lactose utilization) typical of its parent typhoid culture (*11*).

This Lac$^+$ hybrid, referred to as strain 643L$^+$, still arabinose-negative (Ara$^-$), was again mated with the *E. coli* Hfr and also with an *E. coli* F$^+$ strain on minimal medium containing *l*-arabinose. Hybrids of the presumably F$^-$ strain 643L$^+$ appeared at a relatively high frequency in the Hfr cross and could also be detected in the F$^+$ cross, whereas the previously unmated F^0 strain 643 failed to yield any recombinants that were able to utilize *l*-arabinose.

An opportunity to determine the frequency of recombination for Lac$^+$ occurred when Lac$^-$ hybrids of 643L$^+$ were obtained from matings of this strain with a Lac$^-$ Hfr strain of *E. coli* (*12*). These Lac$^-$ hybrids, observed in the progeny of crosses selected on minimal *l*-arabinose medium, were able to recombine at a high frequency for Lac$^+$ when mated again with the Lac$^+$ *E. coli* Hfr. The frequency of recombination found here (expressed as the ratio of recombinants to the number of Hfr parent cells) was of the order of 1×10^{-4}. This is typical of the frequency determined for the streptomycin-resistant mutant of *S. typhimurium* (TM-9S^r-2), which is now considered to have been a fortuitous isolation of an F$^-$ strain from the population of F^0 cells of *S. typhimurium* TM-9 prior to mating (*13*).

L. S. Baron
W. M. Spilman
W. F. Carey

Division of Immunology,
Walter Reed Army Institute of Research,
Washington, D.C.

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Radiation-Induced Crystallization of Sucrose

Abstract. In the presence of gelatine, sucrose crystallizes after a relatively short time (minutes, hours) when exposed to the radiation of an x-ray tube with copper target, or of a medical microwave unit. The formation of sucrose spherulites, visible with the naked eye, was observed.

The crystallization of sucrose from water solutions is inhibited by various substances, such as gelatine, which both hinder the formation of crystal nuclei in supersaturated solutions and reduce the rate of crystal growth. When sweetened and fruit-flavored gelatine (Jello) is dried, the sucrose generally remains in "solid solution." If crystallization does take place, a long period of time (weeks, months, or more) elapses before it is detected. Crystallization of sugar started to take place in a dried raspberry-flavored Jello, however, shortly after it was exposed to x-rays or microwaves.

Figures 1*A* and 1*B* show the x-ray diffraction patterns of Jello before and after a relatively long exposure to x-irradiation from a tube (copper target) operated at 40 kv and 20 ma. While only two amorphous rings appear before irradiation (Fig. 1*A*), the presence of "Laue spots" in Fig. 1*B* indicates that a great number of small single crystals (approximate size, 300 μ) were formed during the 6-hour exposure. The crystals obtained were identified as sucrose by their powder pattern (*1*). Their size increased with the time of exposure.

A similar effect was observed after the dried sample was irradiated by means of a 100-watt medical microwave unit (Raytheon, $\lambda = 12.5$ cm) at a distance of approximately 5 cm. The originally transparent gelatine became opaque in a few (10 to 15) minutes, and the sucrose crystallized in spherical aggregates consisting of radially arranged needles barely visible with the naked eye (Fig. 2). The x-ray diffraction pattern of these spherulites (Fig. 1*C*), obtained with a small pinhole (100 μ di-

