nisms) which inhibits or restricts growth. Such a possibility is also indicated by the reduction in growth in length of the main axis obtained with pyridoxin at 3.0 times standard in the control mediums. This inhibitory effect of pyridoxin, at approximately this same concentration, has been observed in other experiments not yet published.

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Effect of Linear Energy Transfer on Radiation-Induced Chromosome Aberrations in *Tradescantia* Microspores[1]

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Comparative studies in which various types of ionizing radiations were utilized have provided evidence for a marked effect of ionization distribution (specific ionization) on the production of chromosome aberrations in *Tradescantia* microscopes. These studies have involved the use of different radiations—for example, x-rays and fast neutrons (*1*) and alpha particles (*2*)—to provide different patterns of ionization distribution. The recent availability of more powerful particle accelerators and improved exposure techniques have now made possible direct comparisons of the effect of linear energy transfer (rate of energy loss) utilizing single particle beams (*3*).

This paper presents the results of some experiments (*4*) carried out in the summer of 1948 with the 184-in. Berkeley cyclotron. The experiments must be considered to some extent preliminary, since in certain instances, especially with alpha-particle exposures, the quantitative data are not as extensive as is ordinarily desirable. Since it has not yet proved feasible to expand these observations, as was originally contemplated, it seems desirable to record the data and conclusions obtained to date.

Deflected beams of 190-Mev deuterons and of 380-Mev alpha particles were used. The particles had nearly parallel trajectories, and the radiation field covered an area of about 1 in. in diameter. By placing absorbers in front of the plant, the beam energy could be lowered. Data are reported here for high-energy deuterons having linear energy transfer (LET) of 0.73 kev/μ tissue (position I); deuterons, slowed by 1842 mg/cm^2 of aluminum, having a LET between 5 and 30 kev/μ at the neighborhood of the Bragg ionization peak (position III); high-energy alpha particles with LET of 2.9 kev/μ. Buds from fresh inflorescences were immersed in water and exposed near the center of the radiation field, with the axis of the buds parallel to the beam. Because of the variations of the size of buds and position of the pollen grains within, both the dose and LET of the low-energy deuterons may be in considerable error. Exposure normally took less than 1 min, and dosimetry was done by means of parallel plate ionization chambers (*3*).

Following irradiation, inflorescences were placed in containers of water and maintained at room temperature. Slides were prepared by the acetocarmine smear technique at 24 hr following radiation exposures for an analysis of chromatid aberration frequencies.

The results reported here are confined to isochromatid and chromatid aberration types. The first comparison was obtained in exposures of inflorescences to deuterons of two different energies. The results are given for isochromatid aberrations in Table 1 and Fig. 1 and for chromatid aberrations in Table 1. Standard errors have been calculated as described by

Table 1. Frequencies of isochromatid and chromatid aberrations induced by deuterons in *Tradescantia* microspore chromosomes. Slides made 24 hr after irradiation. (Position I, low LET; position III, high LET. See text.)

Expt.	Dose (rep)	Position	No. of cells	Isochromatid aberration	Isochromatids per cell	Chromatid aberration	Chromatids per cell
1	36	I	675	52	0.08 ± 0.01	34	0.05 ± 0.01
1	70.7	I	558	68	.12 ± .01	29	.05 ± .01
2	24.2	I	600	25	.04 ± .008	15	.025 ± .006
2	46.7	I	300	18	.06 ± .01	12	.04 ± .01
2	97	I	250	56	.22 ± .03	24	.10 ± .02
2	187	I	50	22	.44 ± .09	14	.28 ± .07
1	48.2	III	152	76	.50 ± .06	34	.22 ± .04
2	11.0	III	250	33	.13 ± .02	8	.03 ± .01
2	22.4	III	350	57	.16 ± .02	24	.07 ± .014
2	44.5	III	300	100	.33 ± .03	27	.09 ± .02
2	65.7	III	210	131	.62 ± .05	48	.23 ± .03

