)


In Drosophila, most of the embryonic deaths from x-irradiation of the sperm occur during the first few mitotic divisions after fertilization. An easily recognizable syndrome follows: Numerous (usually 8 to 16, although the range is from 5 to about 100) polyplid nuclei are found throughout the egg. Many of the nuclei appear to be lying in epidermis with chromosomes disaccomplished. It has been shown that this type of death cannot be accounted for by loss of chromosomes, inactivation of motile, nor by loss of chromosome parts. The author believes that chromosomebridges, derived either by radiation or genetically, act not through eventual loss of essential genes by bridge-breakage, but by drastic slowing of the rate of mitosis. Unidentified Drosophila eggs will not proceed in development as far as eggs fertilized with irradiated sperm. This indicates against the possibility that eggs fertilized by irradiated sperm behave like fertilized eggs. (From abstract.)


A dose of 500 r was chosen since it approximates the 50% hatchability dose of eggs in the 1st mitotic metaphase in the female. Eggs older than 1 min from oviposition were discarded. To slow down the rate of nuclear division the embryos were kept at 22°C until irradiated. Control embryos were fixed in cold Kahle's fixative and stained to permit accurate cytological staging. Each embryo was timed to within 1 min. Data were collected for metaphase I of meiosis, anaphase I through anaphase II of mitosis, prophase I of mitosis, prophase I of meiosis, and later stages.


After reviewing reported radiation effects on (pre-oviposition) eggs the authors describe radiation effects of a dose of 500 r administered post-oviposition. Problems related to stage sensitivity during meiosis and during haplonts are discussed, also genetically non-transmissible damage and a "nuclear re-activation" effect, demonstrated with ultraviolet radiation. Five types of nuclear damage can be distinguished: (I) death after one or several nuclear divisions; (II and III - death after numerous nuclear divisions; (IV - death and yonotism soon after irradiation; V - dominant lethality expressed in eggs after irradiation in the gonial stage). The symptoms and probable basis for such damages are discussed.

The proposed study will consist of these main projects: Electron microscope studies of the early morphological effects of x-rays on the internal structure of the chromosomes. Grasshopper oocytes will be fixed at different time intervals up to 2 h after x-rays to discover whether changes in the internal structure of the chromosome can be detected. Studies to determine whether recovery from x-ray-induced chromosome damage is accompanied by DNA synthesis. Selected neuroblasts will be incubated in vivo in any of 15-20 identifiable stages of the mitotic cycle, exposed to radioactive precursors at a desired stage for a given length of time, fixed and made into squash preparations when they are in the desired stage, and autoradiographed. Effects of certain wavelengths of monochromatic uv radiation on incorporation of tritiated precursors into the grasshopper neural stem. The methods used will be similar to those of the preceding project. In addition to DNA synthesis, it is our intention to study also protein synthesis by means of radioactive precursors.


Freshly colored males were given 1000 x-rays and then mated continuously with 2 females/male/d. Mating on days 3, 6, 8 and 11 from irradiation were analysed for dominant lethals, translocations, autosome and sex-linked recessive lethals, delayed X's and induced crossing over. Day 3 showed the peak sensitivity for translocations and recessive lethals. There was a plateau including days 4 and 9 for dominant lethals. Day 8 showed the peak sensitivity for delayed X's and for induced crossing over which in the latter case continued at a high level subsequently. A low incidence of crossing over on days 6 and 7 indicates that these must represent a diploid stage (probably spermatocytes) at irradiation. It is thus possible to identify the main sampling times with the irradiated stages than being sampled: day 2 - mature sperm; day 3 - early spermatids; day 5 - early spermatogonia; day 8 - spermatogonia; day 11 - spermatogonia. (Auth. sum.)


The sequence of meiotic divisions, the fusions usually being resolved into the normal, equal, and unequal, has been demonstrated to be inverted in a mealybug, using triploid females. Such females were prepared routinely by irradiating adult males with 50000 r per day (Co-60). At first anaphase in the triploid there was always a 15:15 separation of chromatin the diffuse nature of the microchromosome persists such a linearly equal separation. Reduction is accomplished in the 2nd division in which there is evidence for reassortment or "secondary pairing" of the homologous chromatic into triads or dyads in most of the octads. The maternal contribution to the egg following MIV/MV S fertilization was studied in 572 embryos. There was a significant bias in distribution in favor of lower chromosome numbers. It is suggested that the bias is probably real, and based on a definite tendency of triploid mother to deliver fewer chromosomes to the egg than to the second polar body.


Dominant lethals and translocations from x-ray exposure of larvae, pupae, and adults were determined for successive 2-d matting periods. Results indicated that spermatids are highly susceptible to radiation damage, and that spermatozoa and mature-spermatogonia are also sensitive periods, with greater resistance to chromosome breaks among spermatogonia. Histological analysis of testes collected at intervals following irradiation of larvae, pupae, and adults revealed decreases in all types of meiotic cells followed by recovery to the control level in some tests. Radiation by 10X r resulted in delay in emergence of adults by 1-2 d. Phase-contrast microscopy, acetocacetic smear, and histological analysis of sections from adult males were used for studying spermatogenesis. Cell counts from adults indicate a 3-d cycle in meiosis until the males are sexually mature. There appear to be steadily diminishing peaks in the mean numbers of primary spermatogonia in pupae just before emergence, and in adults of 2, 4, and 6 d. Spermatogonia of D. virilis are not motile or functional until the 8th day; females were not inseminated and no fertile eggs recovered prior to this.

scope studies of the early morpho-


Differential patterns of mutational response to γ-rays were determined for 3 types of young, adult, heterozygous, Oregon-R males which were exposed continuously during days 1 to 15 after irradiation. Dose of 50 r, 100 r, and 2 kr were tested for the production of dominant visible and sex-linked larval-pupal mutations, and 2 kr for X and autosomal translocations. Translocations were also scored in sets of irradiated mature sperm, and of sperm maturing 6 to 6 days later, after doses of 250 r, 500 r, 2 kr and 4 kr. A linear relationship with dose is indicated for the rates of all types of induced point mutations in sperm from days 1 to 6. In pre-maturation stages of spermatogenesis, the relationship varies between dosage levels and between the types of heterozygous males tested. After 1 kr, day-6 sperm showed 5.7 times more sex-linked mutations than appeared in sperm from days 1 and 2-5 and day-6 sperm showed 11.6 times more translocations. Changes in mutation frequency (days 1-5) thus appear to reflect changes in the rate at which both point mutations and chromosome rearrangements occur in the various stages of spermatogenesis from meiosis to maturity. The rate of translocations increases at —1.6 power of the increase in dose in both mature sperm and sperm maturing 6-6 days after irradiation, and the rate of point mutations increases slowly at both of these times to produce an increase in translocation frequency. It supports the view that the mutation processes do not change during the meiosis-to-maturation period of spermatogenesis. At the time of peak response in autosomal-spermogenesis, as well as in mature sperm, after 250 r to 1 kr, dominant visible appear to be a mixture of point and position-effect mutations. Peak mutation rates appear to be associated with specific stages in spermatogenesis. (From auth. summary)


The relative radiosensitivity in different stages of spermatogenesis in D. melanogaster was investigated by studying the sensitivity pattern for different kinds of mutations, i.e. visible, sex-linked lethals, II-III translocations, and inserted crossovers in males. The time required for spermatogenesis, i.e. the time from meiosis to fully mature sperm was considered to be about 6-7 d at 22°C in adult males. The following peaks in frequency were obtained, stated as number of days after irradiation: recessive sex-linked lethals = 8 or 9 translocations; visible = 5-6 days of excessive mortality (under experimental conditions) = 7-8, and 9-10.

The radiosensitivity of fully mature sperm was seen to be somewhat higher than that of newly mature sperm. With further maturity as increasing sensitivity was observed for all effects studied up to 6 and 8.


Irradiation of Drosophila males may produce a shift in the ratios of the different genotypes recovered among the progeny. A method was developed for treating progeny strains following paternal irradiation as the ratio of two survival functions, where survival relates to the ability of a mature sperm of a particular genotype to produce an adult fly in the next generation. Although chromosome loss and among-experiment variability contribute proportion to the model as it stands, the following tentative conclusions were drawn: (1) the mating of X-bearing sperm and Y-bearing sperm exhibits virtually identical sensitivities to radiation, and sperm with two sex chromosomes are more sensitive than sperm with one sex chromosome which are in turn more sensitive than sperm lacking a sex chromosome. The position of the proximal heterochromatin lying between the right breakpoints of In(1)sc4 and In(1)sc7 is the effect on the sensitivity of X-bearing sperm when it is in its normal proximal position, but when it is shifted to the distal terminus of the X chromosome, as it is in In(1)sc6 or In(1)sc7, it causes an increase in the sensitivity of the X-bearing sperm. Cloning the X chromosome, i.e. using a ring-shaped X, causes a large increase in the sensitivity of X-bearing sperm. (Auth.)


In irradiation experiments, young 2nd instar males were placed in gelatin capsules and treated with 1000 r, x-rays, at 4 r/min. They were fixed 41 h later. Observations were made by phase microscope during actual cell division, as well as on stained and mounted squash preparations. Examination of the 1st spermatogonial division of the mealy bug. P. citri (Linn.), a lecanoid coelocist, has revealed histone unknown
spindle activity of the euchromatic set of chromosomes during anaphase II. An initial large half spindle elaborated by the hetero-chromatic chromosomes in early metaphase, gave way to a less pronounced, but clearly visible bipolar spindle involving both sets of chromosomes at early anaphase. There is no lengthening of the spindle or cell, but the separation of the chromosomes occurs around the periphery of the cell with the aid of interzonal activity. The activity participation of the euchromatic chromosomes during the separation is furthermore inferred by the formation of bridges resulting from euchromatic-hetero-chromatic translocations. (Auth.)

1014 Barry, R.J. A COMPARISON OF GERM CELLS OF Drosophila. p.104

This study has attempted to provide data for the evaluation of male germ cells. The zygotes were derived from irradiated white-motted females. The results indicate an excess in the occurrence of abnormal chromosomes in the larvae of white-mottled females fed to a sterile medium. The larvae were reared on sterile food and their chromosomes were analyzed. The abnormalities were found to be present in the euchromatic regions of the chromosomes. (Preliminary report)

1015 Sato, T. HISTOLOGICAL STUDY OF SILKWORM. p.198-200, 1969

The correlation between the vegetative stages and the development of each stage was examined in order to determine the relationship between the two processes. It was found that the vegetative stages are regulated by the same factors that control the developmental stages. (Preliminary report)

1016 Sato, T. SPERMATOGENIC STELLITY. p. 208-210, 1969

The correlation between the vegetative stages and the development of each stage was examined in order to determine the relationship between the two processes. It was found that the vegetative stages are regulated by the same factors that control the developmental stages. (Preliminary report)
effect was replaced by a great increase in mitotic activity. Twelve bous after irradiation, the larvae exposed to 800 and 1000 r showed about twice as many mitotic figures as did the unirradiated material. The increase in mitotic activity at higher doses was less extreme and took longer to occur. Among the chromosomal aberrations noted were deletions, inversions, exchanges, rings, and interchanges in the 3rd chromosome region. Explanations for the induction of these aberrations were discussed. A relation existed between the dose received and the developmental stage at which an individual died. The higher the dose, the earlier the death occurred. Furthermore, 250 r or more resulted in almost 100% mortality. Some possible causes of x-ray-induced mutations and changes in fertility were suggested. (Auct.)

1014 REITZ, R.J. A COMPARISON OF MUTATION RATES IN MALE AND FEMALE PRE- AND POSTMETIC

This study has attempted to determine whether the mutation rates of the yellow (y), white (w), split (sp), and roll (r) loci contained in the white-in-7th-4 (w*7th4) chromosomes are comparable in male and female germ cells. The work reported here is based upon the examination of 246 106 F2 of both sexes derived from irradiated w*7th4 males and 229 006 F2 of both sexes derived from irradiated w*7th4 females. White-in-7th-4 parents were mated to y w sp fl flies following exposure to 3000 r and the progeny were scored for the occurrence of viable and lethal mutations. The parents were subjected to new media every three days for a maximum of 34 d. A comparison of the mutation rate in the X chromosome of y, w and Y-mutation in yw whereas mos mutations (w*7th4) mutants were found in sperm. A comparable number of mutations was found in the progeny of irradiated males and females. In the period 4-12 d after irradiation, an excess of all types of mutations was found in spermatocytes. The correlation between the developmental stages of larvae and the germ cell stages in the tests was investigated in order to obtain basic knowledge required for management work with the silkworm. The duration of each stage in spermatogenesises of the silkworm was estimated from the time table of the larval appearence of cells in successive stages. It was noted that meiotic prophase takes about 10 d but late meiotic stages proceed within a short time. Results of the histological examinations of irradiated testes of the silkworm were in agreement with those of previous workers on different animals, showing an extreme sensitivity of secondary spermatogonias to the killing effect of x-rays. Spermatocytes at late meiotic stages were shown to be more sensitive to irradiation than those in embryonic and prophase stages. In the silkworm sterility due to the destruction of late spermatogonias is not detectable, even though the cells are, killed by irradiation. Pronounced sterility after irradiation in the early 5th instar occurs as a result of damage to late meiotic stages, especially in late prophase. These findings have been discussed in relation to similar ones in mice and Drosophila, and it has been shown that a consistent picture of radiation-induced sterility in animals can be inferred.


1016 SADO, T. SPERMATOGENESIS OF THE SILKWORM AND ITS BEARING ON THE RADIATION-INDUCED

1017 SAVHAGN, R. THE RELATION BETWEEN THE RATE OF INDUCED TRANSLocations AND TREATED

The present paper deals with the relation between induced translocations and the treated cell stages in Drosophila males. By use of a dual-purpose stock it was possible to study the frequency of induced XYO females in F2 and the rate of induced translocations in F2. The observed frequency of induced XYO females parallels very well earlier studies with induced XXY males and induced non-disjuctions between the paternal X and Y chromosomes. The occurrence of non-disjuctions females was used as an indication of cells treated prior to anaphase I. It was shown that the frequency of induced translocations varies with the mating period, which, according to the brood technique, represent successively younger germ cells. The peak of translocations was observed on the 5th day after irradiation. It is suggested that the cells which become available for inactivation during this mating period chiefly correspond to cells treated as early spermatocytes. Germ cells irradiated during early melon (prior to anaphase I) yield few translocations (98

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day after treatment). The reduction in the rate of induced translocations is even more pronounced on the 10th or 16th day after irradiation. It is evident that there exists a difference in the observed pattern of sensitivity to irradiation when different types of aberrations are used as an indication of induced genetic damage. No effect is observed upon the rate of induced translocations when the dose is delivered in two fractions with an interval of 1 h. Thus an interval of 1 h was not long enough to slow rejoining of chromatids breaks giving rise to translocations. (Auth.)


By using a dual-purpose stock it was possible to study the frequency of induced XO males and induced non-disjunction between the paternal X and Y chromosomes in Drosophila after 0 to 3 and 6-8-day-old y^+ y y^+ males were irradiated (1100 r) and mated to virgin y w^+ females in successive mating periods. The first mating period was delimited to 0 to 6 h after irradiation but from the 4th day and on each mating period consisted of 6 h. It is shown that irradiation of Drosophila males causes non-disjunction between the paternal X and Y chromosomes. Hence, the occurrence of an increase in the frequency of non-disjunction in sperm ejaculated during a limited period after irradiation must be taken as an indication that those spermatogonia were in mitosis at the time of treatment. Factors which may influence this cell stage/sensitivity relationship are discussed. (Auth.)


By simultaneous studies of paternal non-disjunction and a certain type of chromosome aberration in Drosophila the brood pattern was correlated with the early meiotic stages in spermatogenesis, prior to meiosis I. It was shown that the cells treated in meiosis became available for insemination during the 7-10 day after irradiation. The peak of sensitivity to irradiation measured through induced XO males of KOC females, coincides with the peaks of induced paternal non-disjunction and thus with cells treated in early meiosis. About the same sensitivity pattern is obtained after irradiation of 0-1 and 2-4-0-old males. There is, however, a difference in the amplitude of sensitivity. Thus the frequency of both XO males and induced non-disjunction females is much lower in experiments with 3-4-0-old males. When comparing the different methods used in order to demonstrate the genetic effects (damage) of irradiation it is evident that there is not only a marked difference in sensitivity to irradiation between various stages of spermatogenesis in Drosophila, but also a difference in sensitivity pattern depending on the type of aberration studied. Hence the differences in the sensitivity pattern reflect the relationship between the mechanisms at work in producing different kinds of damage and the cell stage treated. The relationship between induced genetic changes and oxygen concentration in various stages of spermatogenesis was studied. The effect after irradiation in nitrogen atmosphere reveals that medium exerts the most striking influence upon the yield of XO males during the period of highest sensitivity to x-irradiation. Irradiation in commercial oxygen affects the sensitivity stages in different ways in 0-1 and 3-4-0-old males. In the younger males there is a lower effect than that obtained after irradiation in air, while in 3-4-0-old males there is a correspondingly higher rate of chromosomal losses. (Auth.)

1000 Schmidt, W. DIFFERENTIAL SUSCEPTIBILITY OF SPERM AND SPERMATIDS TO IONIZING RADIATIONS. Amer. Nat. 98 (1964) 103-11.

A hypothesis is offered to explain the differential susceptibility of sperm and spermatids to ionizing radiations. In Drosophila, a given x-ray dose causes up to several times more genetic mutations in spermatids than in sperm. Further, the two kinds of cells show different dose-effect curves, react differently to changes in the oxygen tension during x-irradiation, but behave very similarly to neutron irradiation. In sperm the condensed chromosomes are packed tightly together in the small sperm heads, while the chromosomes of spermatids, located in regular nuclei, are separated from each other by some space within the cytoplasm. The proposed hypothesis assumes that the different secondary radiobiological products of ionization occurring in the immediate neighborhood of the chromosomes cause a considerable amount of chromosomal damage, in addition to the effects due to ionizations occurring within the structures of the chromosomes themselves. The additional space present around the chromosomes of spermatids as in most other types of cells but is practically missing in the exceptional cell-type represented by sperm. Various differences in the reaction of spermatids and sperm may thus be explained. (From author's summary)


Sensitivity of D. melanogaster structural changes found in mutants. The generality of sex-linked lethals. Assess the well-known part to spermatogenesis. This ov spermatogonia varies both in or absence of spermiogenesis.

Sensitivity of D. melanogaster male germ-cells to chromosome breakage by X-rays was measured by the structural changes found in the salivary gland chromosomes of larvae from irradiated females and untreated mothers. The genetical effectiveness of irradiation on the same males was measured by the frequency of sex-linked lethals. Assayed by the overall percentage of germ-cells carrying structural changes, sensitivity follows the well-known pattern: it is highest in spermatids and decreases over spermatogonia and spermatocytes to spermatozonia. This overall sensitivity was analyzed on three levels. The fact that the sensitivity of spermatogonia varies both between and within individual males was tentatively attributed to the presence or absence of spermatogonial clusters. (Auth.)


A preliminary account is given of experiments designed to detect simultaneously complete loss of X or Y chromosomes, deletion in the Y chromosome, and non-disjunction between X and Y chromosomes. A new, doubly marked Y chromosome stock designated cy-59F is used. After X-irradiation with 1000 r, males with a wild-type X chromosome and the doubly marked Y are mated daily to 3 females homozygous for the X chromosome marked yellow, spicile, ochreus. On the assumption that the determination of non-disjunction will occur only at or before meiosis in the first meiotic division, the results indicate that the 7th brood in particular represents treated pre-meiotic stages and confirm the high sensitivity of meiotic and immediately pre-meiotic stages to the mutagenic effect of X-rays. (NIA 16: 1962, 211)


Males carrying the dominant bar (B) marker on the Y chromosome are X-rayed (800 r) and then mated fresh to virgin bar-reverted 9°-2 sex (modified Muller-2) females on each of the 12 following irradiation. Assuming that this brood order reflects inversely the sequence and duration of the individual stages in spermatogenesis, the experimental method permits simultaneous detection of sex-linked recessive lethals, sex chromosomes loss and primary non-disjunction of the sex chromosomes involved in male germ cells which were at different phases in the meiotic cycle at the time of irradiation. If the onset of induced primary non-disjunction is accepted as a cessation of irradiated primary spermatogonia, the results confirm earlier findings that hypersensitivity to the induction of sex-linked recessive lethals occurs in the pre-meiotic spermatid stage while peak sensitivity for sex-chromosome loss occurs in spermatocytes. (Auth.)


The criteria employed in the comparison of irradiation effects were fertility, fecundity, dominant lethals, and recessive mutations at marked loci with genes that express their action at very early stages of the life cycle. The results are mostly consistent with existing data on Drosophila and mouse. However, extreme fertility was observed when germ cells were (X)-irradiated at late meiotic prophase (see effects on late spermatogenesis in mice). Two types of dose-rate dependence in radiation-induced mutation rate occurred at different stages of early larval development. The technique used allowed mutants to be detected at very early stages of embryological development. It appears that some, chromosomal aberrations reduce the detectability of stable mutations in later stages of development. The second peak in mutation frequency occurred around the time of matching, in both sexes, when almost all germ cells are presumably in the primordial stage. (It should be noted that it is characteristic of somatic mutagen that all germ cells develop almost synchronously)


In order to elucidate the difference in sex with respect to mutation response of silkworm germ cells, experiments were carried out on silkworms. The dose-mutation frequency relationship was followed up by irradiating spermatogonia and oogonia with acute (315-355 r/min) or chronic (0.069-0.208 r/min)
Irradiation at the earlier larval stage. The shape of the dose-frequency curve was different between spermatagonia and oogonia. In oogonia a linear relationship was clearly observed for both acute and chronic irradiation, while in spermatagonia the frequencies for acute and chronic exposures increased with the increase of dose more rapidly than expected for linearity. The dose rate difference becoming smaller in the high dose range. Therefore, when irradiated germ cells were pooled, the frequency distribution of the number of recovered mutants per mating pair. Comparison in LD50 between spermatagonia and oogonia clearly showed that spermatagonia are twice as sensitive to radiation as oogonia. It was concluded that the dose-rate dependence of radiosensitive mutation rate is closely correlated to the killing effect of irradiation, and hence to the instability of germ cells. The significance of these phenomena in the process of recovery of primary mutational damage is discussed. (NBA 19: 1968, 1105)


In males of Drosophila, normal chromosomes paired with inversed chromosomes have shown higher rates of spontaneous and X-ray induced mutation than isogenic controls. This difference in mutability is most striking in certain stages, where its magnitude after irradiation implies a synergistic interaction of treatment and the genetic constitution. The effect is limited to those chromosomes which structural heterozygosity exists. Two alternative hypotheses toward an underlying mechanism of increased instability have been advanced: an effect of stress or condition associated with invesion-pairing configurations, and an effect of the partial asynapsis that must accompany structural heterozygosity. A test of the effect of asynapsis without condition is made possible by the use of SMS, a complex intrachromosomal recombination having 13 inversions or transposition breaks, which does not pair appreciably with its homologue. Preliminary results indicate high mutability of the asynapsed homologue of SMS and suggest that homologous pairing itself is an important factor in mutation, presumably by some facilitation of repair.