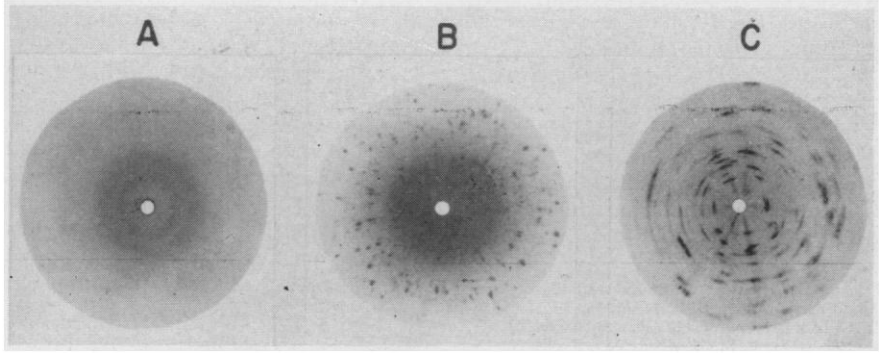

Fig. 1. X-ray diagrams. (*A*) Before irradiation; (*B*) after irradiation; (*C*) sucrose spherulite. (CuKα-irradiation; plane film; specimen-film distance, 15 mm.)

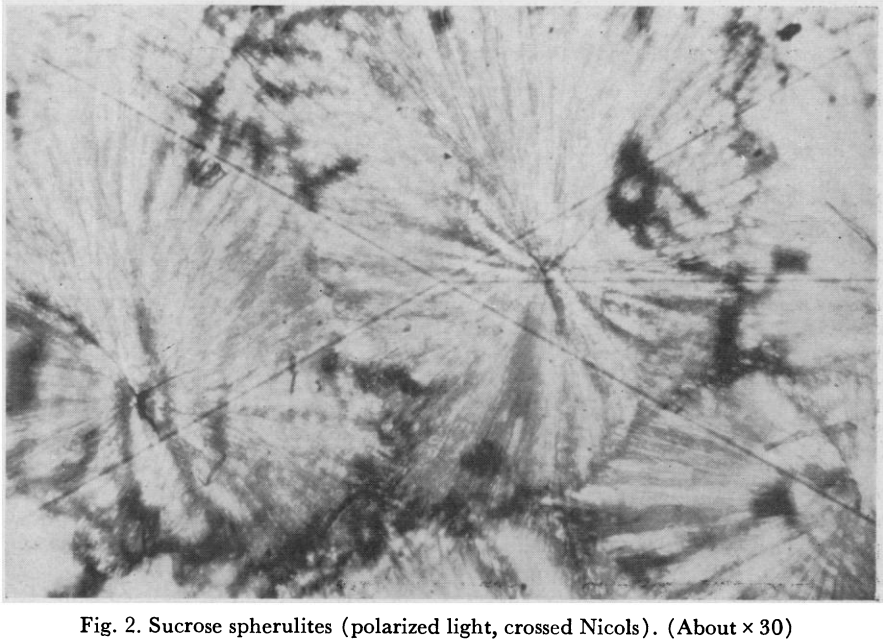

Fig. 2. Sucrose spherulites (polarized light, crossed Nicols). (About × 30)

ameter) in the Norelco micro diffraction camera, is almost identical to a rotating crystal diagram. The long dimension of crystal needles, corresponding to the "rotation axis" of the diagrams, coincides with the *b* axis of the monoclinic elementary cell of sucrose (*2*).

The observed crystallization is similar to the "recrystallization" of Al_2O_3 under the influence of ionizing radiation. According to Baskin and Semerchan (*3*), exposure to an electron beam or to hard x-rays increases the rate of crystal growth and makes the production of Al_2O_3 single crystals possible.

Although the formation of sucrose spherulites was surprising, it can be understood in view of the fact that microscopic spherulites of many substances have been observed during recent years, for instance in organic high polymers such as polyamides, polyesters, polyethylene, and rubber (*4*); spherulites of graphite have been observed in cast iron (*5*), and so on. Apparently the presence of foreign substances affecting the superficial tension of the medium from which crystallization takes place greatly influences the crystal habitus and causes the spherulitic growth of sucrose.

G. Susich
A. O. King
L. M. Dogliotti
Pioneering Research Division, Quartermaster Research and Engineering Center, Natick, Massachusetts

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Photosensitive Site in Lettuce Seeds

Abstract. Red light is effective only in promoting germination of Grand Rapids lettuce seeds, and far-red light is effective only in inhibiting it, when the hypocotyl half of the seed is exposed to the light. It is concluded that the photoreceptor is probably located in the tip of the hypocotyl.

