TABLE 1

DISTRIBUTION OF RADIOACTIVITY IN TISSUES OF *Drosophila virilis* AND *Drosophila melanogaster*

D. virilis	No.	Net total count	Average count per tissue
Larval gonads	23	1374 cpm	59.7 cpm
Larval brains	30	3021 "	100.7 "
Larval salivary glands	30	7801 "	260.0 "
Entire larvae	5	11684 "	2336.8 "
Original ♂	5	13860 "	2772.0 "
Original ♀	5	18873 "	3776.6 "
D. melanogaster			
Entire larvae	5	5732 cpm	1146.4 cpm
Treated ♂	5	4335 "	867.0 "
Treated ♀	5	11044 "	2208.8 "

Net values corrected for background, but not for radioactive decay occurring when these samples were measured.

of the generation raised on the radioactive medium was tested for radioactivity, since only a small number hatched. On the other hand, the hatch of *D. melanogaster* was normal, and here the adults, as well as the larvae, of the generation reared on the radioactive medium, were checked for radioactivity.

All 25 vials of *D. virilis* were fertile and produced the average number of pupae. However, only 39 females and 25 males hatched. Without exception, these imagines were morphologically abnormal. This abnormality pertained mostly to the eyes, legs, abdomen, wings, and genitalia. Twenty-one females and 17 males survived to be tested for fertility to untreated flies. Of these only seven females were fertile.

The low hatch was obviously caused by lack of ability of the treated imagines to emerge. Dissections of unhatched pupae showed fully formed flies with similar or more extreme abnormalities than those just described.

The number of adult offspring from the seven treated *D. virilis* females was very low as shown in Table 2.

Table 2 also shows the number of flies that were again mated to untreated *D. virilis* males and virgin *D. virilis* females. The progeny from these pair matings was about normal in number for *D. virilis*, and enough flies from each tube were inbred so that the progeny from ten tubes could be examined for visible mutations.

The *D. melanogaster* flies were not tested for mutations. Of the treated flies tested for fertility, 78 out of 130 females and 56 out of 109 males were fertile in pair matings to nonirradiated flies. These produced the normal number of progeny.

Beta rays proved to be an excellent source of irradiation for *Drosophila virilis*. The mutations obtained from this treatment are as follows: an eye color, either apricot or an allele of apricot (sex-linked); a wing character, cut or cutlike (sex-linked); scute; extra scutellar bristles; a wing character with unusual venation; another wing character (sterile) in which the wings were folded and rotated 90°; extremely abnormal knobby eyes (both males and females also sterile). Several different mutations of the same general type produced flies with extended wings

TABLE 2

	1		2		3		4		5		6		7	
	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂
No. adult offspring	15	24	2	5	1	3	2	3	4	4	3	2	6	4
No. mated	15	20	1	2	0	3	2	3	4	4	3	2	6	4

with added effects causing sterility. Among the progeny of yet another tube was a male with one apricotlike eye and the other eye a mosaic of areas respectively normal and apricotlike; when mated, no progeny was obtained.

Perhaps the most unusual and interesting mutation found was an aristapedialike character. The ten mutant flies examined (five males and five females) had leglike aristae, extended wings, crippled legs, and all bristles reduced to the size of hairs. They were nonviable and died soon after emergence. The mutant is retained by crossing the heterozygotes. Cytological examination of the salivary gland chromosomes of such heterozygotes show an inversion in the second chromosome. Whether or not this rearrangement is independent of the mutation has not yet been determined. The spineless-aristapedia locus in *D. melanogaster* is located in the right arm of chromosome 3, which is analogous to chromosome 2 in *D. virilis*. This coincidence of mutation and rearrangement in the same chromosome suggests that there is a connection between the mutation and the rearrangement.

The present investigation indicates that radioactive P^{32} not only produces mutations in *Drosophila virilis*, but also chromosomal rearrangements. The tolerance to such irradiation during development is high.

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Chlorophyll Formation in Potato Tubers as Affected by Temperature and Time[1]

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In studies of chlorophyll formation, tubers of the potato (*Solanum tuberosum* L.) offer certain advantages as experimental material over the etiolated seedlings of different plants which have been employed commonly in the past for this purpose. The development of chlorophyll in the tubers seems to be dependent on temperature and time in the same general fashion as in etiolated seedlings. However, the rate of development of chlorophyll in potato tubers is slow, the tubers are not dependent on photosynthesis and can thus be kept alive for a long time at the low light intensities required for this kind of study, and by using potato tubers it is possible to avoid the complicating effect of growth of the tissue in which chlorophyll formation is occurring.