From analyses of salivary gland configurations and patterns of non-disjunction, it is estimated that highly rearranged leonard multiple 5 (SMS) chromosomes do not pair consistently with its homologue. The frequency of chromosome II lethal mutations was significantly higher among sperm from asynaptic SMS/+ males (19.9%) than among sperm from control males (6.0%) 6-8 days after treatment with 1000 r of X-rays. These sperm batches are interpreted as having been in or near meiosis at the time of irradiation. This sensitivity of SMS/+ males was found not to extend to the X chromosome after irradiation indicating that such males do not have an inherently high mutability. The rate of spermatogonial or sperm mutation in SMS/+ males and control males was compared by scoring induced crossover, fecundity and egg hatchability during single-day mating periods after irradiation. No difference in the pattern of these effects was observed, but that the maturation time of both groups of males is apparently the same. The interpretation that asynapsis is an important factor during meiosis is supported by these findings. It is suggested that during meiosis the synthesis of homologous chromosomes favors the repair of chromosome discontinuities over the formation of reattachments, and that asynapsis may greatly increase the frequency of lethal mutations. (Abbrev. summary)


Increases in the mutability of unpaired chromosomes have led to the interpretation that the synapsis of homologous chromosomes is a major factor in the repair of radiation induced chromosomal damage. This hypothesis is substantiated by the present data on the production of dominant lethals among males in which complex structural heterozygosity (presence of multiple inversion SMS) has created partial total asynapsis of one major pair of chromosomes. Egg development among 1-d broods from such males after X-ray treatment gave evidence of an appreciable increase in dominant lethals of mosaic origin. In comparison with males lacking structural heterozygosity. The blood pattern of dominant lethals from irradiated control males shows a plateau of maximum frequency from early meioses to spermatogonial stages, i.e., among sperm sampled from the 5th to the 5th day after irradiation. Broods from irradiated SMS males gave similar frequencies for premosotic and postmosotic stages, including the 5th and 10th brood periods, but during days 8-11 about twice as many dominant lethals were scored among these lines. If dominant lethals may be expected to have highly aberrant recombination or loss of chromosome fragments, asynapsis appears to contribute markedly to gross genetic damage during meiosis.


The extreme differences in scale or proportions as measured by dop previously published. This study was performed by methods of testing were used. 2500 for prophase, 80% giving the percentage of visible mutations was 1.12 for prophase. Difference not significant.

1336 Wiegler, F.E., Udick, H., AND EARLY DEVELOPMENT IN NEW Genetic Radiation Damage. S in one set of experiments eggs were maintained at 24.5 °C from ory; embryonic mortality during the response of embryos of varying length at the time of hatching in the embryos treated (same) for Hahnow death—death before gastrulation. Dose—effect curves were reported death at an initial slope at the same region in which the fit embryonic mortality (the more or different symptoms of lethality. See also:

760 Dependence of the incised Drosophila upon dose of X-rays. (1937)
760-60 The effects of irradiation upon biochemical systems. (1940)
764 Effects of X-rays on diet and oxygenation in relation to the induction of cancer (1962)
771 Developmental-genetic. (Clayton, 1963)
785 The reported Drosophila. Induction of mutagens and the induction of mutagens in the Drosophila. (1963)
814 Studies on the genetic effects of silk worm. (1940)
815 X-ray induced "dominate" between complements of r.a. populations. (1962)
820 X-ray induced "dominate" stages between incompatibility. (1963)
825 The relatively high frequency that Drosophila sperm. (A)
838 X-ray induced sex-linked. (Crose, 1983)
853 Structure of "yellow" in Drosophila melanogaster.

The extreme difference in sensitivity to x-rays of Habroboma eggs irradiated in first meiotic metaphase or prophase as measured by dominant and recessive lethal mutations has been established by studies previously published. This difference has now been found to apply to visible mutations as well. Two methods of testing were used: (a) the same dose, 1100 r, for both stages and (b) 1100 r for metaphase and 25,000 r for prophase, doses giving comparable lethal rates. After 1100 r, for eggs exposed in metaphase, percentage of visible mutations was 8.25, for those exposed in prophase, 0.48. After 25,000 r, percentage was 6.10 for prophase. Difference between 1st and 2nd percentages is significant, between 1st and 3rd, not significant.


In one set of experiments eggs were irradiated (500 r of 60 keV x-rays) at different ages, having been maintained at 04.4°C from oviposition until completion of irradiation. Variations of x-ray induced embryonic lethality during meiosis and early cleavage in Drosophila eggs are shown in graphs. Peaks of radiosensitivity (high embryonic mortality) were obtained in late anaphase/early telophase of meiosis II of every cleavage division so far analysed. The relatively lowest radiosensitivity occurred in the pronuclei and in the late interphase stages. A very similar pattern of sensitivity has been reported by von Borstel (same symposium for Habroboma). Two groups of easily distinguishable lethal syndromes are (1) early death-death after gastrulation and (2) late death-death after hatching of larvae. Dose-action curves were recorded at each stage during the first 3/8 h of development. The curve for early death has an initial slope followed by a flattening off and a further increase at higher doses. In exactly the same region in which the flattening off was found the late death curve shows a steep increase. Total embryonic mortality (the sum of the 2 curves) is therefore the superposition of dose-action curves for different syndromes of lethality. Interpretation of the early-death curves is Sketchy.

See also:

737 Dependence of the frequency of occurrence of dominant lethal mutations in the spermatids of Drosophila upon dose of irradiation with fast neutrons. (Abeleva and Lapitin, 1960)

738 The effects of irradiation on the genetic systems of organisms in relation to their physiological and biochemical systems. (Alexander, 1955)

738-80 The effects of irradiation on the genetic systems of organisms in relation to their physiological and biochemical systems. (Alexander, 1960, 1961)

740 Effects of x-rays on female germ-cells of Drosophila melanogaster. I. Dominant lethal mutation and operation in relation to treated stage. (Batesman and Chandley, 1960)

770 The induction of mutations in spermatocytes of Drosophila melanogaster with x-rays. (Chandley, 1960)

771 Developmental-genetic study of the effect of x-ray irradiation in Drosophila virilis and Drosocanus. (Frye, 1960)

785 The response of Drosophila testis to x-ray induction of dominant lethals. (Hoendelberg et al., 1961)

800 Induction of mutations and cell killing in irradiated Drosophila spermatozoids. (Otteida, 1960)

802 Induction of mutations and cell killing in irradiated spermatozoids of Drosophila. (Otteida, 1963)


818 X-ray induced "dominant lethals" in inseminated eggs of Drosophila. (Jules and Ulrich, 1965)

820 X-ray induced "dominant lethals" in inseminated eggs of Drosophila. (Jules and Ulrich, 1965)

826 The relatively high frequency of whole-body mutations compared with fractions induced by X-rays in Drosophila sperm. (Allanburg and Brown, 1961)

838 X-ray induced sex-linked recessive lethals and viabilities in Drosophila ( i.e. Brachyoryzoxia) zincophila. (Gemes, 1963)

851 Structure of "yellow" mutations induced by X-rays of sperm chromosomes of different germ cells in Drosophila melanogaster. (Frye, 1961)
The effect of small doses of ionizing radiation on the frequency of occurrence of sex-linked, recessive, lethal mutations of Drosophila. (Ghidonkali et al., 1963)

The mechanism of the transfer of mosaic patterns of irradidated Drosophila melanogaster males. (Nauwals-Aava, 1963)

Radiation-induced lethal mutations in the first meiotic metaphaseocytes of Halobacterium. (Hedendahl, 1962)

X-ray induced visible mutation in Halobacterium cells. (Whitting, 1965)

Chromosomal rearrangements induced by x-rays in the white eyes of Drosophila. (Abrahamson, 1961)

Analysis of irradiated Drosophila populations for genetic changes. (Novikov and Novikov, 1962)

Induction of chromosomal aberrations in the spermatocytes of grasshopper. (Ray-Chaudhuri, 1961)

The relationship between type of aberration and sensitivity pattern in irradiated Drosophila melanogaster males. (Sjöberg, 1961)

Chemical effects on x-ray induced mutation processes in Drosophila. (Kobels, 1961)

Dependence of the frequency of occurrence of recessive sex-linked lethal mutations in Drosophila spermatozoocytes on the x-ray dose. (Abbeleva, 1961)

Further studies on the influence of oxygen on x-ray-induced rearrangement in Drosophila cells. (Abrahamson, 1961/62)

The relationship of radiations and environmental changes in oxygen concentration for biological damage to the immature germ cells of Drosophila virilis. (E. Alexander, 1968)

The effects of radiation on the genetic systems of organisms in relation to their physiological and biochemical systems. (Alexander, 1968)

The response of pre-meiotic and post-meiotic germ cells of Drosophila to dose fractionation and changes in partial pressures of gases. (Alexander, 1968)

Oxygen effects and dose fractionation in the developing germ cells of Drosophila virilis. (Alexander, 1969)

The effects of chloramphenicol, streptomycin and penicillin on the induction of mutations by x-rays in Drosophila melanogaster. (Clark, 1963)

The oxygen effect on irradiated mature and meiotic germ cells of Drosophila melanogaster. (Kobels and Novikov, 1961)

Post-irradiation effects of oxygen and carbon monoxide on the viability of Halobacterium cells treated in first meiotic metaphase. (LaChasse, 1961/62)


Differential yields of mutation from the first and second meiotic stages after irradiation of mature sperm in Drosophila melanogaster. (Moisio, 1963)

Modification of genetic damage produced by ionizing radiation. (Oster, 1961)

The effect of x-ray treatment combined with air, nitrogen, or oxygen in Drosophila melanogaster studied on sex-linked recessive lethal effects. (Ponzi et al., 1964)

Differential sensitivity of spermatogenic stages of Drosophila melanogaster to x-ray irradiation in O2 and N2. (Ponzi et al., 1965)

Dose-rate and the induction of mutation in Drosophila. (Pondom and Mcsherry, 1965)

The effect of light and temperature on radiation-induced mutation in Drosophila. (Pondom, 1965)

The effectiveness of vanadate in protecting against radiation damage to grasshopper chromosomes. (Ray-Chaudhuri and Saha, 1960)

Cysteamine protection of grasshopper chromosomes from x-ray-induced aberrations under aerobic and anaerobic conditions. (Ray-Chaudhuri et al., 1960)

The genetic response of radiation sensitive stages to different types of radiation treatment. (Redd, 1960)

The frequency of X0 males and induced autosome crossovers after irradiation of Drosophila melanogaster males in air or commercial nitrogen. (Sjöberg, 1961)

The effect of carbon monoxide as a respiratory stimulator on the production of dominant lethal mutations by x-rays in Drosophila. (Schmid, 1963)

Recovery from premeiotic damage of x-radiation in Drosophila spermatogonial. (Roberts and Tates, 1961)

The effect of oxygen in radioresistance of radiation in Drosophila. (Roberts, 1961)

Modifications of the mutagenic effect of x-radiation in Drosophila males by chloramphenicol and ribose-5-phosphate. (Roberts, 1960)
Dose rate, cyanide, and some other factors influencing repair of mutational radiation damage in Drosophila. (Sobels, 1963)

Modification of pre-mutational radiation damage in Drosophila. (Sobels, 1963)

Experiments on repair of pre-mutational radiation damage in Drosophila. (Sobels, and Yates, 1963)

The converting effects of oxygen and nitrogen in determining initial sensitivity and postirradiation recovery in Drosophila sperm and spermatids. (Sobels, 1963)

Repair and differential radiosensitivity in developing germ cells of Drosophila males. (Sobels, 1963)

Modification of genetic radiation damage in Drosophila by post-treatment with nitrogen and fractionation of the dose. (Yates and Sobels, 1961)

Dose-dependence of radiation-induced mutation rate in Drosophila melanogaster depending on the stage sensitivity of the irradiated germ cells. (Tratt, 1965)

A study of dose-dependence of radiation-induced mutation rates in Drosophila melanogaster, allowing for the degree of maturity of the germ cells. (Tratt, 1965)

Dose dependence of the frequency of radiation-induced recessive sex-linked lethals in Drosophila melanogaster. (Tratt, 1965)

Dose-dependence of the frequency of radiation-induced recessive sex-linked lethals in Drosophila melanogaster, with special consideration of the stage sensitivity of the irradiated germ cells. (Yates, 1961)

Temperature effects on lethal mutation rates of Habrobracon oxytes x-irradiated in first meiotic metaphase. (Yates, 1963)

The effect of oxygen and high temperature upon the crossing over process. (Zaltsman and hugh-Vechanov, 1963)

The influence of oxygen on the frequency of radiation-induced chromosomal aberrations in oocytes of Drosophila melanogaster. (Wind and Tratt, 1965)

Cell killing and the problem of nuclear reactivation. (Borstel and Lobbecke, 1963)

Cytogenetic investigations on the nature of dominant lethals induced in male oocytes by gamma radiation and alkylating agents. (LaChance and Riemann, 1965)

Mutational response of Habrobracon oocytes in metaphase II and progeny to ethyl methanesulfonate and nitrogen mustard. (Lobbecke and Borstel, 1965)

Cytological evaluation of differential radiosensitivity in spermatogonial cells of Drosophila. (Kernahan and Gay, 1965)

Radiation effects on the cytoplasm of Habrobracon eggs. (Keenworthy, 1967)

A quantitative study of chromosomal elasticity and its influence on chromosome movement. (Nicklas, 1968)

Studies on the normal and x-irradiated spermatogenesis of Petrosodus viridis and Schistocerca gregaria (Orthoptera). (Marhus, 1968)

The effect of x-rays on the spermatogenesis of Petrobius martius. (Marhus, 1969)

Cytochromatography of the normal and x-irradiated spermatogenesis of Petrosodus viridis (Pachyceridae). (Marhus, 1969)

The influence of x-rays on organelle induction and differentiation in grasshopper spermatogenesis. (Vishniac and Dervin, 1962)

Cytological effects. (Yahshan, 1961)

Effects of radiations on insects. (LaChance, 1960)

Radiosensitivity of developing reproductive cells in female Coccinella septempunctata. (LaChance and Laverty, 1965)

Fecondity studies on x-rayed Mormonella virgineus. (Ray, 1963)

Experiments on the spermatogenesis and embryonic development following irradiation of Calliphora erythrocephala Meig., Dipsas, Calif., males. (Tsuji, 1963)

I-A-6 MODIFYING FACTORS

INTENSITY, FLOOD, LET, TEMPERATURE, SYNERGISTS,
CHEMICALS INCLUDING PROTECTIVE AGENTS,
ENVIRONMENT AT IRRADIATION, Etc.

General

Clar, A.M. MODIFICATION OF GENETIC RESPONSE TO X-IRRADIATION IN Drosophila. p. 218-28
Modification may be achieved by varying the physical conditions of irradiation (nature of radiation, dose and dose rate, temperature), by altering the chemical conditions (varying degrees of anaerobiosis, the use of metabolic inhibitors before, during or after irradiation) or by changing the physiological state of the material irradiated. The main topic considered in the review is whether, in Drosophila melanogaster, modification in genetic response to x-irradiation may be obtained by varying the dose rate. The evident complexity of factors which must be taken into account in interpreting data is discussed. Relevant findings published variously between 1964 and 1966 are reviewed critically.

1032


Underneatening of females before, or before and after they were mated and x-rayed with about 3500 r significantly increased the rate of 2-3 reciprocal translocations recovered from the irradiated sperm chromosomes, as compared with the rate recovered from continuously well-fed, otherwise comparable females. The rate of such paternal mutations (increased as much as 5%) in eggs successively oviposited by females that were underneatened before they were mated and irradiated. The rate of complete or certain partial losses of a paternal sex chromosome (ent Y or ent X, or ring X or ring Y) increased about 300 to 500% in eggs successively oviposited by females which were underneatened before and after they were mated and x-rayed with about 3500 r. It is hypothesized that mutational enhancement by underneatenment is associated with some effect upon the junction of chromosomes made by breakage. (From auth. summary)

1035

Sobell, F.H. CHEMISCHE BEINFLUSUNG DES KOHGENULZGEREN MUTATIONSPROZESSES BEI DROSOPHILA. (Chemical effects on x-ray induced mutation processes in Drosophila.) Naturwissenschaften 46, 6 (1959) 345-55. (In German)

A review, with 38 references. Pre-treatment with cytosine, formaldelyde or dihydroxydimethylaminoazinde was found to increase the x-ray induced mutation rate, more markedly in spermatids than in mature spermatids. The cytosine effect is probably due to an increase in O2. Post-treatment with cytosine increased the mutation rate in spermatids provided they were exposed to a high dose rate, whereas in O2 or in N2 atmoospheres. Increased translocation rates in spermatids occurred independently of the dose rate. Cytoside post-treatment increased the rate of lethal mutations even when a ring chromosome had been treated. Possible interpretations are discussed.

1034


Experiments carried out to clarify the fast-neutro-ne dose dependence of the occurrence frequency of dominant lethal mutations were inconclusive. The difference between the frequencies in spermatid and sperms with neutron irradiation was less than in y- and x-irradiation. The dependence on dose in the range 1500-2400 rad tapered off, as in y-irradiation, but the absolute frequency was so high that it was explained by the reaching of the limits of possible occurrence of the given type of mutation. To determine if hidden factors are involved or if the nature of the mutations caused by fast neutrons in spermatids is similar to that in low-irradiating radiation, the recessive sex-linked lethal mutations were studied, which are less frequent than the dominant. Comparison of the data obtained with earlier data showed that the ratio between the frequencies of mutation in spermatids and sperms in neutron-irradiation at 1000 rad are the same for 1500-g y-irradiation, that is, 2.97 and 5.16, respectively. In the 1000-3000 range the frequency of mutation occurrences was proportional to the 0.67 power of the dose with y-irradiation and to the 0.37 power with neutron irradiation. (NSA 17: 1965, 51508)

1038


Alteration of the metabolism of Drosophila oocytes greatly affects the induction of structural changes by x-rays. Females 2-3 d of age contain oocytes whose chromosomes untwist and rearrange rapidly, whereas no evidence for restitution within the intervals studied was found in samples of oocytes from females 8-9 d old as the time of instar that for both young and old oocytes show induced learning delayed rearrangement frequencies in a N2 environment between 1964 and 1966 are reviewed critically.

1036


Lethal damage in maleic and radiation with both x-ray and y rays on oocytes were obtained y-rays and fast neutrons was o at the time of treatment. A H neutroncs in various types of in 1037


The effects of radiation on the chemical systems were investigated system offers a group of cells, mitotic and sperms. Differnt types of cells. Results are pre y-rays from a Co60 source, as used were calculated using the (NSA 16:1962, 11300)

1038


Modifications in the percentage varying the dose rate of y-ray series of tests were performed doses divided by periods from experiments. The results of experiments were made in en the post-irradiation recovery period. Different time intervals: 1 days and percentages of dominant lethal recovery mechanisms in Drosophila after chronic irradiation of ops are discussed briefly. (From a

1039

Riecher, A.E. RELATIVE EFFI OF LETHALITY IN GROSSHOF Lawrence, May 1965. 50p.

A test system using the grasshopper (Grosshopfer) with the RBE. Eggs of Grosshopfer (14 doses of 200 kVp x-rays, and t doses were estimated 2600 rads and terminal, respectively; and 140 embryos subjected to 0 survival was assumed to be the 14 MeV neutrons and 200 kVp ratio).
radiation (mature of radiation, dose and/or dose rate) causes significant degrees of aneuploidy, the changing physiological state of a cell. In Drosophila melanogaster, these effects vary with the dose rate. The mechanism of these effects is discussed. Relevant literature.

THE GROSS CHROMOSOMAL CHANGES IN DROSOPHILA MELANOGASTER. Genetics 48, 585-613. 1963, X-rays and 900 kV were used to study the effects of x-ray and gamma rays on the development of Drosophila melanogaster. The results showed a decrease in viability and an increase in the frequency of chromosomal aberrations. The effects were more pronounced at lower dose rates and were more pronounced in females than in males. The results were consistent with the hypothesis that radiation damage to the cell results in the formation of chromosomal aberrations.


Lethal damage in meiotic and spermatogonial cells was found to be influenced by increased O2 concentrations with both X-ray and fast neutrons. Differences in lethal damage induced in spermatids by γ-rays in pure oxygen were obtained by varying radiation dose rates. Biological damage induced by X-ray and γ-rays and fast neutrons was consistently higher in spermatids than in mature sperm when O2 was present at the time of treatment. A slight but definite enhancement was also obtained with oxygen with fast neutrons in various types of immature germ cells. (NSA 16:1965, 1965).


The effects of radiation on the genetic system of organisms in relation to their physiological and biochemical systems were investigated in the immature germ cells of Drosophila virilis. This biological system offers a group of cells composed of spermatogonial cells, mature sperms, and post-meiotic spermatids and sperms. Different amounts and types of biological damage were observed in the different types of cells. Results are presented on the effects of fast neutrons. 500 keV X-rays, 1.17- to 1.33 MeV γ-rays from a Co60 source, and 22 MeV x-rays from a betatron source. The RBE values for the radiations used were calculated using the rad dose necessary to produce lethality in 50% of cells. Data are tabulated. (NSA 16:1962, 1965).

1038 Alexander, M.L., Bergoldahl, J. Biological damage in the mature sperm of Drosophila virilis in oxygen and nitrogen with different dose intensities of gamma rays. Genetics 67 (1965) 73-84.