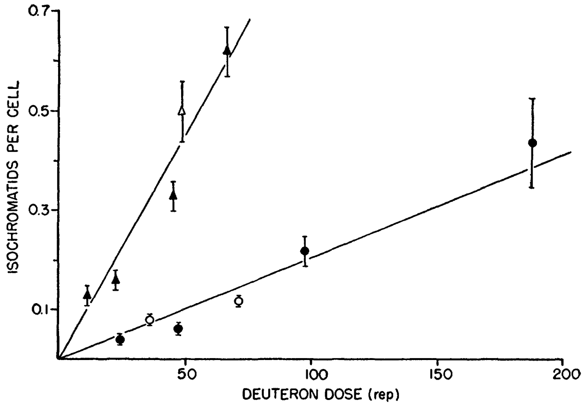

Fig. 1. Relationship between deuteron dose and isochromatid aberrations per cell. Position I, low LET: ○, expt. 1; ●, expt. 2. Position III, high LET: △, expt. 1; ▲, expt. 2.

Table 2. Frequencies of isochromatid aberrations induced by alpha particles in *Tradescantia* microspore chromosomes. All exposures at position I (low LET). Slides made 24 hr after irradiation.

	Dose (rep)	No. of cells	Isochromatid aberrations	Isochromatids per cell
Expt. 3	3.1	50	0	0.0
	6.0	100	2	.02 ± 0.014
	23.1	100	3	.03 ± .017
	46.5	100	10	.10 ± .03
	93	50	12	.24 ± .07
Expt. 4	25	107	6	.056 ± .02
	54	100	15	.15 ± .04
	107	40	18	.37 ± .10

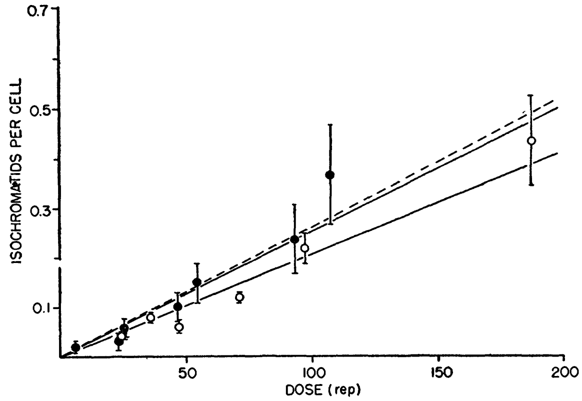

Fig. 2. Relationship between isochromatid aberrations per cell and radiation dose with three different radiations in exposures giving approximately equal linear energy transfer (LET): ○, 190-Mev deuterons; ●, 380-Mev alpha particles; - - -, about 100-kv x-rays.

Catcheside, Lea, and Thoday (*5*). Although in both instances the relationship between radiation dose and aberration yield has been plotted as linear, the possibility that the exponent in the dose-effect relationship may be somewhat greater than 1 is not excluded. It is clear that for both kinds of aberrations, there is a marked increase in yield with an increased rate of energy loss. The relative biological effectiveness for chromatid aberrations is approximately 2.7 and that for isochromatids, 4.5. Thus these observations agree with previous ones (*1*) in indicating a greater efficiency in chromosome aberration production by radiations having high specific ionization.

A further comparison was made of aberration production with 380-Mev alpha particles, exposures being made in the region of low rate of energy loss. These data are presented in Table 2 and are plotted in Fig. 2. Comparative data have also been included in Fig. 2 for two other radiations involving exposures at comparable rates of energy loss. The data for deuterons are those obtained in this study; those for x-rays are taken from the combined observations of several investigators, as reported by Lea (*6*, Fig. 34). It is clear that, within the limits of error, there is no difference in the effects of these three radiations when comparisons are made under comparable conditions of linear energy transfer. These results thus indicate in a striking manner that the important factor in determining radiobiological effectiveness is not the type of ionizing particle but rather the rate at which energy is dissipated along the particle path.

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Enzyme Concentrations in the Brain and Adjustive Behavior-Patterns

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This is a preliminary report of a close relationship between concentrations of an enzyme in the cerebral cortex of the rat and its adjustive behavior-patterns.

For our behavior test we used a standardized insoluble maze (*1*). The rat cannot learn the maze, since after each run the pattern of illumination cues and of