In the study here reported concerning the effects of temperature and time on chlorophyll formation, tubers of

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the White Rose variety were used. Tubers approximately 2 in. in diam were selected for the experiment and inspected closely after washing to exclude tubers with even the slightest amount of greening. A single layer of

TABLE 1

CHLOROPHYLL CONTENT OF WHITE ROSE POTATO TUBERS EXPOSED TO 13–19 FOOT-CANDLES OF LIGHT AT DIFFERENT TEMPERATURES

Length of exposure, hr	Chlorophyll, mg/100 cm² exposed surface, at		
	40.9 ± 0.37 °F	51.4 ± 0.82 °F	66.3 ± 0.49 °F
72	0.02 ± 0.003	0.05 ± 0.002	0.16 ± 0.009
120	0.01 ± 0.005	0.09 ± 0.009	0.19 ± 0.022
240	0.02 ± 0.004	0.32 ± 0.014	0.33 ± 0.025
360	0.04 ± 0.005	0.48 ± 0.046	0.42 ± 0.011
480	0.10 ± 0.014	0.61 ± 0.010	0.41 ± 0.019
600	0.18 ± 0.011	0.71 ± 0.037	0.45 ± 0.010

tubers was arranged in circular fashion in three containers with mean temperatures of approximately 41°, 51°, and 66° F, respectively, with a 25-w Mazda lamp suspended 80 cm over the center of each lot. The light intensity at the level of the tubers was 19 foot-candles directly under the lamp and 13 ft-c at the periphery.

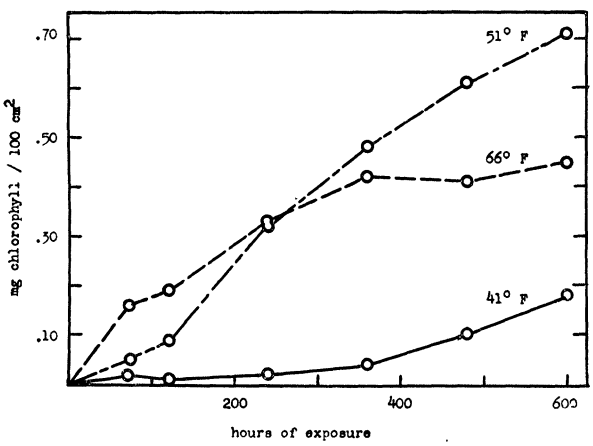

FIG. 1. Length of exposure to light, and concentration of chlorophyll in potato tubers maintained at three levels of temperature.

Samples, consisting of nine tubers each, and taken in a random manner were obtained from each temperature-controlled chamber after 72, 120, 240, 360, 480, and 600 hr of continuous exposure. Each tuber was sampled separately by cutting 10 disks, each 3 mm thick and 9.1 mm in diam, from the exposed surface. These disks were macerated and extracted in 95% ethanol for 24 hr and the chlorophyll concentration in the filtrate measured spectrophotometrically. The details of the procedure are described elsewhere (*1*).

The chlorophyll content in the tubers (Table 1, and Fig. 1) increased slowly at the low temperature 40.9° F throughout the experiment. At the medium temperature 51.4° F, the chlorophyll content increased relatively rapidly throughout the whole exposure period (600 hr) and the curve showed but little tendency to level off at the end of the experiment. At the high temperature of 66.3° F, the chlorophyll content increased most rapidly but reached a maximum after 360 hr of exposure and thereafter remained relatively constant throughout the rest of the experiment. For the first 120 hr the curves show the same general trend as those found by Lubimenko and Hubbenet (*2*) with wheat seedlings and by Smith (*3*) with barley seedlings.

These similarities give reason to believe that chlorophyll formation in potato tubers is dependent upon temperature and time in a manner which is, in principle, similar to the way the formation of chlorophyll in etiolated seedlings is dependent upon these factors. On this basis, the results have some significance in that they show that the temperature which promotes the most rapid development of chlorophyll, and thus can be termed optimum for this process, is not the temperature which promotes accumulation of the highest total amount of chlorophyll under prolonged exposure. Lubimenko and Hubbenet (*2*) found in their work that 79.8° F (26° C) was the optimum temperature for chlorophyll formation in etiolated wheat seedlings within the 72-hr limit of their experiment. They also assumed that the amount of chlorophyll accumulated at 79.8° F (26° C) after 72 hr of exposure was the total possible to accumulate at any temperature and length of exposure. However, by examining their results it can be seen that the curves obtained for 79.8° F (26° C) and 60.8° F (16° C) have trends which indicate that the two curves would have crossed if the experiment had been carried on long enough. Therefore, it occurs to the writer that Lubimenko and Hubbenet did not have sufficient reason to believe that the amount of chlorophyll accumulated at the end of their experiment at the optimum temperature 79.8° F was the absolute maximum possible to accumulate. Rather, their work indicates that they would have obtained results similar to those reported here had the exposure time been extended long enough.

It seems logical to assume that there is an absolute maximum for the amount of chlorophyll that can accumulate in the tissue of a certain species of plant. As far as the author is aware, the conditions of temperature, time, and genetic constitution which promote development of this maximum amount have not been established. However, the data for potato seem to suggest that this upper limit of chlorophyll accumulation will occur when the temperature is slightly above the lower temperature limit (approx. 38–39° F) at which chlorophyll formation takes place and after a very long period of exposure. The results obtained also lead the writer to believe that the nearer the temperature approaches a certain zero point for the process (possibly 38° F) the higher the maximum quantity of chlorophyll, provided the exposure period is extended accordingly. Further experiments are needed to prove or disprove this hypothesis.

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