In recent years studies of the effect of light on the germination of photosensitive seeds have been focused upon the photoreversibility of the reaction between red and far-red light (*1*). The photoreceptor has been considered to be a pigment system which changes its absorbing form with red and far-red light and which may be identical with the system mediating other photoreversible reactions in plants (*2*). However, few attempts have been made to locate the actual site of the light-absorbing system in the seed. Klein and Preiss (*3*) reported that if the seeds are turned over between the illumination with red and far red, so that the two exposures are given to opposite sides, then the germination-promoting effect of the red is still reversed by the far red, and vice versa. Since very little light could be transmitted through the seed, these results raise the question of possible diffusion of the photoreceptor or of photoproducts across the seed tissue. However, these experiments did not show which morphological unit it is that reacts to the incident light. In the following paragraphs (*4*) it is shown that the light-absorbing system is present in the hypocotyl half of the seed, but not in the cotyledon half.

Table 1. Effect of 2 minutes' illumination with red or far-red light on half-exposed Grand Rapids lettuce seed. Red illumination was given at 2 hours and far-red at 3 hours following illumination with red at 2.5 hours (all times were measured from the beginning of imbibition).

Exposed part	Germination (%)				
	Normal seed: irradiation for				Seed with fruit coat off: irradiation for 2 min
	10 sec	30 sec	2 min	5 min	
	Red light				
Hypocotyl	55	89	93	88	98
Cotyledon	7	8	16	17	42
Whole seed	63	96	96	98	100
None	4	6	5	4	28
	Far-red light after red illumination of the whole seed				
Hypocotyl		14	2	1	
Cotyledon		91	74	41	
Whole seed		1	5	2	
None		92	89	93	

The seeds used were those of *Lactuca sativa* var. Grand Rapids, supplied by Breck's (Boston, Mass.). Fifty seeds were soaked in a 9-cm petri dish on two layers of black filter paper (Schleicher and Schüll No. 2490) with 5 ml of distilled water in darkness at 25°C. Since preliminary experiments had shown that a dark purple dye coming out of the filter paper inhibited the germination of the seeds considerably, the filter paper was washed thoroughly with running tap water for 24 hours beforehand. After 1.5 hours of imbibition, each seed was carefully covered with a piece of aluminum foil by means of a pair of fine forceps, under a green safe-lamp (20-watt fluorescent lamp filtered through two layers each of yellow and green cellophane), either the cotyledon half or the hypocotyl half of the seed being left uncovered. Completely covered and uncovered seeds were prepared as controls. The procedure took 20 to 25 minutes; the safe-lamp was known to produce very little effect on germination in this time. Exactly 2 hours after the beginning of imbibition, all seeds were irradiated for varying times up to 5 minutes with red light (100-watt incandescent lamp filtered through a Corning Signal Red glass filter, placed 25 cm above the level of the seeds). Similar experiments were run with seeds whose fruit coats had been removed, except that 25 seeds were used per petri dish instead of 50. Immediately after the red irradiation, the piece of aluminum foil was quickly removed from the seed, lest suppression of the respiration of the seed interfere with germination.

For experiments with far-red light, a 100-watt reflector flood lamp, with Corning glass filter No. 7-69 (2600) (50 percent transmission at 742 mμ) placed 25 cm above the level of the seeds, was used. After 2.5 hours' imbibition in the dark, all seeds were given 2 minutes' irradiation with red light, as discussed above, to induce germination. Either the cotyledon or the hypocotyl half of each seed was then covered with aluminum foil, and far-red light was given for various periods of time exactly 3 hours after the beginning of imbibition. After the light treatment the aluminum foil was quickly removed from the seed, as before.

Table 1 shows the results of the experiments, each reading being the average from two dishes. These results show that red light promotes gemination when only the hypocotyl is exposed almost as well as it does in control seeds which are wholly exposed. Similarly, far-red light inhibits germination whether the whole seed or only the hypocotyl is exposed. Exposure of the cotyledons, on the other hand, has little effect, since germination is about the same as that of