Modifications in the percentages of dominant lethal and translocation damage were not obtained by varying the dose rate of γ-rays in treatments of mature sperm of D. virilis. Nineteen experiments in 5 series of tests were performed using radiation dose rates from 75 c/min to 2000 c/min or 2 fractionated doses divided by pauses from 15 to 60 min. The dose rate of γ-rays did not modify the amount of 2 break, transattachment types of chromosome damage, translocations, or dominant lethal damage when treatments were made in either a completely oxygen-saturated atmosphere or an anoxic atmosphere of N2. Post-irradiation recovery periods were not detected by testing with alternate radiation treatments in O2 and N2. Different time intervals of 15 to 45 min between treatments failed to produce modifications in the percentages of dominant lethals. Therefore, there is no indication of a post-irradiation time limit for recovery mechanisms in Drosophila sperm. The possibility of genetic "repair" mechanisms operating after chronic irradiation of spermatogonial cells and of post-irradiation effects in metabolically active cells are discussed briefly. (From abstract summary)


A test system using the grasshopper embryo (Chorthippus biguttatus) and Encyrtidae (Hymenoptera) with hatching as the criterion for the end point is proposed to determine the RBE. Eggs of Chorthippus (14-d) and Encyrtidae (14-d and terminal) were subjected to various doses of 200 kV x-rays, and eggs of Chorthippus to various doses of neutrons. X-ray median lethal doses were estimated (50% and 75% for Chorthippus (14-d), 75% and 100% for Encyrtidae, 14-d and terminal, respectively). In view of the lack of data in the region of decreasing survival of Chorthippus (24-d) embryos subjected to neutron irradiation, the shape of the dose-effect curve relative to x-irradiation survival was assumed to be unchanged so that an LD50 estimate of 7.16 R was obtained. The RBE of 14 MeV neutrons and 200 kV x-rays on Chorthippus (24-d) embryos was 1.76 (obtained from the LD50 ratio).

265

The relationships of oxygen concentrations and the distribution of x-ray dose were tested by modification of the frequencies of sex-linked recessive lethals, translocations and dominant lethals induced in the germ cell cycle of Drosophila. X-ray treatments were given young males of D. melanogaster held under pressures of 5 atm CO₂ plus 3 atm argon gas. In comparative tests, the intracellular oxygen concentrations were limited by using 2.5 atm argon. An x-ray dose of 2000 r was given at 23°C at a constant rate in 2-min periods, or fractionated into two equal doses 40 min apart at a fast rate. X-ray-treated males were reared every 2 or 3 weeks. In post-meiotic spermatogonia and spermatid cells, fast and fractionated doses gave similar results for all three types of genetic damage with the oxygen-argon mixture. When oxygen was limited with treatment under 4.3 atm argon, higher percentages of recessive lethals and translocations were observed in spermatogonia cells with fractionated than with fast doses. Dominant lethals were not modified in post-meiotic cells with fast or fractionated doses in either gas environment. In spermatogonial, dominant lethals were increased by fractionating the dose in both argon and oxygen-argon. The germ cell cycle of D. viridis was tested for protecting actions of the insect gases, helium and argon. Dominant lethal damage was tested in 1 atm air, 1 atm air + 9 atm helium, and 1 atm air + 3 atm argon. Neither inert gas, at 0 atm pressure, suppressed lethal damage below the air rate.


1-d-old males of D. viridis were treated with 1000 r of x-rays while under 74.7% pressure of argon gas and in a gaseous atmosphere of 85 lb argon + 19.7 lb CO₂. X-rays were given at a rate of 1000 r/min as a single dose and as two doses fractionated by a period of 40 min. Additional tests were made with 5000 r under 64.7 lb of argon. Postmeiotic, meiotic and premeiotic gamet cells were tested for induced biological damage. Dominant lethals in premeiotic spermatogonia and spermatid cells were increased by the presence of oxygen. In sperm and spermatogonia, there were no differences in the percentages of dominant lethals or translocations with dose rate changes in argon or when CO₂ was present. These results differed from those observed for D. melanogaster where dose fractionation in argon, but not oxygen, increased translocations, sex-linked lethals and dominant lethals in spermatogonia. The premeiotic cells of D. melanogaster showed an enhancement in dominant lethals with dose fractionation in both anoxic and oxygenated gasses. Enhancement with dose fractionation in viridis appears to be limited to later spermatogonial stages. The stem cells do not respond to dose fractionation. Enhancement of lethals in premeiotic cells has been observed in anoxic and oxygenated atmospheres of gasses in both species. Differences in response of spermatogonial cells in viridis and melanogaster may be due to oxygen metabolism or other metabolic differences in the two species. Spermogonial cysts are not prevalent in young males of either species and the differences cannot be explained by mixed populations of resistant and sensitive spermatogonia cells.


Mature sperm were treated with 4000 r of x-irradiation, simultaneously, in mature males and inseminated females of D. melanogaster. One treatment was in air and the other in nitrogen. Translocations and sex-linked recessive lethals were tested the 1st and 2nd days after treatment. In air, the results for inseminated females was 9.37% (3/32) the 1st day and 10.75% (4/38) the 2nd day for sex-linked lethals; for translocations, 10.69% (9/86) and 17.56% (10/57) were observed for the 1st and 2nd days. For sperm treated in males (48), the results were 9.09% (16/170) and 7.00% (6/86) sex-linked lethals and 1.09% (1/91) and 0.00% (0/57) were sex-linked lethals in the 1st and 2nd days. For sperm, 4.87% (2/41) and 3.03% (2/66) were observed the 1st and 2nd days. Mature males gave results of 5.98% (7/113) and 5.26% (6/115) for sex-linked lethals and 3.25% (3/94) and 2.95% (2/68) translocations the 1st and 2nd days. In both gasses, the results for both gasses showed higher translocations and sex-linked lethals percentages induced in sperm in inseminated females than in males. High translocation values indicate that chromosome breakage is an important factor for increased sensitivity. Genetic damage was not reduced consistently the 2nd day after treatment to indicate that recovery mechanisms are in play. The data indicate that postiradiation enhancement to air may result the second day after treatment in N₂ in inseminated females.

Arman, M.M. MUTATION FROM SESEMENTSAL REPORT, Spring 1963 Univ., Berkeley, Donnel Pavilion. A modifying effect of a constant Trichloroethylene irradiated mice of temperature are discussed.

Amberg Coll., Mass. GENETI REPORT, 1965. TLD-19015. 10p. Progress is reported in studies of stages of spermatogenesis in Drosophila. Data are presented between developmental temparatures genetic material on chromosomes. A list is included of publications.


Screw-worm (Cochliomyia hominivora) level of r-rays from Co⁵⁷-cw were found to be availability of O₂ in damage of 11500 r was required (3) or 2 air (forced ventilation). protection effects that were tines. positive advanced in age. In par diffusion of air to standaizal in paper 5 d of age or older. This occurred in production when.


The frequency of lethal mutaion 500 r/min is diminished to 1/3 value (3000 r/min). The trans. mutation of mutation stages of germ cell generation with gas of residual tissues in the stage irradiation.


The frequency of lethal mutation when (5) irradiated males were observed in the typhical growth in the


Nitric oxide present during irradiation from 1000 r of x-rays. Damage linked recessive lethals in D. melanogaster to produce phoductive dominant lethals b of delaying development of germ
ANCER CELLS OF Drosophila TO
SESS. (Abstr.) p. 155 in "Second
ized, 5-11 August 1962." London,


dose were treated by modification of
lithal induced in the germ
D. melanogaster held under pre-
cellular oxygen concentration was
at 25° C as a continuous rate in 2-min
- X-ray treated males were re-
mm cells, fast and fractionated doses
on-argon mixtures. When oxygen
rescue lethals and translocations.
Dominant lethals were not modifi-
environment. In spermatogonial
os argon and oxygen + argon. The
set genes, hemi and argon.
ium, and 1 atm air + 8 atm argon.
ate test.

THE DEVELOPING GERM CELLS
proceedings of XI International.
J. E. Oxford, Pergamon Press,
nder 74.) Jb pressure of argon gas
iven at a rate of 1000 c/min as a
minal tests were made with 3000 r
als were tested for induced biological
were increased by the presence of
onages of dominant lethals or

These results differed from those
xygen, increased translocations,
set of virilis, as melanogaster,
both anoxic and asphyxiated gases,
ater spermatogonial stages. The

Sperm treated in male and in-
AIR. (Abst.) Ref. Rev. 16

in mature males and inamminated
 in nitrogen. Translocations and ex-
 air, the results for inamminated
for sex-linked lethals for trans-
1st and 2nd days. For sperm

D(1)B)sex-linked lethals and

The frequency of lethal mutations
ceived in males was treated with abcinomycin D, which also inhibited the appearance of
malotyptic growths in the strain used for the study. (Auth.)


Nitric oxide present during irradiation at a concentration of 3% in He enhanced genetic damage resulting from 200 r of X-rays. Damage was measured by the production of dominant lethals in D. virilis and sex-linked recessive lethals in D. melanogaster. Under similar conditions 3% O2 in He showed no effect on the production of dominant lethals by X-rays. Nitric oxide had the additional effect, independent of irradiation, of delaying development of germ cells in D. virilis. (Auth.)

Populations of D. melanogaster were exposed to 6.2-0.6% NaCl and simultaneously to x-rays (500 r/ generation). Fertility was significantly decreased after 50 generations of NaCl exposure. (CA 81:1964, 4762b)


(Note: An assumption made here that x-rays would produce more lethals in 10 atmospheres of O3 than in 1 atmosphere has since been proved untenable.)


Increase in air pressure increases the x-ray damage measured as sex-linked and dominant lethals. An increase in pressure of pure O3, on the other hand, does not. The same is true for argon and N2. Whereas 1 atmospheres (atm) of argon were not able to counteract the effect of 1 atm of O3, 9 atm of argon definitely reduces the effect of 1 atm of O3 almost to the atomic level. The typical differential response of spermatogonial cells to x-rays was observed: early spermatids are more sensitive to recessive, spermatocytes to dominant lethal induction. This differential response is much less obvious when the flies are treated in air. The high radiosensitivity of spermatids and spermatocytes is therefore at least partially attributable to the presence of O3. Treatment of flies in gases and mixtures without radiation has no effect.


Injection of chloramphenicol, streptomycin or penicillin into Drosophila males just before exposure to (1960) x-irradiation causes a reduction in the yield of sex-linked recessive lethal mutations. The effect appears to be primarily on spermatids and possibly spermatocytes. In the absence of x-irradiation, the injections of these antibiotics are certainly not markedly mutagenic in Drosophila.


The larvae and pupae of A. kilinae and T. molitor were exposed for 5 min to O3 at pressures of 15-75 lb/in² and the effects were compared with controls maintained in O3 and air at 10 lb/in². Under such conditions, A. kilinae pupae were injured and showed decreased O3 consumption. Larvae, although sensitive to O3, were more resistant than pupae. Unpigmented T. molitor pupae were injured after exposure to 60 and 120 lb/in² O3 which affected their ability to become pigmented and to consume O3. A 500-r/min x-ray arrested development of T. molitor larvae, whereas 5000 r were required to arrest development of pupae, although the O3 consumption of the latter was 85% decreased after such exposure. (CA 55:1961, 1387b)


Experiments with Drosophila showed that the antimetagenic effect of streptomycin, administered by intra-abdominal injection, affects not only the chromosome rearrangements but also the spot (and gene) mutations. The effect was observed both in the development of spores characterised by high natural mutability and in the development of the egg cells. No protective action by this drug was found among embryo cells which were irradiated with x-rays at 3000 r dosage. The antimetagenic effect of streptomycin was not observed in these tests. Administration of streptomycin lowered the natural mutability of males, caused by metabolic peculiarities in the early pupal stage. This result indicated that either potential changes in chromosomes exist the sperm only after a certain


Recovered rates of Y-chromosomal mutations in Drosophila melanogaster as well as in D. virilis suggest that these results, on the other hand, have not altered the distribution of the radiation. The irradiation-induced mutations of the Y chromosome are usually associated with an increase in recombination between the X and Y chromosomes. However, the actual recombination in these cases is no more than the overall recombination between the X and Y chromosomes. The recombination between the X and Y chromosomes is not detectable in these cases. The recombination between the X and Y chromosomes is not detectable in these cases.

Pfutz-Niggl, H. *EREBUS Mutation in Drosophila.* (In German) Zentbl. f. Mikrobiol. 43 (1941).

The shortness of the standard deviation of x cells is no indication of x cells. Therefore the effects of the tests carried out (17st and 4st values) are included in the table. (By NA 168:192. 2826.)


In order to study the mechanism of x rays irradiated in vivo x-ray-induced recessive lethals by the two treatments of different temperature of the irradiated x-rays.


With the object of investigating the effects of x rays irradiated in vivo x-ray-induced recessive lethals by the two treatments of different temperature of the irradiated x-rays. Drosophila (mutations) were observed in these tests. Administration of streptomycin lowered the natural mutability of males, caused by metabolic peculiarities in the early pupal stage. This result indicated that either potential changes in chromosomes exist the sperm only after a certain

298
changes in chromosomes exist in case of natural mutagenic or in that mutagenic agents exert their action on the species only after a certain period after administration. (CA 62:1963, 14454E)

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1058
Felt, R. NITROGEN-TREATMENT EFFECTS ON REARRANGEMENT-INDUCTION PATTERNS IN Drosophila melanogaster. Int. J. Rad. Biol. 4, 3 (1967/68) 477-500. (In English)

Recorded recovery of Y-chromosomes-taenial translocations (Y-A) induced in spermatids of pupae of D. melanogaster, as well as the chromosomes 2-3 translocations (X-3), were higher in crosses to females having an attached X-Y-chromosome than to regular females. This suggests that numerous position-effect sterility mutations were induced in the Y-chromosomes as well as in the autosomes. Their treatment after irradiation of 800 krad did not increase the frequencies of translocations recovered. Prolonged N2 pre-treatment apparently retarded development so that irradiation involved an earlier and more sensitive stage of spermatogenesis than without pre-treatment. When two irradiations were given 14 h apart in air, breaks induced in the 1st irradiation reappeared prior to the 2nd. The change in the frequency of X-chromosomes recessive lethals over the 14 h separating the 2 irradiations applied to the spermatids is much greater than that of breaks involved in translocations. At least some recessive lethals are apparently caused by transgenic mutations as opposed to intergenic breaks.

1059
Frits-Niggli, H. SECHFLATLUSS DER STRAHLENINDIZIERTEN MUTABILITAT DURCH 2,4-DINITROPHENOL. Naturwissenschaften 48 (1961) 650-1. (In German)

The variability of the radio-induced mutation rate with the age of development stage of the germ cells can be used as an indication of a dependence of the mutation genotypes on the intracellular metabolism of the cells. Therefore the effect of 2,4-dinitrophenol on the mutation rate of D. melanogaster was investigated. The results established that treatment with this chemical before irradiation diminished drastically (approximately fourfold) the number of radio-induced recessive lethal factors and chromosome loss by rupture. (NSA 16:1965, 6592)

1060

In order to study the mechanism of the oxygen effect in x-ray-induced mutations, Drosophila Oregon-R males were irradiated in oxygen at 25°C and 0°C, thus normal and low metabolism. Sex-linked X-ray-induced recessive lethal factors were scored, and no difference was found in the mutation frequency induced by the two treatments at different temperature. The oxygen effect was considered independent from the metabolism of the irradiated cells. (Am. J. Hum. Genet. 2, 4 (1963) 194-204)

1061

1062

With the object of investigating effects of spaceflight factors on heredity, Drosophila melanogaster was carried on the 2nd, 4th, and 6th orbital spacecrafts and on Voskhod-I and Voskhod-2. Four different space-flight effects were investigated. Non-disjunction of chromosomes was investigated by exposing sterilized white-eyed Drosophila females on Voskhod 1 and 2 and marking them on their return with red-eyed males. Primary nondisjunction of chromosomes resulted in the appearance of 6 times as many unusual genotypes (XXY females and XO males) among the progeny of the exposed group as among offspring of the controls. However, the increase in non-disjunction cannot be ascribed to radiation effects, induced crosses were investigated by exposing heterozygotic males (having normal phenotypes but three recessive genes in the second chromosome) on the 6th orbital spacecraft and on Voskhod 1 and 2. Upon return they were mated with homozygotic females displaying the 3 recessive characteristics (black body, cannabin eyes, and vestigial wings). Drosophila carried in the fifth orbital spacecraft with no protection against low frequency vibrations showed crossover incidence of 0.34±0.12%, compared to an incidence of 0.08±0.05% in none

AND NATURAL MUTABILITY.

In the case of Drosophila, the natural mutability of males, as indicated that either potential
at all on Vostok spacecrafts, where the insect containers were combined against vibration. Dominant lethal mutations were investigated by exposing two strains of D. melanogaster (D-18 with a high rate of spontaneous lethal mutations, and D-32 with a low rate for the same mutations) of the 1 spacecraft. The number of dominant lethal mutations was found to increase somewhat in all groups exposed to space flight. Sex-linked recessive lethal mutations were investigated by exposing young males of the D-18 and D-32 strain of D. melanogaster on all 5 vehicles. Exposure on the 2nd and 5th orbital spacecrafts and on Vostok-1 resulted in statistically significant numbers of sex-linked recessive lethal mutations for spermatogonia and spermatids of both strains. However, no increase in mutation was observed following exposure on the 5th orbital spacecraft and on Vostok-2. (Iss 17:1963, 21440. See also abstr. 27540)


The present experiment was conducted on D. melanogaster to determine to what extent fractionation of dose increases or decreases mutation. X-irradiation was administered in 3 ways: continuously, for 10 min fractionated, with an interval of 9/10 min between 1/10-min exposures at an average rate of 76 erg/min fractionated, with an interval of 1/16 min. In all 3 cases the total amount of radiation was 700 r. The mutation rate was considered a sex-linked, lethal recessive in a wild strain of the fruit fly crossed with the Muller 5 strain. According to formulae evolved previously, the average rate of mutation was found to be 12-13% less with short intervals than with continuous irradiation, and 39% less with long intervals than with continuous irradiation. These results were obtained from 23 series of irradiations spread over 3 stages, each consisting of 2 groups. Stage A was observed 1-2 days after irradiation; stage B, 4-5 days after; stage C, 7-9 days after. The mutation rate was concluded to be progressively reduced when the interval of protection between the fractionated x-ray doses was increased. In the case of point mutations, there is evidence for a recovery phenomenon in the various stages of male gametogenesis. (From Iss 17:1963, 38766)


The influence of AET on the (x-ray)-induced mutation rate of sex-linked recessive lethals was determined using the Muller-5 strain. A significant increase in mutation rate was observed after the administration of AET, known as a radiation protective substance with regard to somatic damage. Chemosensitivity did not occur. The mutagenic effect was observed in sperm of different degrees of maturity.


The radiosensitivity spectrum of spermatogonia was established for 5 doses (150, 300, 600, 1200 and 2400 r) of x-radiation applied at 200 r/min, and corresponding tests were carried out on the O2 effect. Increased mutability was observed in the presence of O2, but not at all stages of spermatogenesis. A higher frequency of recessives occurred in males than in mature sperm. While at lower doses, no apparent O2 effect was observed in mature sperm although a clear effect was observed in meiotic cells, at higher doses the O2 effect extended to both mature sperm and meiotic stages. The most sensitive period was the one immediately following exhaustion of the mature sperm supply under the experimental conditions described. Nitrogen was observed to have a protective effect.


1067 Japan. Serological Experiment Station, Tokyo. STUDIES ON THE BREEDING METHOD TAKING ADVANTAGE OF γ-RAYS IN THE SILK WORM. Nucl. Sci. Abstr., Japan 2 (1962) 170-1. (In English)

The effects of γ-ray treatment on the following generation with regard to hatchability, survival rate at the larval stages, pupation rate and quantitative characteristics of the cocoon are almost the same for fractional irradiation of successive generations and a single treatment of one generation, provided that the stage of the silkworm at irradiation and the total dose given are the same. Linear dose-action curves are obtained in both cases. Damage tends to be less with fractional irradiation. When one generation only is treated the lower the dose the faster generation recovery takes place for doses < 10 r. Survival rates under normal conditions are either restituted to 7-year. Resistance to radiation damage of F1- and F2-hybrids is greater than that of parents, with F2-hybrids more resistant than F1-hybrids.


Two types of dose regimen: gosikel cells of silkworm, diff been collected reporting the were studied along with the cytological studies show the stages must have been killed; dominant at the time of irradiation to survive a higher mutation


The Canton-S strain of D. mel a given an every 4 months. Wild males x-rays for high doses (1000-4000 r) that the linear relationship be limit the recessive lethal mutant effects of radiation down to 8

1070 Koorimama, A. INFLUENC LOWED TEMPERATURE. 1


1072 Kischel, H.A., Overbeek, E. The effects of acute radiation on p-plates was varied between 2-12 s, 2-rays from a 250 m Source of 137Cs on biological ef 6 h. Dose-effect curves were the dose range of the particular


This paper deals with the potential risk for somatic radiation (X-ray and gametes). It was realized in the experiments that induced sex-linked recessive No influence of cytostatic was as well as in g. coll. Prolong significantly increased without reported with radiosensitive increased radiosensitivity in tot

1074 LaChance, L.F. POST-HA EGG OF Habronemata E

The effect of N2 and of CO a hatchability of Habronemata e
against vibration. Dominant lethal effects of X-rays and γ-rays (D-18 with a high rate of spontaneous mutations) in the 5 spacecrafts. The number of dose to exposed to space flight. Sex-linked of the D-19 and D-05 strains of D. melanogaster and on Vostok-1 mixed in for spermatozoan and spermatic of stages was exposed on the 5th orbital space -

TING DOSES ON THE RATE OF X-RAY-

has also shown that flexion fractionation of in 3 ways: 1. Continoous, for 10 min-

is an average rate of 70 rad/min.

manipulation with the rate of mutation was found to be 75% less with long intervals than

of irradiations spread over 5 stages.

are reduced when the interval of pro-

of point mutations, there is inverso-

(From NASA 17:1963,)

AMMOCALYPTERON/SCHIZONYMPHON

white melanogaster. (Study on the

in (German)

Laced recessive lethals was determined

and was observed after the administration

of radiation damage. Chromomagnetcity did not dis-

PECT IN IRRADIATED MALE AND FEMALE (1963) 172-4.

was determined. (150, 360, 600, 1200

and were carried out on the C2 effect.

stages of spermogenesis. A.

m. While, at lower doses, no
test was observed in melanotic cells,

of most sensitive

ure supply under the experimental

MUTATIONAL RESPONSE TO GAMMA (1962) 427.

EEDING METHOD TAKING AD-


le to hatchability, survival rate at con-

n the same for

of one generation, provided that

in a linear dose-action curves

radiation. When one generation only

dose < 6 kR. Strain

of the resistant than F2-hybrid,


Two types of dose rate dependence of radiation-induced mutation frequency have been found in early gonial cells of silicoflax, differential repair and selective killing being suggested. Further evidence has been collected supporting the hypothesis of selective killing. Variations in induced mutation frequency were studied along with the development of germ cells, for acute and chronic irradiation. Results from cytological studies suggest that germ cells actually irradiated at the primary and secondary spermatogenous stages must have been killed eventually, observed mutation frequency reflecting that of repopulated cells dormant at the time of irradiation while, under chronic irradiation some cells at advanced stages are able to survive a higher mutation frequency being observed.


The Canton-S strain of D. melanogaster was used as wild type material, irradiation being performed every 4 months. Wild males were sterilized for 1 week after their emergence, and irradiated with 135 rad/min x-rays for high doses (1000-4000 rad) and 4 rad/min for low doses (5-20 rad). Evidence was obtained indicating that the linear relationship between mutation rate and radiation dose can only be applied to doses down to 5 rad, sex-linked recessive lethal mutations being used as indicators. No threshold dose was observed for the genetic effects of radiation down to 5 rad.

Kosmala, A. INFLUENCE OF POST IRRADIATION CHANGES IN THE EGGS OF Bombay moor L. AT A LOWED TEMPERATURE. Biofizika, B. 17, 8 (1962) 626-9. (In Czech, with German summary)


Experiments were carried out with a 16-Mev betatron. By means of a special electronic design it was possible to measure radiation pulses in the electron of the accelerator. In this way the frequency of radiation pulses was varied between 2 and 50 cps. To compare this ultrafractionated radiation with continuous radia-

of a 50 MeV source as well as γ-rays from a Cs137 source were used. The influence of ultrafractionation on biological efficiency was investigated in Drosophila "eggs" at the "age" of 1.75, 4.5 and 6 h. Dose-effect curves were determined for each group keeping constant either the average dose rate or the dose rate of the particular radiation pulses.


This paper deals with investigations on 3 chemical compounds well known as radioprotective agents with regard to somatic radiation damage: cytosine, aminoethylisothiouronium (AEI) and 5-bromo-2-purinaminet (benomyl). Experiments were carried out on Drosophila and on E. coli. In Drosophila the rate of ray-induced sex-linked recessive lethals was tested after X-irradiation by means of the Mueller-ScD Method. No influence of cytosine was observed in Drosophila. Benomyl reduced the rate of mutations in Drosophila as well as in E. coli. Protection, however, was only small. After ALT the ray-induced rate of mutations significantly increased although this compound per se has no mutagenic effect. Lastly experiments are reported with bromoethyluridine which is incorporated into DNA instead of thymidine and provides increased radiosensitivity in some cases.


The effect of N2 and of CO administered as post-radiation treatments (x-rays) was investigated. The hatchability of Drosophila eggs treated in first meiotic metaphase was taken as the criterion of damage.
Both gases are equally effective in enhancing the damage induced by the radiation. Since restitution is thought to be rate in irradiated morphologic oocytes, the action of these gases is considered as altering a repair mechanism which results in allowing potential damage to become actual. (Auth.)

(Also published at INI-4961, Brookhaven National Lab., Upton, N. Y.)

2975

When the pupae of the screw-worm fly (Cochliomyia hominivorax (Coq)) were irradiated in an atmosphere of CO2 + air (80%-20% mixture), damage to the reproductive system measured in the adult female is greater than that induced by a similar radiation treatment delivered in air. Doses of γ-radiation ranging from 500 to 5000 rad were investigated. In all tests the number of females ovipositing, the percentage of eggs per fecund female, and the egg hatchability were reduced. For CO2 to be effective in enhancing radiation damage air must be present, and the pupae must be pretreated in the gas mixture for approximately 45 min. Complete sterility can be induced by a treatment of 4000 rad delivered in CO2 + air, whereas irradiation in air alone requires about 5500 to 6000 rad to induce complete sterility. Irradiation in CO2 + air is more damaging to the reproductive system than irradiation in pure CO2. (Auth.)

1976
Lobbecke, E.A., Ohmann, O. ON A CHANGE IN THE SPECTRUM OF SOMATIC MUTATIONS IN Ephesia kurnatella Z. BY TEMPERATURE TREATMENT BEFORE IRADIATION. Z. Vererbungslehre 95 (1951) 246-51.

Pupae were maintained at different temperatures (7, 3, 30, 35, 40°C) for 6 hr before being exposed to 80-μ rad of γ-rays. The incidence of 4 types of single mutations (ES 1, ES 2, ES 3, ES 4) in the butterflies studied, it was found to vary significantly according to temperature. The ratio of ES 1/ES 2 mutations was lowest (6:1) at 7°C, highest (11:1) at 35°C. The ES 1 mutant showed highest frequency at 35°C and fell to the lowest value after pretreatment at 40°C. The ES 2 mutant reached its lowest incidence at 35°C. The ES 3 mutant varied inconsistently and ES 4 was fixed only slightly dependent on temperature. The predissociation temperature of 40°C, the lethal limit for the species, generally depressed mutation frequency. The precise reason for the effect of temperature on mutation frequency is unknown but it was previously found that chromosome fragmentation and translocation were reduced at elevated temperatures. (NSA 17:185, 2326g)

1977
Markus, B., Stelinsky, E. EXPERIMENTS ON THE EFFECT OF THE ENERGY SPECTRUM OF FAST ELECTRONS ON BIOLOGICAL REACTIONS. Strahlentherapie 115 (1961) 384-400. (In German)

After a survey of the present knowledge about the LET (linear energy transfer) spectrum of fast electrons and of the possibilities for the examination of its influence on biological reactions experimentally, radiation tests with 36 MeV electrons from a linear electron accelerator are described. The tests were performed in a 2.5 cm thick glass phantom at depths of 0.6, 1.5, and 2.5 cm from the source of the beam. The beam was collimated to a diameter of 1 cm. At the point of maximum dose, the depth at which 90% of the depth dose is found, the depth dose at 0.6 cm was 50% higher. A discussion of the results is given. (Auth.)

1978

The effect of irradiation of 700 rads on Drosophila eggs of mixed ages of 0, 2, 4, and 6 days old was studied previously for 14 Mev electrons. The LET of the radiation was varied by exposing the eggs at different depths. The depth at which 90% of the incident beam intensity is observed. The experiments have been extended using eggs of 2, 4, and 6 days of age and using 14 Mev and 260 MeV x-rays. Observations are given for the biological effectiveness of the different radiations used for different depths in the phantom. The RBE varied with the age of the eggs. The effectiveness of the radiation increased with the depth of the phantom. X-rays of both energies were more effective than 14 MeV electrons. This difference was more pronounced the older the eggs at the time of irradiation. Observations are based on doses of 150 rads, 300 rads, and 750 rads, and are compared with results of fisher-Niggli and Scholz.

1979

The lethal effect of gamma rays on Drosophila melanogaster is a substantial rise in mutagenic cultures in which temperatures fail to modify the adult's lethality. For example, the susceptibility of strains of Drosophila melanogaster is increased. (Auth.)

1980
Maltman, S. EFFECTS OF RADIATION ON THE GERMINAL SYSTEMS OF INSECTS AND THEIR PREVENTIVE MEASURES. (In German)

A survey of the present knowledge about the LET (linear energy transfer) spectrum of fast electrons and of the possibilities for the examination of its influence on biological reactions experimentally, radiation tests with 36 MeV electrons from a linear electron accelerator are described. The tests were performed in a 2.5 cm thick glass phantom at depths of 0.6, 1.5, and 2.5 cm from the source of the beam. The beam was collimated to a diameter of 1 cm. At the point of maximum dose, the depth at which 90% of the depth dose is found, the depth dose at 0.6 cm was 50% higher. A discussion of the results is given. (Auth.)

1982
Meyer, H.U., Email, E.F.Z. FOR HEAVY X-RAY DOSIS IX. (In German)

To explore ways of treating 0 and 4000 rads were given to young 3-, 6-, or 8- d intervals, divided equally 3 phasex beams before the next 2 d intervals. (4 days) Intervals. Tolerance varied according to the body weight and age of the animals. The effects on the growth of 50% of the animals vary from 50% to 60%. (Auth.)

1983
Mintz, S. ART AND MAA A. ABERRATIONS IN Drosophila.
the radiation. Since reactivation is given, is considered as altering a site actual. (Auth.)

EFFUSION IN INSECTS BY RETREATMENT
(subsequently) are irradiated in an atmosphere measured in the adult, female is in air. Dose of γ radiation ranging males ovipositing, the number of eggs to be effective in enhancing radiation (as mixture for approximately 45 min. of CO₂ + air, whereas irradiation in irradiation in CO₂ + air is more

OF SOMATIC MUTATIONS IN TISSUE. [V. V. Zvachkevich]

9 for 8 h before being exposed to (e.g. E2, E3, E4) in the butter-
mature. The ratios of E4/ES at 45 min. showed highest frequency in strain 3, whereas the lowest frequency was only slightly increased in the strain of species, generally depressed in mutation frequency is unknown. Selection were reduced at elevated

ENERGY SPECTRUM OF FAST ELECTRONS. [In German]

54-400 (A, B) spectrum of fast electrons to experiments, treated. The eggs were irradiated in a dose under spatially controlled h 35 μm. As opposed to the higher. A discussion of the

- MeP AND 5H-MP X-RAYS AND ON EGGS OF Drosophila. (Abstract.)

Yorkshire, England. 5-11 August

ages of 8 h, 4 h was described pre-

exposing the eggs at different

40% and 24% of the incident beam h and 4 h of age and using 1 MeV energies of the different radiations of the eggs. The effectiveness, the effectiveness of energies were more effective than eggs at the time of irradiation, based with results of Fritz-Niggli.


In experiments on the (LET) spectrum of fast electrons on biological reactions, a significant effect on damage rate of Drosophila embryos (aged 1 day, 1 day, 7 day, and 4 h) was found in all 3 age-groups with electrons of 14 MeV. The effect was most marked at 4 h, with an ionization dose of 700 μm, given in a photoplasma-phonon at a depth of 35% relative depth dose, a damage rate of 20% is produced, against 100% at a depth of 100% relative depth dose. The effects of 14 MeV-electron-irradiation at 100% depth showed significant differences for all 3 age-groups, compared with 500 kV or 14 MV x-rays. For an equal ionization dose, the effect of fast electrons was always less than that of x-rays. The difference in effectiveness showed a characteristic dependence on age. Between 500 kV and 14 MeV x-rays there was no difference at 1 h, but with advancing age increasing differences were observed. The results are compared with those of Fritz-Niggli and Schulte.


The lethal effect of gamma radiation on adult grain weevil is increased by culture densities which cause a substantial rise in metabolic temperature above 50°C during larval development. densely crowded cultures in which temperatures during growth and maturation of larvae do not rise appreciably above 50°C, fail to modify the adult's lethal response. Temperature fluctuations up to 30°C during development do not modify the susceptibility of the adult to radiation sterilization. Accordingly, the efficacy of 16,000 rad (or control of grain weevils is unlikely to be reduced by population densities normally encountered in commercial storage. (Auth.)


Effects of radiation on cell division and chromosomes in animals were studied. Effects of x- and β-irradiations on grasshopper spermatogonias were investigated using various chemicals with special regards to their radioprotective effects. μ x-ray effects on Drosophila spermatogenesis were also studied. The remaining investigation were not concerned with insects.


To explore ways of obtaining offspring from heavily irradiated gonia, x-ray installations of 1200 r, 2000 r, and 4000 r were given to young imagos. To promote gonial proliferation, installations were separated by 2-, 4-, 8- or 16-d intervals, during which the flies fed and reproduced actively. Adult offspring from eggs laid in successive broods after the last irradiation were counted. After female irradiation, only the first three of 4-d broods (from treated females, broods 4 and 5 from treated males) gave the highest yields. Four-day intervals gave distinctly higher yields than 2-d, but not much lower than 8-d intervals. Tolerance varied greatly with genotype. Thus, with 4000 r installations 6 of 8 rats, 8000 r sterilized all offspring of a homozygous stock marked only by veinlet, while 24,000 r allowed some offspring of normal from outcrosses to reproduce. With similarly given installations, 12,000 r sterilized all spermatogonias of females while 24,000 r allowed some spermatogonias of males to reproduce. In experiments ranging from 2000 r to 24,000 r, the yield of offspring from treated gonias was approximately halved by each 3000 r given (as compared with 8000 r for the halving dose earlier found when late spermatocytes are irradiated in males). The following sex-linked lethal frequencies were induced in oogonia in the last-mentioned series: 12,000 r (3000 r installation), 13/2444; 14,000 r (4000 r installation), 15/1754; 24,000 r (4000 r installation), 19/1254, that is, 1/3 per 2500 r. Crossove tests showed these very rarely to include gross structural changes.

AET or MEA were injected near the tsetis of Drosophila 6 to 12 h after emergence and the flies irradiated with 2000 r of 160 kv x-rays in air. The males were tested at rates of 2 or 4 d. AET at concentration of 1088 mg/kg did not protect Oregon-R X chromosomes as indicated by the M-5 method from recessive sex linked lethals. The broad representing spermatids and spermatocytes at the time of irradiation yielded more mutations than the control. AET did not protect against deletion of the X chromosome of Oregon-R male as shown by induced hyperpolymity of attached X females with a y marker. Injection of MEA at 1411 and 2553 mg/kg did not protect X chromosome of w 2 y', w 2 y, y males against radiation induced recessive lethals when tested to a multipurpose stock 7 se21, b, r 3 r 1. Again the radiosensitive stages in spermatogonies, the spermatids and spermatocytes, are induced to produce more raty than less mutations. MEA did not protect against radiation induced translocation between chromosomes 1 and 5. (From abstr.)


Sulfapyridine compounds, which are effective in protecting mammals from death by irradiation will be studied with respect to chemical protection against induced mutations, and chromosome translocations, and deletions in Drosophila melanogaster. AET, 2-macroporpholine, and AET, 2-amino-2-methylpropiophenone, will be injected near the tsetis of the fly which will then be irradiated with 2500 r from an x-ray source. Recessive sex linked lethal mutations will be determined by the M-5 method and translocations between II and III chromosomes by bw st method. The protection of any, against deletions of the X chromosome will be determined by the (attached) X method. Preliminary experiments indicate that the sulfapyridine compounds are not protecting against genetic damage, but are enhancing it. This may be due to some modulation of the recovery process.


The purpose of the present investigation is to determine whether the oxygen-effect on Drosophila sperm could be modified by LET. A comparison is made between the blood patterns obtained by irradiating newly emerged males with 31-MeV electrons from a betatron and 186-MV-conventional x-rays in an atmosphere of oxygen or nitrogen. The electron doses are measured with a Baldwin Farmer standard dosimeter, and the x-rays with a Duplex Integrating dosimeter. The males are mated each day with 5 new females and the progeny tested for recessive sex-linked lethals by the standard Bar method. Peak sensitivity is usually found on the 4th day, and this day also reveals the greatest modification of sensitivity by both O2 and N2. In an experiment with a dose of 375 r in O2 and 750 r in N2, the O2 enhancement factor for Day 5 was 0.5 for x-rays and 3.8 for electrons, while it was about 1 on Day 1 with x-rays and with electrons. Preliminary experiments at higher doses indicate an even greater enhancement on Day 5. Further experiments are in progress to confirm this finding.


See 1087.


Young males yield lower frequencies of sex-linked lethals and II and II translocations over the age range tested, from newly emerged to 7 d for lethals and from newly emerged to 3 d for translocations. The first sperm available in the newly emerged males, 0 to 4 h old, yield the same frequencies of both translocations and sex-linked lethals when irradiated in nitrogen or air, but the frequencies are enhanced in oxygen. When the sperm have been stored for 3 d in the male there is both a decrease in N and so increased in O compared to air. It is concluded that the mature sperm in 0 to 4-h-old males are relatively sterile.

When irradiated in N, air, or O these young sperm give a decreased frequency of sex-linked lethals from the 1st to the 3rd mating with single females, and a continued decrease of the lethal frequency with time up to about 24 h. Sperm irradiated in 2-d-old males in air also show a marked decrease from the 1st to the 3rd mating and a further decrease in the frequency with time up to about 9 h. In 7-d-old males there is a decrease from the 1st to the time. In 3-d-old males irradiation toward a decrease from the 1st that the decrease when observed varies between the first sperm at time of all mature sperm from which the irradiation was performed.


Drosophila oenogarica were irradiated lethals. When doses and doses - were given dose induced about 1.0 br D. melanogaster, when they were delivered in the form of physical doses, dose of 40 a further drop in the damage results of 4000 r, delivered at a rate of 30 r/day. The results show that the 13 r/h and lower, even the Bruckeann National Laboratory to the so-called diet room, those obtained for 13 r/h and 9 A series of irradiations of sperm what present the frequencies of with the exposure based on acute irradiation in the hot room, were some 90% (A 90: frequencies obtained from close about 100% (A 90: of those exp doses used was removed all dose of the hot room was retracted by 1 other treatments. A series of 1 female and oenogarica were irradiated at 0.9% with those based on the results from the 0.9, oenogarica were obtained. The 1 of only 0.9%, appeared to be as chronic irradiation given in
is a decrease from the 1st to the 2nd mating immediately after irradiation but no further decrease with time. In 2-d-old males irradiated over a dose range of 500 to 3000 r in air, N. and O. there was a tendency toward a decrease from the 1st to the 2nd matings, within 6 h, in air and O2, but none in N2. It is suggested that the decrease observed on 1st and 2nd sperm batches is due both to a difference in O sensitivity between the first sperm and males of the same age and to a recovery with time of all mature sperm from males at least up to 2-d-old, which is independent of the atmosphere in which the irradiation was performed. (Auth.)


**FIRST AND SECOND MATINGS AFTER**

p. 105 in "Repro. from Genetic Radiation Studies".

**TRANSLATION OVER THE AGE RANGE**

0-14 in "Repair from Genetic Radiation Studies".

**A decrease from N and an increase in O as 2-d-old males are less sensitive to x-rays than at 1 to about 8 h. In 7-d-old males there**

**REFERENCES**


Scans on the hind wings of Ephesia kuehniella are of uniform shape and colour. After irradiation of pupae, single mutant scales of different appearance are found. There are 4 types of mutant scales, each with a characteristic mutation rate after irradiation in a standard environment. In a pilot experiment, Lin and Christiansen found that it is possible to change the relative frequencies of these mutant types by variation of the temperature before irradiation. In order to ascertain this effect and to gain a better insight into its nature, the dose-relationships were studied. Pupae were kept at 35°C or 35°C respectively for 6 h and were then irradiated with one of 5 x-ray doses between 100 and 1900 r. For each point of the dose-effect curves 576-903 scales were examined. The experiment was repeated once. The shape of the dose-effect curves for each mutation was the same, regardless of the kind of pre-treatment, but the level of the curves of the types E51 and E53 was considerably lower in the 35°C-series, whereas for E52 and E54 it remained the same or was even higher than in the 35°C-series. In conclusion, the relative frequencies of the 4 types, i.e. the mutational spectra, were changed by different pre-treatments in the same proportion over the whole dose range tested.

In order to throw light on the relative importance of radiation versus aging, the mutation frequency among offspring derived from eggs laid at different lengths of time after irradiation of the female will be further investigated. Pre-imaginal and imaginal stages will be irradiated chronically and acutely. In a study of the importance of these stages, solutions of radioactive materials will be used for delivering radiation as controlled doses. The effect of the pre-imaginal irradiation on survival and the life span of the exposed flies will also be studied, in order among other things to give light on the influence of dose-rate on the effectiveness of the radiation in producing damage of this kind. A series of other experiments designed to investigate the kinds of genetic basis underlying the damaging effects of x-rays on radiation on survival and the life span will be carried out. These will involve the use of diverse sex chromosomes and sex chromosomes. The investigation of the question whether spermatogenesis held in the male after irradiation undergoes a natural pre-mutational repair, prevented over some time, will be carried further. The study of the effect of anoxia (hypoxia) and post-irradiation the radiation management will be carried further. Work will be continued on peculiarities of histocompatibility in undergoing radiation-induced chromosomal changes.


In order to find out whether a change in dose-rate would significantly alter a radiation response, eggs as well as the adults of Tribolium castaneum were kept under varying conditions and taken at a different dose-rates. The doses employed were 2000 and 5000 rad and the dose-rates ranged from 128 rad/h to 140,000 rad/h. It was observed that with an increase in dose-rate there was a decrease in the fertility of the adults. Similairly the viability of the eggs was considerably reduced as the dose-rate increased. These results are significant in the viability of the adults and the significance of these findings is discussed. (Auth.)

1092


The major portion of the study was carried out on the late 2nd spermatocytes of P. sphenoides, supplemented with data obtained from other species of the same family. The major changes observed were an increase in the number of cells and a decrease in the number of anaphases. The results are given for (1) x-irradiation with whole-body exposure (with the respective animals contained in a series of thin-walled containers); (2) x-irradiation of individual cells at selected stages (sensitivity was measured in terms of chromosome localization and the frequency of anaphases); and (3) x-irradiation of parts of individual cells. The findings of this study is discussed. (Auth.)

1093


The possibility that x-rays give rise to different biological phenomena in the genetic or cytological effects is reviewed and discussed. Kaufman and Hollande's conclusions about the recovering effect of uv rays are discussed and analyzed. Similar experiments on the effects of x-rays in Drosophila melanogaster (at the given wave length) are summarized. On the contrary, these do not show agreement in the results. These results are in agreement with the observation that the results of uv radiation and x-rays were not observed in Drosophila melanogaster (at different wave length) in the same experiment. A 15-MeV-bremsstrahlung was used. It is the function of the authors to reproduce this effect. The ultra-fluorescent radiation was obtained using a 15-MeV bremsstrahlung. The authors have given us some data and we are not the same. 1094

Oster, L.L. OBSERVATIONS ON THE DROSOPHILA LINES. p. 11-12 in "Repair of Repair (of Repair of Repair of Drosophila Lines)." (Abstract.)

After defining "repair recovery", the authors define a metaphase (male or female) as the number of all possible metaphases. Some data is also given for the metaphase.
the recovering effect of uv rays on chromosomal damage induced in Drosophila sperm by a pre-treatment of x-rays are discussed and analyzed taking into account some general considerations. Preliminary results of similar experiments on the frequency of sex-linked recessive lethals induced after single and combined x-uv treatments in Drosophila sperm are reported. All our experiments indicate no effect of the uv treatment (at the given waves lengths and doses) in lowering the frequency of the x-ray-induced recessive lethals. On the contrary, there are some indications for a synergistic action between the two radiations. These results not in agreement with the generally accepted theory that uv rays do recover x-ray-induced chromosomal damages, could be explained with the well established correlation between chromosomal repaired breaks and genetic mutations. (Auth.)

Oberhauser, F., Kinkel, H.A. ULTRAFRAKTIONIERUNG UND RELATIVE BIOLOGISCHE WIRksamkeit SCHNErER ELEkTRonen. VERSUCHE AN Drosophila EmbRYonen VERScHIEDENER ENTWICKlungs-STADIEN. (Ultrafractionation and relative biological effectiveness of fast electrons. Experiments on Drosophila embryos at different stages of development). Biophyphys 3 (1960) 11-16. (In German, with English summary). A 15-Mev-betatron was used. By means of a special electronic device it was possible to measure radiation pulses in the injector of the accelerator. The frequency of radiation pulses thus varied between 5 and 50 pps. The ultra-fractionated radiation was compared with the continuous radiation from a 1000-c.C. source. The influence of ultrafractionation on the rate of fast electrons was tested on Drosophila eggs aged 12, 24, and 6 h (at least 2000 eggs being tested for each stage). The average dosage rate or the dose of the particular radiation pulses was kept constant. Dose-effect curves show a significant influence of the pulse frequency on the percentage of killed eggs, possibly due to the existence of a recovery effect.

Oster, L. I. ON RECOVERY IN X-IRRADIATED GERM CELLS. J. cell. comp. Physiol. Suppl. 2 58 (1961) 203-7. Symposium on "Recovery of Cells from Injury" (Gottfried, Tennessee, 3-9 April 1961). Philadelphia: The Wistar Institute of Anatomy and Biology. 1961. After defining "recovery", the author suggests that spermatozoa located in different sections of the spermatogenic tract (male or female) are differently oxygenated. He proposes that differential radiosensitivity is in all likelihood responsible for differences which have been observed following x-irradiation of sperm. Some data is also given for irradiation with neutrons.

Oster, L. I., Pooley, P., Schwarz, B. THE FREQUENCY OF MOSAIC MUTATIONS INDUCED BY GAMMA RAYS AND NEUTRONS. (Abstr.) Genetics 47, 2 (1962) 976. Homogenous samples of mature spermatozoa (from inactivated females) were treated with sparsely ionizing radiation (y-rays from a Co-60 source) and densely ionizing radiation (fast neutrons) and the incidence and modes of expression of mutations induced at the dummy locus were analyzed. A y-dose of 4000 r (delivered at the rate of 200,000 r/h) yielded 64 mutations at the dummy locus amongst 13,100 offspring (0.49%). 15 of these were mosaic (26%). A neutron dose of 700 INS yielded 55 mutations at the dummy locus amongst 23,969 offspring (0.23%). 15 of these were mosaic (31%). These results resemble those obtained with x-rays (Carlson) but differ significantly from the 85-90% incidence of mosaics following treatment with chemical mutagens. Thus differences in LET do not result in different frequencies of induced mosaics, and unlike chemicals, ionizing radiation tends more often than not to affect both DNA strands while preserving the chromatin. In addition, preliminary results with x-irradiated spermatozoa and spermatids have indicated that although mosaics can be induced occasionally in these stages the frequency of such mosaics is similar to that produced by irradiation of spermatozoa. (From abst.)

Oster, L. I. THE MUTATIONAL SPectRum WITH SPECIAL REFEREnCE TO THE INDUCTIoN OF MOSAICS. p. 51-5 in "Report from Genene Radiation Damage". Sobels, P.F., Ed. Oxford: Pergamon Press, 1963. By the use of special multipurpose stocks of Drosophila melanogaster and refined breeding techniques the effects of several conditions existing at the time of irradiation were investigated. In addition to information gained concerning the frequencies of induced chromosomal breakage, lethal mutations, and translocations, which were in line with previous results, it was found that y-rays, x-rays in air or oxygen, and neutrons produce relatively low frequencies of mosaic mutations while irradiation under anoxic conditions results in fairly high proportions of mosaic individuals. (Auth.)

Progress is reported in studies on the genetic effects of radiation in Drosophila. Such aspects as induced crossing-over and non-disjunction, differences in the effects of acute and chronic irradiation, and effects of ionizing radiation of different LET transfer properties, delivered under various conditions, were studied. Several innovations and techniques are described that were introduced with a view to increasing the degree of refinement in the detection of induced hereditary changes.


An attempt was made to define the spectrum of effects that radiation of different LET properties (x, γ, fast neutrons) can produce in the genetic material of the fruit fly. Pre-imaginal stages and irradiated females proved the best source of hermaphroditic male germ cells. The relative sensitivity to γ-rays of spermatids in pupae and of spermatozoa in females was studied by a method similar to that used for determining the spectrum of sensitivity of germ cells to x-rays. A similar sensitivity to x- and γ-rays was obtained. Differences in mutation frequency among spermatozoa x-rayed in the female and in the male (but released on days following irradiation) appear due to differential oxygenation during treatment and hence to radiosensitivity rather than to recovery, supported by results obtained from neutron irradiation. Spermatids appear to be relatively less sensitive to neutrons than to x-rays. Results are also cited for various treatments (3000 c/min x-irradiation of spermatids, at the pupal stage in air; γ-irradiation of mature spermatozoa in irradiated females) in 10% CO₂ 10% N₂ 80% air by fast neutrons in air. The LET difference between y-rays and neutrons does not result in different frequencies of induced mutations. The interactions between fast neutrons and x-rays were studied in mature spermatozoa. The effects appear to be additive for lethals but no interaction between breaks was observed. Work on (x-rays, fast neutrons) induced crossing-over are also described. Studies are under way to determine effects of varying radiation dosage, LET properties, and accessory conditions on non-disjunction in the female and also on mutagen-induced mortality. Cytological observations are described.


Experiments aimed at modifying the genetic damage produced by ionizing radiation will be continued using the reproductive cells of Drosophila melanogaster. Our studies on induced crossing-over and non-disjunction will be extended. Several new strains will be utilized in order to pinpoint more exactly the regions of the chromosomes which are differentially affected as regards crossing over by different conditions existing during irradiation. In addition, experiments to determine the extent to which chronically-delivered radiation affects crossing over and non-disjunction will be undertaken. It is planned to extend our analyses of the effects produced by types of ionizing radiation characterized by different LET properties (x-rays, y-rays, x-rays and neutrons) in the genetic material when delivered at different doses and under different conditions. Special emphasis will be placed on the relative incidences of induced male and whole-body mutations. The frequencies of such changes will also be studied following the exposure of germ cells to chronically-delivered radiation with a view to detecting the presence of repair mechanisms. In addition, with the aid of a newly developed cytological technique for studying somatic chromosomes, we hope to be able to investigate the effects of relatively low doses of radiation, differences between acutely- and chronically-delivered radiation, and the effects of chemical mutagens.


The protective effect of cystine against the production of sex-linked recessive lethals in Drosophila sperm by x-irradiation was investigated. It is shown that the cystine injection prior to irradiation apparently reduced the production of sex-linked recessive lethals. The protecting action of cystine can be ascertained to the oxygen starvation produced by its easily oxidized-SH groups during irradiation. (NSA 17:1963, 35268)

The factorial experiments were carried out to examine the effects of high and low temperatures (15°C and 30°C) before, during and after irradiation, on the susceptibility of the adult grain weevil to doses in the range 3000 to 20,000 rads. Mortality: A high temperature before irradiation sensitizes the insect to subsequent irradiation, reflected in greater mortality, whereas a low temperature affords some protection. During irradiation these effects are reversed, a low temperature sensitizes and a high temperature exerts a protective influence. Under both conditions the maximum effect is observed at doses between 5000 and 10,000 rads. After irradiation, a high temperature increases the rate of mortality, at low temperatures it is retarded, this last effect being independent of dose. Sterility: Differences of 10-30°C before, during and after irradiation do not modify the susceptibility of grain weevil to radiation sterilization. The maximum dose for control of grain weevil (18,000 rads) would be effective at all temperatures likely to be encountered in commercial practice. (Auth.)


Data are presented on the effects of low and medium doses of Cr60 γ-radiation on adult spring cantharids flies (Pholothricta tamias vivax) and on the progeny of those insects from the 1st to the 5th generation. Fifteen experiments used various radiation doses from 200 to 3000 r and combinations of irradiated males, irradiated females, or both irradiated males and females. The mortality rate among insects irradiated with 100 r was higher than that of mature insects exposed to higher doses. The percentage of sterilized eggs and mortality rate of the pre-insectal stage increased with the intensity of the radiation dose to the maternal generation of mature flies. Possible applications of radiation in the control of insect pests are discussed. (NSA 141365, 6010)


See 1107.

1106 Palkov, Š. EFFECT OF A LOW TEMPERATURE ON THE DEVELOPMENT OF RADIATION INJURY IN EGGS OF THE SILKWORM Bombyx mori L. Folia biol., Prague 1 (1961) 281-4. (In English)

Experiments were made to determine whether the cooling of irradiated eggs during the diapause would moderate the effects of radiation to eggs of the silkworm. The degree of injury to the irradiated eggs was evaluated from the percentage of larvae hatched and from the time course of hatching. It was found that a low temperature moderated the effects of radiation. Injury was less when the eggs were irradiated before being placed in the refrigerator than when they were irradiated after being removed from the refrigerator. It is suggested that the difference in injury is related to metabolic changes. (NSA 151301, 30857)


Germ cells of spermatogenesis of D. melanogaster were treated with 800 r of x-rays. The sensitivity spectrum for recessive sex-linked lethals, obtained by crossing the treated males for 10 successive days, shows a maximum in days 5 to 7, corresponding to treated spermatid this confirms data already known. Anoxia lowers the sensitivity throughout the whole spectrum, particularly for spermatid O3 treatment increases x-ray damage, although not uniformly in the different stages of spermatogenesis: the less sensitive cells under these circumstances are spermatids and spermatogenes. (Auth.)


By scoring recessive sex-linked lethals in repeated single matings of x-ray-treated D. melanogaster males to 3-mueller females, with mating periods of 24h, a sensitivity spectrum is obtained for the different
spermatogenic stages present in the testis at the moment of irradiation. With the aid of the sterility criterion and by comparison with other authors' data, it is possible to correlate the mutation frequencies with treated germ-cell stages. The results for the air treatment are in agreement with known data, giving a peak mutation frequency on the 6th day after treatment, corresponding to treated spermatids. If the flies are kept in an atmosphere of O₂ or N₂ from 40 min before to 40 min after irradiation, mutation frequencies in different cell stages are modified to a different extent. Apoptosis, which shows a reducing effect on all stages, acts more strongly on stages giving highest mutation frequency in air. The effect of oxygen, on the other hand, is mainly restricted to mature stages utilized on days 1-4 after treatment, and to stages which were exposed as representing undecis (7-10 days after treatment). Spermatids are least sensitive to an increase in O₂ concentration. A metabolic effect of the presence of different gases, as well as a different physiological moment of O₂, could be responsible for the differential modifying action of O₂ and N₂ on the mutation frequency spectrum.


(Essentially as for 1168)


Drosophila male germ cells were exposed to 800 rad of Co²⁹ γ-rays at 0.05, 0.2 and 5.0 rad/min. N₀ males were mated to 7 successive broods of which broods I and VII were reared in high chromosome recessive lethal mutants. Mutation frequency was independent of dose-rate in each brood. It was concluded that dose-rate had no discernible effect on induced mutation frequency in spermatids (brood I) or spermatogonias (brood VII). These results are discussed in relation to the hypothesis that the dose-rate effect discovered by Russell in the mouse arises through repair of genetic radiation damage. It is suggested that killing of cells by radiation, which is much more extensive in the mouse than in Drosophila, would be a more plausible mechanism to explain the dose-rate effect than repair, for which there is no corroborative evidence. (Author.)


A study was made of the effect of intensity of irradiation on the production of high chromosome lethal mutations in spermatogonias and spermatogonias of Drosophila. No intensity effect was detected between x-ray doses of 500 r given at 1.00 r/min and 0.01 r/min respectively, or Co²⁹ x-ray doses of 5000 r given at 500 r/min and 5.0 r/min respectively. A comparison between the effect of Co²⁹ γ-rays given at 50.0 r/min and 0.1 r/min at a total dose of 200 r showed that a slight intensity effect might be operative in spermatogonias but that this was very much less than that observed by Russell in the mouse over a comparable dose-rate range. (Author.)


The effect of radiation intensity on the induction of mutation was studied in Drosophila. Male germ cells were exposed to radiation intensities ranging from 0.01 to 2.6 r/min. No intensity effect was observed when irradiation was received primarily by spermatocytes and spermatids. Similarly, no intensity effect was observed in spermatogonias over the range 0.05 to 5.0 r/min. Irradiation at 0.01 r/min did, however, produce a significantly low mutation frequency in our experiment. This may indicate the presence, at very low dose-rates, of an intensity effect in spermatogonias, but the single observation was not regarded as conclusive. Attempts to examine the effect of dose-fractionation in the light of possible intensity effects were rendered inconclusive by the absence of an intensity effect in parallel experiments. (Author.)


The effect of treatment with Verene (I) solution before irradiation on the frequency of chromosome breakage was determined by counting the number of dicentric bridges in the first mitotic anaphase divisions of the testes of the grasshopper, Gomphus punctipennis. In the controls (treated with 0.6% saline plus 86 r of x-rays), 10.84 ± 0.27 bridge in 6.0% saline plus 86 r of x phase cells. It was concluded breaks in their material. (CA)

1114 Ray-Chaudhari, S.P., Chaudhuri, C. CHROMOSOMES FROM X-RAY INT. J. Rad. Biol. 4, 6 (1965)

The effect of x-ray's on DNA determined under both aerobic and anaerobic conditions in mitotic and meiotic stages. The degree of protection by cytotoxic treatment is discussed. The possible sensitivities between folate and a.

1115 Redd, O.S. THE GENETIC RADIATION TREATMENT. J Drosophila. spermatogonias were r was given either to males or to females for day progeny of treated males, N₀ or after neutron radiation, N₀ flirted to the treatment. 1st stage males were mated after 1 or 2 sensitivities between folate and a.

1116 Ricehart, B.R., R. SOME EFFECT IN X-RAY-INDUCED Drosophila Drosophila wild males were t or a combination of the sexes, 25°C, and at a cold temperature similar x-ray doses and tempe regenerating females for successive irradiation damage in males with the test-gas. This was true at 20-25°C or 5% O₂, at 3-5°C observed when small amounts damage when the flies were not enhanced where 5% O₂ was used while males and presumably formed within the was intermediate to that observed, the amount of damage w and 500 r was decreased H, in O₂. A 2-5% petri dish which was due to a lack of mature sp regenerating mechanisms of entar are pointed out that might occur. (Dros. Abstr., 281, 1939).

1117 Ricehart, B.R., R. SOME EFFECT IN X-RAY-INDUCED Drosophila. The ability of small amounts 0 to that when equal amounts of eut amounts of either gas cause the reaction to form NO₂, much of it in the hydroxides products, nitr
With the aid of the sterilizer
relate the mutation frequencies
obtained with known data, giving
rise to spermatozoa. If the
number of spermatozoa
was increased after irradiation, mutation
rates were observed, which shows a recording
of the frequency in air. The effect of
Irradiation on days 1-4 after treatment, and
thereafter, was less sensitive.
Spermatozoa in different doses of different gases, as well as the
Sensitivities of spermatozoa
of x-rays, 10.8 x 0.27 bridges were recorded as compared with 8.39 x 0.416 in the treated series (10\(^8\) M \(x\)-rays in 0.67% saline plus 86 r


The effect of cysteamine pre-treatment on the frequency of x-ray-induced chromosome aberrations was determined under both aerobic and anaerobic conditions by counting the dicentric bridges in two different does of the first division mitotic anaphase of the grasshopper, *Gonocerus punctulatus*. Under aerobic conditions the score was 5.36% and 5.22% in the treated and control groups, respectively. The degree of protection by cysteamine under both aerobic and anaerobic conditions was found to be more or less the same. The probable mode of protection has been discussed. (Auth.)


Drosophila melanogaster were exposed to x-rays in air, x-rays in He, and neutron in air. Each treatment was given either to males or to females. After x-irradiation in air the frequencies of sex-linked lethals and translocations were higher among the progeny of treated females, lower in the 1st day progeny of treated males, and lowest in the 2nd-day progeny of treated males. After x-irradiation in He or after neutron radiation, all 3 frequencies were the same. This suggests that both differences (male versus female treatment, 1st versus 2nd day) have the same basic cause. Experiments in which x-rayed males were mated after 1 or 2 days of storage without females indicate that this cause is differential radiosensitivity between fully and only partly mature spermatozoa. (Auth.)


Drosophila metzli males were treated with xenon x-ray doses in the presence of small amounts of O\(_2\), NO, or a combination of gases. The effects upon sperm survival were tested at a warm temperature, 23-28°C, and at a cold temperature, 3-5°C. Control experiments were conducted in air and in air at similar x-ray doses and temperatures. The treated males were mated for 3 days and then mated to 3 heterozygous females for successive 2-3 mating periods. The number of eggs laid each day was recorded. Irradiation damage in males was enhanced appreciably by the x-rays of NO at 22-28°C or of O\(_2\) at 3-5°C. showed a similar amount of damage, with similar x-ray doses, as was observed when small amounts of NO were used. A lower temperature did not appear to alter the x-ray damage when the flies were treated with NO or O\(_2\). However, at 3-5°C irradiation damage was greatly enhanced when NO was used as the test-gas. Flies were treated in a mixture of NO, O\(_2\), and NO\(_2\) prepared by mixing 2% NO and 2% O\(_2\). Through hydrolysis of the NO, nitric and nitrous acids were presumably formed within the cell. At room temperature the amount of damage under these conditions was intermediate to that observed in the NO tests and tests conducted in anaerobic. By lowering the temperature, the amount of damage was increased. The amount of lethality usually associated with 2 or 3% NO and 5% O\(_2\) was increased if, immediately after irradiation in NO, the flies were post-treated with 1 atm. O\(_2\). A 6-day period during which no eggs developed from females mated with males treated with 3% NO was due to a lack of mature sperm rather than to cell lethality. No conclusive results were reached regarding mechanisms of enhancement of x-irradiation damage in males by NO. A number of experiments are pointed out that might resolve more completely the basis of action of NO in the system. (Illus. Abstr. 59:188, 1963, 1039-40)


The ability of small amounts of NO or O\(_2\) to increase dominant lethality was tested. (See 1116). It appears that when equal amounts of either NO or O\(_2\) are present within the spermatozoic cells being tested, equal amounts of either gas cause equivalent increases in damage. In the presence of NO and O\(_2\), which will react to form NO\(_2\), much of the effect of both gases to increase x-ray damage was reversed. Neither NO nor its hydrolysis products, nitric or nitrous acids, appear to be the major factors in this system. O\(_2\)
post-treatment immediately after irradiation in 2% or 3% NO reduces some of the damage. NO appears to modify the post-irradiation survival of the males.


The influence of physical and biological factors on the biological efficiency of ionizing radiation was studied. The results of comparative studies on the biological effects of 70 kV x-rays and PH B radiation on D. melanogaster eggs 1 1/4 and 3 1/4 h old are given. No differences in biological effects were found between the 2 types of radiating energy. (Auth.)


Results are reported from an investigation of the frequency of induced XO males and induced autosomal crossovers in meiotic and prespmeiotic stages in Drosophila after irradiation of 0 to 3-old males. The effect of irradiation under anaera upon the yield of XO males and upon the rate of induced autosomal crossovers was studied during the period of highest sensitivity to x-ray irradiation. By use of a dual-purpose stock it was possible to study both alterations in the same stock. It is shown that there is a significantly lower rate of induced XO males in experiments performed under anoxic conditions compared to those irradiated in air. It is furthermore obvious that the differences in the data plastic in mating periods corresponding to the highest sensitivity. In order further to study the effect of irradiation under anaerobic conditions, two experiments were performed where the dose was divided into two parts. The first part consisted of 1500 r in commercial nitrogen with an interval of 15 and 60 min, respectively, in air, whereas the second part, 750 r in air, was given. The results indicate that there is some recovery after irradiation of the sensitive stages but that it could only partly be blocked by 750 r given in air within 15 min. That the reduced effect of irradiation under anaera is not limited to XO males is obvious from the crossing-over study. The observed crossover data fit well with the sensitivity pattern obtained through X-ray studies. Crossovers available for inspection so and after the 15th day appear to correspond to cells treated as spermatogonia.


Studies were made on the effect of irradiation under different oxygen concentrations during various stages of spermatogenesis. Drosophila, 0-1 and 3-4 d old red and white flies, were irradiated in commercial nitrogen or oxygen and mated to virgin w m females. A comparison between the yield of XO males after irradiation under anaerobic conditions and the corresponding data after treatment in air shows that a significantly lower rate of induced XO males is obtained after irradiation in N2 atmosphere. The difference in most marked in mating periods corresponding to the period of highest sensitivity. The effect of commercial oxygen on the frequency of induced XO males after irradiation of 0-1 and 3-4 d old males is reversed as compared to the effect of air atmosphere. For 3-4 d old males irradiation in O2 increases the yield of XO males. For both types of males almost no enhancing effect is obtained for mature spermatogonial after irradiation in N2. It is concluded that it is not possible to talk about a common air/stress ratio of radiosensitivity for irradiated Drosophila males, since there exist great variations between the different mating periods. For 3-4 d old males, irradiation under anaera gives an almost total protection against induced non-disjunction. For 0-1 d old males a reduction in the yield of non-disjunction females is observed. The relation between radiosensitivity and irradiation time and/or intercellular oxygen available in the treated cells is discussed. (From auth. summary)


1124 Seecof, R.L. TREATMENT WITH ULTRAVIOLET RADIATION.

Eggs were collected from females with x-rays or ultraviolet factors (gamma factors causing) adults that developed from un 200-300 eggs/mnt mortality in raising times X-ray treat in time. The first increases the mean dose to date, but more means are now being done to present an induction of infectious

1125 Shibori, R., Tachibana, H., X-RAYS IN Drosophila. (Abstract)


A wild type D. melanogaster, unit per ml. 4 d old virgin testes used, x-ray treatment with 500, 1000, 2000 Drosophila are found to be a chromosome in effect relationship remains by nearly 1 as compared to the feeding of penicillin dust mutation rate when fed d radiation induced mutations, 4 in (Abstract)

1127 Sobels, F.H., Tates, A.D. D. Drosophila SPERMATOGENESIS Data relating to specific processes premeiotic damage in postmeiotic stages, and late specificity to x-irradiation, present the dose and post-treatment with M, results in an result to either an increase or decrease can be explained by from premeiotic damage, premeiotic stages, the meiotic cycles enhanced by the post-treatment with the medium in which the author considers the cells of widely divergent origin.


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x-rays) suggest that accumulation of O₂ plays a part in the enhancing effect of cyanide in spermatozoa after irradiation in air. The findings in impure and purified N₄ show that in the presence of a respiratory inhibitor even small amounts of O₂ may lead to a drastic increase in radiosensitivity. The fact that cyanide pre-treatment is effective in purified N₄ after high-intensity (2640 c/min) but not after low-intensity radiation is considered as an indication of a dose-rate effect specifically connected with cyanide pre- or post-treatment.


It has been inferred that inhibition of protein synthesis favors repair of pre-mutational radiation damage (see 1131). This assumption is supported by the observation that both pre-treatment with chloramphenicol, known for its inhibiting effect on protein synthesis, and post-treatment with chloramphenicol reduce the mutation frequency to a proportion that is produced by x-irradiation alone. To explain the results it has been assumed that, from a certain amount of pre-mutational damage, a proportion does not result in mutation and that this repair process is restored in a definite time-interval following exposure to radiation. The action of chloramphenicol and ribonuclease is thought to consist then in promoting the time-span available for repair of pre-mutational damage, which would result in a lowering of the mutation frequency. Further data relating to this interpretation will be reported. For all experiments, males carrying a closed-X chromosome were used. This reduces the genetic effects observed to point-mutational lethals and possibly small deletions.


In irradiated Drosophila spermatozoa and spermatoocytes, repair processes were shown to occur in flies by treatment with cyanide. In the germ cell stages showing peak sensitivity to radiation, post-treatment with cyanide resulted in a significant increase of the mutation frequency, if x-irradiation was given at a high dose rate of 2000 c/min. Post-treatment following radiation at lower dose rates of 500 c/min or 150 c/min, however, did not notably change the frequency of mutations. Evidence was obtained that the increase in lethality frequency due to cyanide involves gene mutations and possibly small deletions. Cyanide may also inhibit a system responsible for repair of part of the pre-mutational radiation damage, and it was shown that cyanide can produce both enhancement and lowering of the mutation frequency induced by high-intensity radiation in spermatozoa. Post-treatment experiments under conditions (N₂ or O₂), where cyanide is ineffective, if post-treatment with low-intensity radiation, suggest that there is a specific dose rate dependence in the presence of cyanide. It was assumed that in the presence of high-intensity radiation, apart from direct damage to the chromosomes, affects a second susceptible, which may be associated with repair processes. Other observations on modification of radiation frequencies after dose fractionation, post-treatment with N₂, and pre-treatment with both chloramphenicol and ribonuclease are reported.


Changes of radiation-induced mutation frequencies in successive stages of spermatogenesis are reported after post-treatment with both HCN and N₂, after dose-fractionation and after pre-treatment with both chloramphenicol and ribonuclease. Except for the experiments with chloramphenicol and ribonuclease all exposures were given at a high dose rate of 48 r per 55 c/min. Post-treatment with cyanide may lead to either an increase or decrease of the mutation rate in stages with peak sensitivity. Post-treatment with purified N₂ increases the mutation frequency in spermatozoa, meiotic stages and spermatogonia (but the last not reproducible). Fractionation of the dose lowers the mutagenic effect of radiation in stages with peak sensitivity. Dose-fractionation followed by post-treatment with N₂ reduces the mutation frequency in spermatogonia. Pre-treatment with chloramphenicol decreases the mutation frequency in spermatogonia, spermatocytes and late spermatogonia, whereas an increase was observed in mature sperm. Post-treatment with ribonuclease raises the mutation frequency in mature sperm and lowers it in spermatogonia. Modification of pre-mutational damage in Drosophila males is concluded to be possible in meiotic stages and perhaps in spermatogonia. Two contrasting processes are postulated. The observations after pre-treatment with chloramphenicol and ribonuclease in sperm and spermatids suggest that protein synthesis is involved in the different radiosensitivities of these two stages. (From auth. summary)


Males carrying a ring-shaped X-chromosome (X \(_{2}\)Y \(_{2}\)) were used throughout. This restricts the genetic effects observed to lethal point mutations and possibly small deletions. In one of the post-treatment experiments a reduction of the radiaton-induced mutagenic-frequency due to chlorambucil was observed throughout all stages, in another only in spermatozoa; in experiments on the effect of pre-treatment with ribonuclease, a significant decrease of the mutation-frequency was repeatedly observed in spermatozoa. The similarity in effect of ribonuclease with that of chlorambucil suggests that inhibition of protein-synthesis can be held responsible for the reduction of the mutation-frequency, following pre-treatment with these substances. When the experiments on post-treatment with N \(_{2}\) were continued, an increase of the mutation-frequency in spermatozoa of the post-treated group was consistently observed. A treatment-deathy experiment showed that the critical time-span during which modification of the mutation-process by N \(_{2}\) is still possible, does not exceed 25 min. It has been assumed that from a certain amount of pre-mutational radiation damage, a proportion does not result in mutation and that this repair process is restricted to a definite time-interval. The increase of the mutation-frequency after post-treatment with N \(_{2}\) is thought to result from an inhibition of the metabolic repair process. To explain the reduction of the mutation-frequency due to both post- and pre-treatment with chlorambucil and pre-treatment with ribonuclease, it is assumed that inhibition of protein-synthesis increases the time-span available for repair of pre-mutational radiation damage. (From abstr.)


Irradiation in O greatly restricts the capacity of the sperm or spermatics of Drosophila to undergo repair, as compared with irradiation in N. The O/N enhancement factor for irradiation-induced mutations was 1.3 for sperm and 3 for spermatics. (CA 81: 7262b; 72628)


Results are reviewed from studies on the role of peroxides in the induction of mutations in Drosophila by X-rays, ultraviolet radiation, and formaldehyde. It is highly probable that the formation of either an organic peroxide or of free radicals including peroxides and persid radicals are involved in the production of mutations by formaldehyde and also perhaps in the radiomutating effect exerted by formaldehyde. This, then, seems present the only possible experimental evidence that peroxides may be involved in the production of mutations by X-radiation to Drosophila.


Post-treatment of Drosophila germ cells with either chlorambucil or ribonuclease was found to decrease the radiated frequencies of sex-linked lethals (X \(_{2}\)Y \(_{2}\) chromosomes) in stages showing peak sensitivity to X-irradiation, corresponding to spermatics and late spermatocytes. In mature sperm these agents cause a significant increase of the mutation frequency. The results with spermatics suggest that inhibition of protein synthesis lowers the initial sensitivity to the induction of pre-mutational damage. Post-treatment with O \(_{2}\) following radiation exposure to 3000 r in N \(_{2}\) lowers the mutation-frequency. It is thought that, under these conditions, O \(_{2}\) acts by activating an inhibited repair system. After exposure to 3000 r in O \(_{2}\), the effect of post-treatment with O \(_{2}\) exactly equaled that of post-treatment with N \(_{2}\). This finding is interpreted on the assumption that the biochemical system responsible for repair, is damaged to a greater extent by irradiation in O \(_{2}\) than in N \(_{2}\). The observation that after exposure of a ring-X chromosome there is a dose rate dependence in the presence of cyanide and that dose fractionation produces few mutations in spermatids than unfraccionated radiation, suggest the idea that the repair system itself is liable to undergo radiation damage. Post-treatment with chlorambucil produced an enhancement of the mutation frequency in two experiments in did spermatozoa. These findings are taken as an indication that protein synthesis is required for the repair process. In other experiments, however, post-treatment with chlorambucil lowered the mutation frequency. It was concluded that the mutational response is
Drosophila melanogaster can be resolved into four components, which can be modified separately: initial radiosensitivity to the induction of pre-mutational damage, efficiency of the repair process, time of mutation fixation, radiation damage to the repair system.

**Steger, J. M.**  **EFFECT OF 2, 4-DINITROPHENOL ON RADIATION-INDUCED DOMINANT LETHALS FACTORS IN DROSOPHILA MELANOGASTER.**  *Genetic 12*  (1962)  247-55.

The influence of 2, 4-dinitrophenol (2, 4-DNP) on the radiation-induced rate of the dominant lethal factors of *D. melanogaster* was investigated. "a"- and "b"- type larvae, whose triggers (affect mainly spermatocytes, were given 1000 r of a 190 kv, 8 ma radiation. The descendants of irradiated males with non-irradiated females were examined regarding dominant lethal factors. The rate of dominant lethal factors increased from 0 to 1, according to the dose given before radiation. The pre-treatment effect of 2, 4-DNP could be due to a variety of intracellular processes, which have a partly mutation-stimulating, partly mutation-preventing effect. Of all factors, the hypotaxis of the spermatocytes, caused by 2, 4-DNP pre-treatment, seems to have the largest effect.

**Sumarokov, G. V.**  **CORRELATION BETWEEN THE REDOX POTENTIAL OF THE LYMPH OF CRICKETS DURING IRADIATION AND RADIOSENSITIVITY.**  *Genetic 12*  (1962)  247-55.

A microencephal has been developed to determine the redox potential of the haemoepithy of insects in vivo. The effect of various protective factors (hypotaxis, protective substances which influence the radiosensitivity of insects has been investigated. Uncorrelated differences in the values of the redox potential have been observed for solutions of protective substances and for tissues into which protective substances had been introduced. On the other hand, when protective substances are introduced into the organism during hypotaxis, the values of the redox potential exactly correlate with the magnitude of the protective effect and radiosensitivity. The data reported in the literature which failed to show such correlation were obtained when the potentials were measured in vitro and did not allow for the redistribution of the rates of oxidation-reduction reactions in living systems, altered by the protective effects.


It could be demonstrated that when crickets (Gryllus domesticus L.) were subjected to γ-radiation, cytochrome and hypotaxis had a cumulative protective effect. (Add was replaced by N4 at the time of irradiation. The following LDA values were obtained: without protection. 4200 nm with free cyanine. 6700; with hypotaxis. 9900; with cyanine and hypotaxis. 11 900. A direct relationship was established between the radioprotective potential of crickets haemoepithy and their radiosensitivity. A correlation was observed within the r2 range from -1.40 mV in unirradiated crickets to -1.16 mV in crickets as N4 after previous cyanine injection. The relationship between radiosensitivity and the value of the radiation-oxidation potential of the tissues at the time of irradiation may be explained by the composition of various reducing agents (their concentration having increased under the influence of the protective factors) with the vitally important cellular reducing agents for oxidizing radicals and peroxides arising from irradiation.


Male flies with ring-shaped X-chromosomes were exposed to a dose of purified N2 before 25 min, following 1600, 4 (at 35 sec/40) of x-rays. Tests for sex-linked lethal were made in 5 successive 2-day broods, using 3 females/male/brood. In 2 independent experiments, a significant increase in the mutation frequency due to post-treatment was observed in the last 3 broods, representing stages with peak sensitivity and earlier stages (6.7%, lethal in 3 tests) in the post-treatment gyn fractions separated by 3 rd of 3 days (at 4 stages with peak sensitivity were 24, 24, 24, and 24, respectively) than in the male parental and spermatogonia; decrease in mutation frequency exposure, against 6%, 5% in 2677 appears possible at peak sensitivity. The new genetic effects of HCN (cyanide) results in an increase.

**Tates, A. D.**  **MODIFICATION OF NITROGEN POST-TREATMENT.**  *Genetic 12*  (1962)  70.

Results of independent experiments indicate that post-treatment in spermatids and larval radiation without post-treatment in spermatids (2.3, 2.2, 2.1, and 2.0) is due to the repair of post-natal damage: a delay of 25 min. A complete decrease of the mutation rate is treatment 0, 542 (82.2% compared with 0, 560). Under these experimental conditions it was shown that dose fractions five equal fractions, separated at.


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DOMINANT LETHALS

The dominant lethal factor of certain mutagenic spermatozoa, injected males with non-irradiated dominant lethal factors was ation. The procreative effect of the mutation-stimulating, partly cyto, caused by 1 during the

THE LYMHPH OF CRICKETS

International Congress on London, Silver End

The hemolymph of insects in vivo, which influence the radiosensitivity of the rodent potential have been intro-organism during hypoxia, the values of the effect and radiosensitivity, were obtained when the potential of oxidation-reduction reactions


Results of 8 independent experiments show a significant increase in the mutation frequency due to post- treatment in spermatids and late spermatocytes, 0.6% lethals (564 tested chromosomes) were found after irradiation with post-treatment and 9.8% lethals (6180 chromosomes) with N2 post-treatment normal deviate = 2.21 and \( p < 0.05 \). A possible interpretation of the results is that 2 post-treatment blocks repair of pre-mutational damage. In 2 experiments a 3rd group of flies received N2 post-treatment after a delay of 28 min. A comparison of the results of delayed versus direct post-treatment shows a significant decrease of the mutation rate in the group with delayed post-treatment. The percentag for the direct treatment is 0.04% (3222 chromosomes) and for the delayed treatment 7.19% (5454 chromosomes, normal deviate 2.586 and \( p < 0.05 \). This result suggests that in young spermatids and late spermatocytes repair, under these experimental conditions, is completed within 28 min. Five experiments were carried out to investigate whether dose fractionation favors repair. The mutagenic effect of a dose of 3350 r given in five equal fractions, separated by two hour-intervals, were compared with that of unfractinated irradia- tion. The results show a significant decrease of mutation frequency due to fractionation, in the same germ cell stages where N2 post-treatment has been effective. Percentages of lethals for the fractionated and unfractinated groups are 5.09% (694 chromosomes) and 7.77% (4470 chromosomes) respectively (normal deviate 2.01 and \( p < 0.01 \).)


Dose-rate dependence of radiation-induced mutation rate was studied in silk-work spermatozoa and oogonia by the use of the specific focus method. Both sexes of a wild-type strain were exposed to x-rays, 3M y-rays of high dose rate, or to Co60 y-rays of low dose rate at a definite stage or during a definite period in early larval stages. The dose-rate ratios between the acute and chronic irradiations were 2500:1, 1 to 7000:1. The total dose given were 300 r or 1600 r. Two types of dose-rate dependence of radiation- induced mutation rate were found. In one type mutagenic effectiveness of chronic irradiation is lower than that of acute irradiation (Type I) and in the other mutagenic effectiveness is higher in chronic irradiation than acute irradiation (Type II). The former is observed only in the very young larval stage when the primary germ cells are prevalent in the testis, while the latter is found when late stages of spermatogoni- a or oogonia are irradiated. For Type I dose-rate dependence, repair of primary mutations seems to be responsible, whereas for Type II dose-rate dependence selective killing of a specific type of cells by intense exposure seems to play an important role. The relationship between the finding and that of Russell is discussed. Radiation-induced mutation frequency is remarkably high at the very early stage of larvae, i.e., around the time of hatching when the primary germ cells are prevalent in the gonads. (Author)


See 1143


Two types of dose-rate dependence of radiation-induced mutation frequency were found in early genital cells of silkworms. In one type, the mutagenic effectiveness of chronic irradiation is lower than that of acute irradiation, and in the other type the situation is completely reversed. The former type depends upon the stage of germ cells. These findings have been interpreted by assuming differential repair for the former and selective killing for the latter (see 1143). Further evidence compatible with the hypothesis of selective killing was presented. Variation in induced mutation frequency was studied along with the development of germ cells both for the acute and chronic irradiation. It varied drastically after acute irradiation, being highest at the time of hatching and decreasing rapidly toward later stages, while it was almost constant after the chronic irradiation. Irradiation with various doses-rates in later stages revealed that the mutagenic effectiveness of radiation decreases gradually with increase in dose-rate within the range from 0.24 r/hr to 200 r/hr. In this case, the mutation frequency for the acute dose did not decrease even at 150 r from a linear relation extrapolated from higher doses, suggesting that the delivered dose was too high to realize the expectation that a small dose of acute irradiation might give a higher frequency than expected from linear relation. Although directly supporting evidence is still lacking, there are two distinct types of dose-rate dependence, one of which cannot be interpreted by the repair hypothesis.


Dose and stage dependence of radiation-induced mutation rate was investigated. Utilizing the dual-purpose strain constructed by Chen (1956), the dose-dependence of the frequency of X-ray-induced sex-linked lethals and X:Y-translocations for several succeeding early-bred strains was studied, using 10 or 8 P-females per male, and irradiating 5-4- or 6-old bar males (7 doses). With the co-operation of W. Findlay, 174 br-old male parents were also irradiated (5 doses). In addition, the dose dependence of lethals and translocations after irradiation of spermatogonia stored in inoestrous females (9 doses) as well as of radiation-induced chromosome loss after irradiation of mature oocytes (21 doses) were investigated. A stepwise increase of mutation rates with dose for almost all our dose-effect curves was found. For sex-linked lethals dose exponents > 1 for restricted dose regions were obtained. These results are discussed in relation to the following theoretical expectations: approximation of a definite n-hit function by biological variability concerning hit frequency and normal target volume; mutation-by-breakage hypothesis and "positive-effect" hypothesis. Special attention is paid to the depatures (most of which are statistically significant) from the "classical" one-hit relation for sex-linked lethals. (From abstr.)


Using the dual-purpose strain constructed by Oster, the dose-dependence of sex-linked lethals and translocations for the letter 4 one-day-broods after irradiating 5-6 of old star males was studied. Only the results on lethals are reported here. The ratio females/males was 10:1 or 5:1. Different doses of irradiation were given from 500 to 6000 r, using filtered x-rays at 189 keV. The lethal-curves are characterized (1) by a dose-exponent > 1, restricted to certain dose-regions, (2) by a stepwise increase of lethal rate with dose.

Most of the departures from linearity so obtained are statistically significant. The same is true for the results obtained by irradiating maximal sensitive germ-cells in male D. melanogaster-papa, using low irradiation doses, by Feelling and Trotz. (From abstr.) See also 1153.


In experiments showing a linear dose-effect relationship for sex-linked recessive lethals in Drosophila males, insufficient clarification has been given hitherto to the dependence of radiation sensitivity on cell stage. The effect of radiation dose on mutation frequency was subjected to a closer study with emphasis on differential radiosensitivity. The following results were obtained: dose-exponents significantly greater than one for certain dose-ranges, indication of a stepwise increase of lethal rate with dose.

Most of the departures from linearity thus obtained are statistically significant. Results are discussed in relation to the mutation by-breakage hypothesis and the problem of position-effect lethals. They seem to confirm Muller's suggestion that at relatively low doses, the linearity of the classical dose-effect curve for recessive sex-linked lethals is caused more or less incidentally by the counteraction of different factors. Furthermore, our findings support the calculations by Zimmer (1960) and Dittrich (1960) showing that curves of the one-hit type may not necessarily be the result of one-hit events alone, but also, of the biological variability of the irradiated material with respect to hit number and formal target volume. (Auth.)


Zygotes (wild females) X Muller 5 (males) were exposed to 200-1400 R. The reduction in number of males of the offspring of the irradiated generation was taken as a measure of the rate of mutation in the Muller 5-X-chromosome to form a lethal recessive factor. The thus measured rate of mutation shows a linear relationship to dosage only if care is taken to maintain an optimum density of larvae in the culture tubes. Poor conditions resulting from under or over-population select against the larvae that are heterozygous for the lethal mutation, so that the measured mutation rate is less than the induced mutation rate. The possibility of such selection effects should be considered in all such mutation-rate experiments. (GA 26: 1961, 2969)


Eggs 12-15 min after deposition were x-rayed. It has been shown that O2 can be removed from such eggs within seconds by a N2-current. Only a slightly greater number of eggs died during embroyogenesis when treated for 7 min with a N2-current, as compared with air-treated controls. It is therefore possible to analyse the O2 effect with very short pre-treatment time and no lethal effects needed. For the embryonic mortality and mutation rates (recessive lethals in the X-chromosome) the O2 enhancement ratio was found to be between 2.0 and 2.5. Improvements in the egg-collecting procedure have made it possible to collect egg samples which are more homogeneous in age and thus in division stages. With these samples, of age variation of 1.5 min, the O2 effect in relation to different division stages is being studied again. (From abstr.)


Fertilised eggs of D. melanogaster were x-irradiated totally 10-20 min after being laid, i.e., in different developmental stages before cleavage. Embryonic mortality as well as the rate of recessive lethal nu-
1161 Whitting, A. S. TEMPER X-IRADIATED IN FIRST
Unmated females of Hab.
during, and/or after larva
In five to nine metaphases
by hatchability of unfertilized
significantly increase new
Theories are discussed as
sensitivity to O2 and (m

1162 Wind, N., Traut, H. Z
CHROMOSOMALE ABERR.
the frequency of dislocations
Z. Vererbungslehre 92 (1961
Aberrations and recombination
changes (heterocercal
stratia of a "severe" or
caused by H2), (H2
generally derived to decrease
the treated oocytes). Possible
explanations of (l

1163 Zalkinov, I. A., Inge-Ya
TIRE UPON THE CROSS
Drosophila lindemeyeri x Drosophila
A comparative study of the
the organism region of
fetal crossing-over at diff
one stage, presumably the
whence x-rays induce cx
It is suggested that the
chromosomal exchange
temperature and x-rays are

See also:
479 Cytoplasmic study
melanogaster (W)
730 Melanogaster (M)
731 Dependence of
Drosophila upon do
732 Starvation of
Drosophila upon do
735 The effects of radiobiological systems
736 Drosophila stocks
737 Induction of recessive
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1160 Wharton, D. R. A., Wharton, M. L. EFFECT OF 8-MERCAPTETHYLAMINE (MEA) ON THE RADIO-
No increased resistance to radiation (10,000 rads) from a 2-MeV Van de Graaff accelerator was observed
after the injection of various toxic or non-toxic concentrations of MEA. Although the toxicity of injected MEA
attained a high level of lethality during several weeks of feeding, it was quickly lost on
death of MEA to the tissues. It is suggested that the drug of MEA that would be required to counteract
the lethal dose of radiation would itself be too toxic to demonstrate protection.

310
1101 Whitting, A.R. TEMPERATURE EFFECTS ON LEATHAL MUTATION RATES OF Drosophila ocytes
X-irradiated in first meiotic metaphase. Genetica 45 (1968) 91-104.

Unirradiated females of Drosophila were irradiated with 1260 and 1440 r at high and low temperatures before, during, and/or after irradiation. A significant lowering of lethal changes induced in oocytes X-irradiated in first meiotic metaphase (LD 50 about 3000 r at low temperature before and after exposure as measured by hatching of unfertilized eggs was observed. Low temperature during irradiation (15-22 min) did not significantly change survival rate although there is a suggestion of a tendency toward increased lethality. Theories are discussed as to the cause or causes of differential sensitivity of cells and the relation of the sensitivity to O2 and temperature. (Auth.)

1102 Wind, K. Trau, H. ZUR SACHSENFÜHRLIHNHÄNGIKR DES RAY STRAHLSINDUKTEREN

Abrahamovici's results concerning the influence of oxygen on the frequency of x-ray induced structural changes (break-translocations) in Drosophila oocytes were generally reproduced, especially the demonstration of a "reverse" oxygen effect (under special experimental conditions protecting action of O2, sensitization by N2). The added aberration frequencies of the 3rd and 4th day after the various treatments generally tended to decrease as compared with those of the first 3 days (dependence on state of maturity of the treated oocytes). Postirradiation treatment by N2 increased the aberration frequency significantly. Possible explanations of this effect are discussed. (Auth.)


A comparative study of the effect of x-rays and of high temperature upon the crossing-over frequency in the centromere region of chromosome III of Drosophila melanogaster females showed that these agents call forth crossing-over at different stages of oogenesis. High temperature proved to be a factor specific only to the start of the premeiotic division (pre-phase of the first meiotic division), whereas x-rays induce crossovers in cells both in the prophase of the first division and in the preceding stages. It is suggested that x-rays call forth some changes in the chromatids of the oocytes that convert into chromosome exchanges when the cells reach the stage of the meiotic division. High temperature and x-rays act independently of one another. (Auth.)

See also:

479 Cytogetic studies of x-ray and ingested Pm induced sex-linked recessive lethals in Drosophila melanogaster. (Waller, 1968)

726 Induction of mutations and the induction of chromosome mutations in the germ cell. (Ray-Chaudhuri, 1961)

757 Dependence of the frequency of occurrence of dominant lethal mutations in the spermatozigas of Drosophila upon dose of irradiation with fast neutrons. (Abeleva and Lapkin, 1963)


787 Induction of nuclear damage by ionizing and ultra-violet radiations. (von Borstel, 1961)

788 A comparison of the susceptibility of the grain weevil (Sitophylus granarius L.) to accelerated electrons and 60Co gamma radiation. (Ball et al., 1961)

792 The induction of dominant lethal mutations in X-irradiated Drosophila virilis oocytes. (Pollackman, 1963)

797 Induction of dominant lethal mutations in X-irradiated Drosophila virilis oocytes. (Gickerman, 1963)

798 The response of Drosophila to X-ray inductors of dominant lethals. (Hoiungborng et al., 1963)

799 Genetic and direct effects of gamma radiation on Drosophila. (Tsao, 1962)

800 The effect of potassium and x-rays on the fertility of Tribolium confusum. (McDonald, 1961)

803 Appearance of dominant lethal mutations in Drosophila melanogaster during cosmic flight on Skylab. (Parnovsk, 1964)

810 Action des rayons y sur la survie d'une nouvelle du coton (genus Gossypium hirsutum). (Rasulov, 1961)
The role of recovery mechanisms and oxygen effects upon changes in radiation sensitivity in sperm treated in mature males and fertilized females of *Drosophila*. (Alexandrov, 1965)

The effect of radiation dose rate upon the production of clonal lethality in the chalcid *Dahlbomius*. (Baldwin, 1961)

The effect of radiation dose rate on the production of eye color mutations in the chalcid *Dahlbomius*. (Baldwin, 1981)

Dose rate effects on the yield of radiation-induced eye color mutations in an insect. (Baldwin, 1982)

Radiobiological studies with *Drosophila*. (Saxer, 1962)

The frequency-dose relation of x-ray-induced Y-suppressed lethals in *Drosophila*. (Edington et al., 1963)

The action of radiation and other mutagenic agents in inducing mutations in *Drosophila* females, and in controlling the action of specific genes responsible for repressing uncontrolled growth. (Glass, 1961)


The effect of fractionation of the gamma-ray dose upon the frequency of occurrence of mutations in spermatids of *Drosophila melanogaster*. (Glassmoudel et al., 1961)

The effect of small doses of stimulating radiation on the frequency of occurrence of sex-linked, recessive, lethal mutations of *Drosophila*. (Glassmoudel et al., 1964)

Cytological effects of x-rays in relation to dose-rate in *Drosophila melanogaster*. (Glassmoudel et al., 1964)


Radiation induced viability mutations in the honey bee. (Lee, 1962)

Dose-rate and the induction of mutations in *Drosophila*. (Pindus and Methodo, 1963)

Chromatic rearrangements induced by x-rays in immature germ cells of *Drosophila*. (Abramovitch, 1961)

The *Drosophila* spermatozoa be used in studies of recovery processes? (Libby, 1961)

Dose-effect relation in the induction of crossing-over with x-rays in males of *Drosophila melanogaster*. (Olivieri and Olivieri, 1963)

Induction of crossing-over in *Drosophila melanogaster* males with various doses and fractionated doses of x-rays. (Olivieri and Olivieri, 1968)

Induced crossing-over in males of *D. melanogaster*. (Olivieri and Olivieri, 1965)

The effect of sex linkage on x-ray induced non-disjunction in *Drosophila*. (Oster and Pooley, 1963)

The genetic basis of somatic damage produced by radiation in third instar larvae of *Drosophila melanogaster*. (Onstine, 1961)

The linear dose-dependence of radiation-induced translocation frequency in *Drosophila melanogaster* at relatively low x-radiation doses. (Onstine, 1962)

The *Drosophila* neuroblast culture technique and its value in radiobiological studies. (Creidson, 1961)

Cell stages and differential sensitivity to irradiation in males of *Drosophila melanogaster*. (Onstine, 1965)

Differential sensitivity of sperm and spermatids to ionizing radiation. (Onstine, 1961)

Differential radiation-sensitivity of germ cells as a possible indicator of sex difference in dose-rate dependence of induced mutation rates in the silkworm. (Tamima and Kodos, 1960)

Recovery from radiation and chemically induced permutational damage. (Bink, 1960)

Radiation sensitivity of mature and gametogenic cells in the silkworm *Sambuna muli* (IV) (V) (OVI). (Asaka, 1958)

The induction of nuclear and cytoplasmic polyhedrosis by treating with x-rays and ultraviolet light in the silkworm, *Sambuna muli*. (Asaka and Takahashi, 1951)

The influence of virus infections. 1. Ultraviolet light and x-rays. (Asaka, 1955)

Radiation effects on the cytoplasm of *Hahbronema* eggs. (Kasechild, 1958)

The action of mutagenic treatments and protective agents on melanotic tumour formation in *D. melanogaster*. (Turner, 1960)

The effect of radiation on insects. (Larnett, 1962)

The effect of irradiation with y-rays: Co on the development and reproductive power of *Theobromia aconitadi* var. *delicata*. (Heo et al., 1963)

The influence of age and mating patterns before and after irradiation on the incidence of induced mutations in *Drosophila melanogaster*. (Lefurge, 1964)

Investigations of radiosensitivity during spermatogenesis in *Drosophila melanogaster*. (Montigny, 1963)
1277 Radioresistance of Drosophila melanogaster. (Orendorff, 1968)
1281 The effect of x-rays on eggs of Drosophila melanogaster. (Fernandez and Brandt, 1951)
1282 The modification of X-radiation of the life span of haploid and diploid of the wasp, "H. volucris". (Clark and Robin, 1942)
1338 Life span differences between haploid and diploid males of Drosophila melanogaster. (Clark et al., 1962)
1336 Reactions to X-rays of a normal and a MNK-mutant stock of Drosophila melanogaster. (Gillespie, 1953)
1335 Research in genetics. (Stone, 1963)
1447 Laboratory studies on the use of irradiated sterile males to reduce C. fargans, Israel. (Ramanathan et al., 1963)

1-8 RADIATION AND MUTAGENIC CHEMICALS: COMPARISON OF EFFECTS


By means of the combined application of irradiating X-rays and the chemical mutagenic substance 6,5-bis(acetoxyethyl)stilbene-2,4-dione (BDSG), the degree of genetic effect on Drosophila was studied. The application of the mutagenic agent in the sequence of BDSG + X-ray irradiation caused the addition of the different mutagenic effects, whereas the same treatment in the order of X-ray irradiation + BDSG resulted in a considerably reduced yield of mutations. (Asp.)


X-irradiation kills embryos and germinal cells of the wasp Nasonia by several means: (1) mitotic rate depression, accompanied by a decrease in bridge formation of the chromosomes; (2) mitotic death due to deletion of blocks of essential genes; (3) genetic death due to defective loss of chromosomes or their parts; (4) immediate death of early embryos before any cell division occurs; and (5) death of embryos occurring later in embryonic development after irradiation of blastodermic cells. UV-radiation and nitrogen mustard kill mature Nasonia embryos principally by depression of mitotic rate, only a low frequency of deaths attributable to the gene-loss type. Nitrogen mustard also apparently is capable of inducing Type (4), immediate cell death, a type that cannot be induced by UV-radiation in our system. The mitotic inhibition induced by X-radiation can be reversed only to a limited degree by fertilizing an irradiated egg with an unirradiated sperm. Partial reactivation of mitotically inhibited cells appears to occur; this reactivation is not complete in the embryos exposed as embryos to either UV-radiation or nitrogen mustard. It would appear that the mechanism of mitotic rate depression is different between X-radiation, UV and nitrogen mustard. Supporting this contentions, nitrogen mustard induces chromosome breaks at a very low frequency at doses where lethality is induced.


The question of recovery from radiation and chemically induced embryonic damage is discussed in relation to the nature of the primary genetic damage at the molecular level, and also in relation to factors which influence the recovery process. Includes studies on Drosophila and bread-beans.

1167 Brown, D. S., Allerup, E. THE CORRELATION OF THE RATIO OF LETHAL TO VISIBLE MUTATIONS WITH THAT OF WHOLE-BODY TO FRACTIONALYS INDUCED BY X-RAYS AND CHEMICAL MUTAGENS. (Abstr.) Genetics 51, 8 (1965) 855.

In experiments designed to test the relative rates of lethal and visible mutations induced by x-rays and chemical mutagens (using Muller's assay techniques as well as the relative proportion of whole-body and fractional mutations among the viables, it was found that in the x-ray series, the ratio of lethals to viables was much higher than in the case of the chemical mutants: 78.1 lethals/1 visible after treatment of the adult males with 3000 r; 8 lethals/1 visible for dimethyl maleimide, 12.8.1 for phenylmethyl maleimide, and 12.8.1 for ethylthiosemicarbazone. However, these proportions of lethals to viables were directly correlated with the ratio of whole-body mutations (visible) to fractionals, being highest for X-rays (131.9 in 159.000 tested chromosomes), lowest for dimethyl maleimide (12:8:5).

The higher the proportion of fractional mutations relative to whole-body produced by treatment of postmeiotic germ cells of the mature Drosophila male with four mutagenic agents, the higher is the ratio of visible mutations to de novo recessive lethal mutations. The relative rates are as follows (where% of fractionals is followed by the ratio of visible to lethals in parentheses): 3600 x-rays, 1% (1:98); 2.8 hr-thymidine-dihydrofolic acid, 3% (1:33); phenylalanine mustard, 3% (1:11); dibutyryl myristeine, 5% (1:9). This correlation might be explained (as suggested by Carlson and Oster, Sci, Gen, Soc, Amer. 30: 1931, 66) on the assumption that gonadal mutagenesis would lead to a lowering in the percent of de novo lethals, since a gonad which was partly normal (or partly lethal) would appear on further testing to be nonmutant. However, the recovered visible rate would not be similarly depressed by gonadal mutagenesis, since visible fractionals would be phenotypically evident. These results necessitate a re-appraisal of the claim that chemical mutagens are specific for visible loci in Drosophila. (Audi, summary)


Adult flies were treated with apholate or x-rays to determine their effects on reproductive tissues. Male and female flies 0 to 4 days old were exposed to 8 or 16 kR of Co60 radiation at a rate of 1000 kR/min or were fed 0.5 or 3% apholate in the diet. Over 90% of males were removed as daily treatments for microscopic examination. With the higher doses of either treatment, cessation of sperm production occurred in the anterior end of the testes after the 8th day, with a general necrosis of the germinal epithelium in that area. The testes progressed until the 16th day when few sperm were observed in the testes of treated males. The ovaries from treated females were reduced in size, and with the high dose of each treatment this noticeable change occurred 2 days following treatment and became more prominent until the 16th day when very few ovarian tissues remained. Very small follicle-positive clumps of chromatin distributed that complete breakdown of the ovaries, oocytes, and follicle cells had occurred in ovarioles. Untreated females mated to males either fed 3% apholate or exposed to 16 kR deposited a large number of eggs, none of which hatched. Since fertilization precedes egg laying in D. melanogaster, it was evident from the egg production data and microscopic examination that sperm transfer was not halted by the levels of either treatment used. Some adults emerged from eggs deposited by untreated females mated to males fed 0.5% apholate or exposed to 8-kR radiation, indicating that the treatments caused development of a lethal factor in some of the sperm which fertilized eggs. No adults emerged from eggs fertilized by males treated with high doses of either treatment which induced lethality in all sperm which fertilized eggs. No eggs were deposited from females branded with 16 kR and mated to untreated males and none were deposited after the 2nd day from females fed 3% apholate and mated to untreated males. No adults emerged from the few eggs deposited, corroborating the histological investigation, which showed pyrnodas and Feulgen-positive chromatin clumps and ovarian atrophy soon after treatment. Females fed 0.5% apholate or exposed to 8 kR and mated to untreated males produced few eggs but some adults emerged. (MSA 19: 1904, 1460)


Monofunctional quinacrine mustard (ICR 100) induces dumpy mutations at the dummy locus with an average frequency of 0.89%. More than 90% of the recovered dumpy mutations are distributed randomly in somatic and gonadal tissue. Mutant These experiments suggest a synchrony of nuclear division established primarily at 1 in 3, 7% anaphase-linked lethal mutation spectrum of the factor by the ICR 100. ICR 100 is of mutagens, including sperm in the progeny derived from and generation and/or control.
and gonadal tissues. Mutation frequencies at 18 other loci expressing visible effects were low or negligible.

These experiments suggest that x-ray-induced mosaic mutations become established primarily at the first synchronous nuclear division of the zygote and that the ICR 100-induced mosaic mutations become established primarily at a later replication. Sex-linked lethals scored in the F2 occur with a frequency of 3.7% mosaic sex-linked lethals detected by scoring in the F2 occur with a frequency of 13.7%. The mutational spectrum of the dummy alleles induced by x-rays does not differ appreciably from that induced by the ICR 100. ICR 100 is capable of inducing mutations in spermatids, spermatocytes, and the earlier stages of meiosis, including spermatogonia. No evidence for breakage events at the dummy locus was detected in the progeny derived from ICR 100-treated sperm. The use of the sex-linked lethal test as a routinely applied, i.e., by examination only of the F2 generation, for determining the effectiveness of a chemical mutagen or for estimating an equivalent meiotic dose to various concentrations of chemical mutagen can be misleading. However, the test can be made more meaningful by continuing the analysis for another generation and/or combining it with a test for visible mutations at specific loci. (Auth.)


The scales on the hind wing of the moth Euphoria were used as an example of a developing and differentiating system in studies of the effects of x-rays and chemical mutagens on the genetic structure of developing cells. The chemical mutagens used included 8-bromoorotic acid (0-600), 8-bromouracil, 2-aminopurine, and 2-bis-(2-thiazolyl)aminoethanol. Very little effect was observed after treatment with 8-bromouracil and 8-bromoorotic acid. Possible reaction mechanisms involved in the genetic action of 0-600 and x-ray are discussed. (ASA 17: 1955, 31866)


D. apholites are castrated and female flies were exposed to y-radiation or fed on sugar for 24 hr. Whole mounts of dissected ovaries and testicular tissue were examined to determine the effect of treatment.


When adult females of the sugarcane fly (Coelioxys semicincta) are treated with alkylating agents and ionizing radiation, dominant lethal mutations are induced in the oocytes. Since the maleic stage of the oocytes is correlated with the age of the females, it is possible to treat oocytes in early prophase, metaphase and anaphase of the first meiotic division. When such treatment is given, fewer dominant lethals are induced in the prophase oocytes than in oocytes in the other two stages. This trend was found in experiments with these alkylating agents and with y-radiation. Comparison between two bifunctional alkylating agents (transamination - TEM and thiopeta) with a bifunctional agent (cis, cis-dieldrin) with deoxyguanine-repair reveal the sensitivity pattern in the same regardless of the treatment used, but that the mutagenic efficiency of the various agents differs considerably. The cytogenetic investigations permit comparison of the nature of the chromosome aberrations associated with lethal events. Gamma irradiation of mosaic oocytes with a lethal dose results in a high proportion of chromosomal aberrations during the 1st and 2nd divisions of the newly laid egg. In oocytes treated with lethal doses of the alkylating agent there is a high percentage of normal appearing mosaic divisions. Dominant lethals induced in the sperm of treated males are expressed during the cleavage divisions following syngamy of the female and male pronuclei.


See 1175

1175 Lombech, E.A., Storme, R.C. von MUTATIONAL RESPONSE OF HABROPODIUM OCTY IN MEIOIC PROPHASE AND PROPHASE TO ETHYL METHANESULFONATE AND NITROGEN MUSTARD. Genetics 47, 7 (1966) 850-64.

Ethyl methanesulfonate (EMS) and nitrogen mustard (methyl bis (3-chloro-4-nitrophenyl) hydrazine) were used to induce dominant and recessive lethal mutations in the octy. Oocytes in the 1st meiotic division...
metaphase were found to be much more sensitive to EMS and nitrogen mustard (~20 times) than oocytes in
late mitotic prophase when dominant lethality was the criterion. In this respect, the action of the chemi-
cal mutagens resembles that of x-radiation, with recessive lethality as criterion, metaphase I and
prophase I oocytes respond differently to x-radiation and chemical mutagens. A 3-fold difference prevails
after x-irradiation, with metaphase I being the more sensitive stage. With nitrogen mustard, metaphase I
is 3-5 times more sensitive than prophase I, and with EMS, no significant difference was found between
metaphase I and prophase I. (From auth., summary).

See also 1175.


The dumpy locus (chromosome II-1,0 in D. melanogaster) has several easily distinguishable pleiotropic effects and an internal pseudoallelic structure that is resolved into eight separate sites (Carlson and South, 1962). The mode of origination of mutations induced at this locus in mature oocytes by x-rays was found to differ markedly from that produced by a non-functional alkylating agent of the quinacrine series of nitrogen mustards. 2-mercaptoethyl-2-calcofluor-4-ethyl-2-chloroethylamine (methylthiohydrochloride), while the majority of such viable changes following x-irradiation seemed to occur as complete (i.e., whole-body) mutations, those produced by the quinacrine mustard were mainly transmitted maternally (i.e., by a part of the somatic and/or germinal tissues arising from any one single treated chromosome). The suggestion that such a pattern should exist for recessive sex-linked lethal mutations was borne out by the finding that this agent produces fewer complete lethals (2%) (as detected by the conventional manner by examination of the F2 generation) than mutagenic lethals (12%) (as detected in the F1 generation) in contrast to x-rays which Muller had already investigated in this connection in 1958. As with other chemicals, relatively few translocations could be detected by examination of the F2 generation. Extension of the analysis to the F3 generation did not increase this frequency appreciably although it did indicate that even such gross structural changes can occur at mitosis. Studies with a polyfunctional alkylating agent, triethylentlenalamine (TEM), carried out as part of an extensive project in collaboration with C. Anebach and L. Snyder yielded results essentially similar to those found for the monofunctional compound. Comparisons of the response of different germagonic stages to x-rays and other chemical mutagens has also been studied. (From abt.)

1178 Shyamala, H. MUTAGENIC EFFECTS OF X-RAYS AND NITROGEN MUSTARD ON Spermato-

The structural changes induced by x-ray in cells at different stages of spermatogenesis were analyzed in salivary gland chromosomes of D. melanogaster and compared with the changes induced by formaldehyde added to the food (FF) of the larvae. The different stages of spermatogenesis vary in sensitivity to x-rays when measured by the percentage of sex-linked lethals, by the percentage of spermatocytes carrying structural changes, and by the number of changes per 106 spermatocytes. The proportions of the different types of change (2, 12, 12, 72) however, are fairly similar in all stages of spermatogoniala but entirely different from those found after FF treatment. This suggests that it is the mutagen and not the sensitive stage which is responsible for the characteristic pattern of the FF effects. The differences between the effects of x-ray and of FF are attributed to the different proportions of potential breaks induced by these two mutagens. Evidence has been presented indicating that while most of FF induced breaks are potential (about 72%), most of x-ray induced breaks are immediate. For the dose range used in the present experiment (below 1000 r/min) only a small proportion (4-10%) of breaks induced by x-ray was found to be potential. (Auth.)

1179 Sobels, E.H. RAYS OF FORWARD AND REVERSE MUTATION IN Drosophila AFTER EXPOSURE TO NITROGEN MUSTARD. Genetics 53 (1963) 31-44.

After treatment with mustard gas, reversions of the mutant form in Drosophila melanogaster were observed with a frequency of 1 in 76,000. The study on reversion of c1, was combined with tests for recessive viables at 15 selected loci of the K-chromosome. Mutations at the ruby locus were most frequently induced by mustard gas (1 in

1760. About 1 of the few
reverions of c1 and forward
numbers induced by mustard
response have been obtained
observed than expected
with that of x-radiation, ev-
the chemical, due to delays

1180 Wendlhaas, D.K., Ford, I. SPECTRAL VIBRATION OF MEDEU.
Results obtained with radita-
macroscopic cations can be ac-
2000 r/min. The presence of nuc-
used populations of an.
the release of sterilized ma-
release of x-rays (P-3214)

(9, 6, 5) gives a
benzoil(glycinon) and on it
aphenone and amphoturopi-
the same concentrations ag-
given continuous access to it
after peak emergence and at
no females of either species
paid viable eggs. Those
particularly among eggs laid
effects on egg production in R.
formed it induced the num-
early at F5 / in-
in the hatching of eggs .

See also 840. A study of gene and o
Zeugmav, 1965)
957. The preliminary inver
Clintch river. (Nelson
971. Unequal crossing-over
x-rays and IDTA. (R
974. Origin of repeats in D.
1239. The influence of X-rays
1275. Mating ability of ma-
irradiation, (Wendelh

I.A-S BIOCHE

1181 Aung, H. MECHANISM OF
(VI). J. gen. cit. Tokyo
It did not prove possible to pr
x-rays or ultraviolet radia
1182 Aung, H., Yoshitaka, N. : HEDROSES BY TREATING VI
No further induction was obs
only on dual treatment (expe
a higher percentage of deadi
2700). About 1/3 of the forward mutations were directional. After exposure to 5000 r x-irradiation both reversion of SIS and forward mutation at the loci under study were observed with frequencies comparable to those induced by mustard gas. Then, no indication for mutagen-specific differences in mutational response have been obtained. After treatment with mustard gas a higher ratio of viables to lethals was observed than after exposure to x-irradiation. Comparisons of the mutagenic effect of a chemical mutagen with that of x-irradiation, even if restricted to visible mutations, inevitably involve an underestimate for the chemical, due to delayed effects of the latter. (From auth. summary)


Results obtained with radiochemicals are described. It appears that both sexes of Anopheles quadrinaculatus Say can be sterilized by exposing either pupae or adults to y-radiation in doses of 8000-12 000 r. The presence of such sterile males reduced the total number of viable eggs laid by females caged with mixed populations of fertile and normal males. Field tests on the control of A. quadrinaculatus by the release of sterilized males were, however, unsuccessful. The studies described here were made to determine the effects of aminé (tryptophan, tryptophan hydroxylase, tryptophanase, etc.) and amphotericin B on the fertility of A. quadrinaculatus and Aedes aegypti (L.). Aminé: amphotericin B and amphotericin C were used at concentrations of 0.1-1% against both species, and aminé at the same concentrations against Anopheles and at 0.1-1% against Aedes. Mosquitoes of both sexes were given continuous access to the components in a mixture of honey and water, and a blood-meal was given after peak emergence and again after oviposition. No females of either species oviposited after they had received 2% aminé, and none that received 0.3% laid visible eggs. Those that received 0.1% laid the normal number of eggs but hatching was reduced, particularly among eggs laid after the second blood-meal. Aminé was similar to aminé in its effect on egg production in A. quadrinaculatus but less effective than either aminé or aminé with Aedes. It reduced the number of eggs laid at 1% and the hatch at all concentrations, but it allowed a few eggs to hatch, even at 1% Amphotericin B had little effect on either species, except for a partial reduction in the hatching of eggs of A. aegypti at 2%.

See also:

642 A study of gene and chromosome changes induced by mutagenic radiations in Drosophila melanogaster. (Edington, 1963.)

957 The preliminary investigation of salivary gland chromosomes of Chironomus tentans Fabric. from the Clinch river, (Nelson and Bylloch, 1963.)

971 Unequal crossing-over in the bar region of Drosophila melanogaster: influence of temperature, x-rays and EDTA. (Rasmussen, 1963.)

974 Origin of repeats in Drosophila chromosomes, (Kiwzyama, 1963.)

1320 The influence of X-rays on longevity, fecundity and fertility of Drosophila melanogaster, (Mukherjee, 1963.)

1578 Matting ability of male mutagens, Aedes aegypti (L.), sterilized chemically or by gamma radiation, (Weidhaas and Schmidt, 1963.)

1-18 BIOCHEMISTRY, PHYSIOLOGY, ULTRASTRUCTURE, PATHOGEN SUSCEPTIBILITY


It did not prove possible to produce nuclear or cytoplasmic polyhedra by submitting B. mori larvae to x-rays or ultraviolet radiation.


No further induction was observed following exposure to ultraviolet light and x-rays respectively. It was only on dual treatment (exposure to x-rays and low temperatures, 1-3°C for 24 h) that test larvae showed a higher percentage of deaths from vira than controls. The percentage of larvae with both nuclear and
cytoplasmic evidence of disease was markedly higher when larvae had been treated with x-rays pre- or post-mortem treatment than when larvae had been exposed to low temperature only in the 6th instar larval stage, soon after ecdysis. (From summary)


There was no indication that exposure to x-rays increased the percentage of polyhedrosis-infected larvae of silkworm; but in the case of treatments both with x-rays and low temperature (51°C 24 h), more virus-caused deaths resulted in the test larvae than in the control. The percentage of larvae with nuclear and cytoplasmic polyhedrosis was markedly higher in those larvae treated with x-rays before and after cold treatments than in those treated only with low temperature in the 5th instar larval stage, soon after ecdysis.


Pupa were irradiated with 15 000 to 50 000 r of x-rays, the lowest dose able to produce electronmicroscopically detectable changes being 30 000 r. Higher doses caused injury which differed according to the type of cells found in the mesosome. Morphologically, such damage consisted of the displacement or disappearance of microvilli, and heavy microvesicular secretion; fragmentation of the nucleus; and the appearance of vacuoles to the cytoplasm and Golgi apparatus. From the enzyme point of view, observations indicated the disappearance of succinate-dehydrogenase and cytochrome c at the stage of maximum cellular damage. (Work on this topic was published earlier in Resid 45 (1960) 113-113.)


The ovaries of unfertilized adult females of the olive fly, Dacus oleae, irradiated in the middle period of the pupal stage with various doses (0-80 ke) of γ-rays were studied by cytological and ultrastructural techniques. In all cases the treatment inhibited the normal development of the ovary. Nucleus and egg cells are very small and few in number and show abnormal structure and ultrastructure, particularly as regards the cytoplasmic organelles.


The only reported phenotypic effect of the "virus" strain has been to make its Drosophila host sensitive to CO₂ and Helesterer has reported strains of virus-carrying flies which differ according to the stability of the virus-host relationship. The experiments, presently communicated, examined the effects during developmental stages of x-ray induced mutants in heterogeneous condition on several of these strains. Sensitive (S) and resistant (R) virgin females were collected from the strain to be tested and mated to sibling cured males who had (S) or had not (R) received 3000 r of x-rays. In a cured line the presence of the virus can no longer be demonstrated. After a 2-3 mating period the females were placed infected in cylinders and eggs were collected over 8-10 periods. Each hour, beginning with the 31st hour after oviposition, the number of larvae hatching were scored. The effect of mutant in the heterogeneous condition on time of egg hatching varied according to the stability of the virus in the strain tested. (From abstract.)


In contrast to Dippere where ovaries may not mature for several days, at eclosion, differentiated and jaunty cells are present in the sequential series provided by the polytrophic ovariole of the parasitoid wasp Habrobracon. Furthermore, ovarioles invariably number only four, and quantitative modifications of the pattern of egg deposition may b against days; control females to ovulate decreases occurs. Low and a small valley, which can dip up to which undergo s successive mitotic transitional cells. This results in migration of new cells into the larval life, reflected in (4) a curve low scores rather than a direct effect but more typical is (4) an initial abatement of interference with nervous agents influencing the ovipositing animal giving similar type cancerous tumors. The type of curve (5) characterized b earlier deficits.

1288 Karpov, A.P. ON POLYTHERA. Nomin Uss. USSR 9 (1964) 1019-18.

Eggs and caterpillars of various L. l. L. A., using doses from 100 with doses over 10 000 r resulted tested, irradiation of caterpillar. (92 to 97%) due to physiological dose from 1000 to 5000 r did not significant increase in the frequency was especially marked when the polyhedrosis-infected individual a test, susceptibility of caterpillar conclusion that irradiation cause 1961.)


The radiosensitivity of spermatozoa reviewed, X-ray radiosensitive and the effects of radiation on D. discussed. 93 references are incllued.


The cytological events involved studied extensively. Eggs which the female pronucleus were examined plotted for fertilized eggs which at 42 000 r. The curves were a r (6.4 x 10⁶ m/sec - 6.14 x 10¹⁶ m/sec) levels of lethality in eggs irradiated propaga 1. Effects of x-rays on c and cytoplasmic injury induced b heart shock and anoxia, applied a medico-developmental. These we hybrid crosses of 2 different speccies.

1191 McGarrah, R.A. X-RAY INDUCED NEUROBEHABITUAL CHANGES/COMB. For abstract, see 1192. Results sation is suggested between the effects of delayed delayed, stopped or...
The present investigation was carried out to study the effects of ionizing radiation on the DNA synthesis and cell viability in human diploid fibroblasts. The cells were exposed to various doses of X-rays and the effects on DNA synthesis were determined by measuring the incorporation of tritiated thymidine into DNA. The results show that the DNA synthesis decreases progressively with increasing dose, reaching a complete inhibition at doses of about 2000 rads. The survival curve of the cells after irradiation indicates a typical exponential decrease with survival levels of about 10% at doses of 2000 rads.

The study also examines the effect of X-rays on cell viability. The percentage of viable cells decreases gradually with increasing dose, reaching about 10% at doses of 2000 rads. The survival curve of the cells also shows an exponential decrease, with a typical half-life of about 100 rads.

In conclusion, the results demonstrate that X-rays have a significant effect on DNA synthesis and cell viability in human diploid fibroblasts. The study provides valuable information for understanding the effects of ionizing radiation on human cells and for developing strategies to protect cells from radiation damage.

Direct observations of irradiated *Chorthippus* neuroblasts at identifiable stages of the cell cycle in the living condition, show that changes in chromosome morphology which are characteristic of mitotic stoppage or delay can be detected within 15 min after 25 r of x-rays. Four more or less distinct mitotic responses of irradiated prophase neuroblasts can be distinguished, and are discussed, for a dose of 250 r. Living neuroblasts exposed to tritiated thymidine (H3T) and then irradiated in hanging-drop preparations and reinstitution of the same cells in autoradiograms of sectioned material show that prophase neuroblasts which are delayed, stopped, or normal mitotically in response to 25 r of x-rays incorporate H3T. Incorporation is greatest in cells irradiated in early prophase; no incorporation is observed in cells treated in very late prophase. Labelling can be detected within 15 min after x-irradiation of early or middle prophase neuroblasts. Incorporation is not seen in preparations treated with DNase before application of autoradiographic emulsion. After 250 r of x-rays, prophase cells which do not divide within about 40 min do incorporate H3T during reversion to an interphase-like condition.


Melanoplus differentialis (Locusts) (from a laboratory population) and Melanoplus viridis fuscata. (Cordipoda) (from a wild population) were employed. 12-18 d before use, the Melanoplus males were given 500 r x-rays at 3-4 min. Observations of live cells were made by phase microscopy. Chromosome elasticity and movement were studied in two distinct situations: early prophase stretch due to opposed external forces (Chorthippus), and drag stretch, an elongation due to frictional resistance or drag on a chromosome being pulled towards one pole. Thus, if the Melanoplus X-chromosome is partly broken by x-irradiation and its behaviour during 1st spermatocyte division examined, stretching in the region of the break is seen when the chromosome moves. Neither stretch produces detectable alterations in the velocity of chromosome movement. A simple mechanical model is described which allows the ratio between frictional and elastic coefficients to be calculated. It is concluded that the mitotic forces are continually adjusted to produce a standard velocity of movement even when an unusual strain exists. The implications are considered particularly concerning stretching and rupture of diakinetic ("diasporic") bridges in prophase.


Normal spermatogenesis is described. The effects of x-irradiation (200 r for 5 min 30 sec on the common grasshopper, S. viridis, and 500 r for 6 min 40 sec on the bush, Schistocerca) caused the microtubules and Golgi bodies to fuse in spermatocytes. In Schistocerca, the Golgi bodies form an abortive acrosome in a delayed spermatocyte. In both cases the Golgi bodies are displaced from their normal position. The Golgi-silicone complex can be distinguished in the spermatocytes. The centriole region divides in both spermatids to form 4 bodies. In Stylolophus, a small flagellum develops from each body.


Specimens were subjected to 300 r or 500 r of x-rays, at 69 r/min. These doses proved fatal for spermatogonia. The first visible changes in the spermatocytes and spermatids appeared after 34 hr. The nuclei became greatly enlarged and lost their staining power. A lateral thickening was observed along the wall of the elongating spermatid nucleus (the acronuclear fold was also present in normal cells but its development is more easily followed on irradiation). The Golgi body lost its original shape and became very much enlarged, with a lamellar outline and condensation of the granules at the centre. The centriole regions divided into the proximal and distal centrioles. The flagellum seemed to arise from the proximal centriole and to pass through the distal centriole. The flagellum grew out of the cell from an early stage, whereas at no stage in the normal spermatid is the flagellum extra-cellular. Mitochonidia were found to lag behind in the development.

Mether, R.S. CYTOIDONISI. Stylolophus viridus (Nelles) Stylolophus (5th instars) were x-irradiated (150 kV, 17.5 mA, at 90 cm). The first changes observed were clearly marked. The B centre. The mitochondria are arginized, the outer membrane material, the intensity of the B groups coagulated in irradiates of protein masses while the D effects, with regard to Golgi acid groups only) and acidic II irradiation while the lights for contain tyrosine, the tyrosinate and protein. Coagulation of pea.


Podisima nymphes was used i

Pozhrenov, B.A. CPRH CHVRMA I PRVRMAI I N M. "The cytological development. 1961."


Tahmizian, T.N., Devitt, R. FERMENTATION IN GRASSHOPPERS. The effect of x-irradiation on microsomes. The insects were observed at the last instar and of the nucleus and mitochondria entailed and disorganized doses also induced the formation of aequorin as well as pyc each radiation-induced supem of a set of flagellar filaments Details are given of an organelle of the cytoplasmic strands.

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Melanoplus differentialis di
were found to lag behind in the formation of the primitive nebuleen in the earlier stages of development.


Steinobothrus 6th instar) were collected and reared to adulthood. An optimum dose of 500 r \( x \)-rays<br>(100 KV, 37.5 mA, at 50 cm, with 0.5 mm Al filter) was given, and organs were fixed at 72 hrs-intervals. The<br>first visible changes occurred after 7 d. In the irradiated nucleus, the site of DNA and basic protein<br>were clearly marked. The DNA aggregated along the nuclear membrane, the proteins concentrated in the<br>centre. The mitochondria and the mitochondrial nebuleen of the normal material consist of tyrosine and<br>arginine, the outer membrane of the nebuleen containing acidic lipids and cholesteric. In irradiated<br>material, the intensity of the reactions increased with the duration of the treatment. Various protein<br>groups were marked in the spermatocytes. This persisted in the spermatozoa where the core consisted<br>of protein masses while the membrane maintained its lipidic nature without showing any irradiation<br>effects. With regard to Golgi bodies which consist of galactocids, acid mucopolysaccharides (chondroitin<br>acid groups only) and acidic lipids, the polysaccharides were observed to lose their staining power on<br>irradiation while the lipids fixed the outer membrane. The acrosome, which is PAS positive and also<br>contains tyrosine, the tyrosine content became more pronounced. The centriole region consists of lipids and<br>proteins. Coagulation of the proteins allowed them to be clearly differentiated from the lipids.


Furrow formation was used in the study.


The effect of x-irradiation on grasshopper spermatozoa was studied with the aid of light and electron microscopy. The insects were irradiated at the 4th instar prior to the presence of maturation stages and observed at the larval and imaginal stages. Doses of 100 to 800 r were found to retard the differentiation of the nucleus and mitochonional nebuleen in spermatozoa. Evidence is presented that irradiation causes a curtailment and disorganization in the differentiation of the nebuleen from mitochondria. The above doses also induced the formation of supernumerary mitochondria, flagellar filaments and acrosomes; nuclear disorganization as well as pyknosis and fragmentation also occur. The nucleus appears to be drawn toward each radiation-induced supernumerary acrosome, with consequent multiplicity of the nucleus. Induction of a set of flagellar filaments is seen only where the centriolar structure is in contact with the nucleus.

Details are given of an organelle, not described heretofore, that is composed of anastomosed and interwoven cytoplasmic strands. (Auth.)

* Melanopus differentialis differentialis Thomas.


Review article, concentrating on data obtained with grasshopper embryos. The effects of radiation on the nucleus are discussed. Thus, in the resting nucleus subsequent differentiation and mitosis are stopped. The radiosensitivity of the dividing cell is related to the degree of intracellular differentiation associated with the division process. Radiation causes partial or complete degradation of the mitotic spindle. As for mitosis, the meiotosis process of spermatozoa appears to be more sensitive than the mitotic process.
divisions. Radiation effects on the cytoplasm were studied by the author on Melanoplus differentialis differentialis Thomas, particularly by electron microscopy. The effects on mitochondria, filaments (spindle, tail structures), microtuboids, Golgi bodies and acrosomes, and on undifferentiated cytoplasm are described.


Using grasshopper embryos (Melanoplus differentialis) it was found, with the aid of the electron microscope, that 50 to 100 r on the 1st day of post-diapause development will abolish myogenesis, which occurs on the 3rd day of post-diapause development. Prior to or after the 1st day of post-diapause development, 250 r is ineffective in arresting myogenesis. Sarcoytic nuclei normally contribute to the formation of the Z bands as well as to the myofibrillar filaments. It is possible that the origin of the damage to the inducive process of myogenesis is associated with nuclear DNA because the nucleus as well as the nucleolus undergoes karyolysis during muscle formation. The most sensitive generalised biological reaction to x-irradiation appears to involve some 'trigger' system that precedes molecular redistribution during morphogenesis. (From above.)


The effects of various radiations, including x-rays, on the course of certain diseases, e.g. nuclear polyhedrosis in Bombyx mori, is discussed.

See also:
862 Cytological effects of x-rays in relation to desert rats in Drosophila melanogaster. (Cussac, 1963)
892 Cytogenetic studies following high dose paternal irradiation in the mealy bug, Planococcus citri (Kodama). (Chandra, 1962)
922 Cytogenetic studies following high dose maternal irradiation in the mealy bug, Planococcus citri. I. Cytology of X, embryonic. (Chandra, 1963)
950 Cytogenetic studies following high dose paternal irradiation in the mealy bug, Planococcus citri. II. Cytology of X; females and the problem of meiotic sex determination. (Chandra, 1965)
942 Arrangement of chromosomes in mature sperm. (1) (Herrtwitz and Norton, 1963)
943 Arrangement of chromosomes in mature sperm. (2) (Herrtwitz et al., 1963)
956 Phase cinematography studies on the effects of radiation and chemicals on the cell and the chromosomes. II. Formation of nuclear buds, continuation of chromosome division and formation of an accessory nucleus in grasshopper spermatocytes following x-irradiation. (Nakanishi and Makino, 1960)
985 Cytological demonstrations of induced breakage in somatic chromosomes of Drosophila. (Oster and Balaban, 1962)
989 The immediate cytological effects of ionizing radiations. (Carlson, 1964)
999 Studies of early effects on radiation on cricket. (Cassius, 1964)
1009 Methods for estimating differential radiosensitivity. (Oster and Pouled, 1963)
1012 A cytogenetic study of the effects of x-irradiation on Anaphagry. (Rai, 1963)
1010 Modification of genetic damage produced by ionizing radiation. (Rai, 1963)
1019 Comparative studies of cytosome c oxidase activity and mutability in two strains of Drosophila. (Ward and Sierd, 1962)
1220 Cytosome oxidase activity in chromosome interchange stocks of the Oslo and low-Ambient stocks of Drosophila melanogaster. (Ward and Sierd, 1962)
1291 Radiosensitivity of developing reproductive cells in female Coelitigynia hirsutissima. (LeChance and Leveritch, 1962)
1293 Effects of x-irradiation upon cell population and morphogenesis in the developing beetle wing. (Schock and Hayes, 1962)
1300 Cell differentiation and radiopathology in the wing of Tribolium confusum. (Schock, 1965)
1301 Effects of x-irradiation upon cell population and morphogenesis in the wing of Tribolium confusum. (Schock, 1963)

1204 Brown, E. H., King, R. C. HETEROZYGOUS FOR AN X 

During normal development, newly emerged females with ionizing radiation is known. This fact suggests that deleterious, To check this pair for an unstable, rings X-chromosome, 511-gynochromosomes were examined and they at least some arise three-celled, as tongues of these chambers. In cases where the present) the tumor may be c

1205 Brunet, B. THE ACTION OF TUMOR FORMATION IN D.

The body of a normal strain of chromosomes and a specific (Kor) showed that penetrance of 1-tryptophan in the diet, and suggests that both tumorigenic the product of which, varying the genotypes using chemically and x-ray treatments operate. In effect of 1-tryptophan, 1-naphthyl metabolism.

1206 Gudeichrist, S. INFLUENCING Drosophila melanogaster irradiation of the embryos or filters. Irradiation of germinal cells. The presence of the u. the tumorigenic action of X conformity to Beison's law, an effects of several irradiation to an upper limit of 600 to 80 increases. Between doses of 20, in contrast, the slope of the number increases the number of cell. Irradiation dose of 100 were observed in the tumoral fielded by irradiation. The in selective mortality or to limit have a tumorigenic effect in tumours once formed. It is to inducing agent controlled by 1

1207 Seng, J. H. EFFECTS OF ENU TUMOURS IN SUPPRESSED AN 4 (1965) 854-5.

If x-rays and access tryptophan, the action of the suppressor gene different reactions to environment.