Fig. 1. Action of the lytic enzyme, isolated from phage T_2 , on a living culture of *E. coli* B/2 and a culture treated by chloroform. (1) Culture treated with chloroform + enzyme; (2) culture treated with chloroform + medium; (3) living culture + medium; (4) living culture + enzyme

Hence the sphaeroplasts obtained by the action of the lytic enzyme of the phage and by egg-white lysozyme are similar, and differ from the 'ghost' sphaeroplasts which in these experiments, as in earlier experiments^{1,4}, were found to be unable to provide the reproduction of the virus, and this inability is related with the disturbance of the cytoplasmic membrane.

On the basis of these results and those published previously^{1,4} it can be concluded that the so-called 'killing-effect' of phage T_2 is related to the lytic enzyme, and is unable in isolated form to induce disturbances of the permeability barrier. Probably the protein membrane of phage T_2 maintains besides the lytic enzyme a factor, acting similarly to EDTA or chloroform. This inference is a sequence to the fact that the ability of the 'ghosts' to dissolve the cell wall or to convert the bacteria in a sphaeroplast in hypertonic media is realized in media without EDTA or chloroform. The isolated lytic enzyme of the phage is capable of producing similar effects only by the 'sensibilization' of cells with the aforementioned co-factors. On the other hand, it is logical to admit that the protein membrane of phage T_2 , besides the lytic enzymes, is maintaining a factor which provides the 'killing-effect' by a sharp disturbance in the permeability of the cell. This factor may be a specific enzyme. The possibility that disturbance of the cell permeability barrier is pro-

Table 1. REPRODUCTION OF THE PHAGE IN SPHEROPLASTS OBTAINED BY LYTIC ENZYME ISOLATED FROM PHAGE PARTICLES, EGG-WHITE LYSOZYME AND PHAGE 'GHOSTS'

0.8-1 × 10 ⁹ bacteria treated with	Sphaeroplast production (by the quantity of surviving bacterial cells) (%)	Phage titre after 30 min incubation of the mixture 1 ml. of sphero- plasts + 1 ml. broth	Phage filter after 30 min incubation of the mixture: 1 ml. of sphero- plasts suspension + 1 ml. π-factor
Lytic enzyme of the phage T_2	95.4	0	2.1 × 10 ⁴
Egg-white lysozyme	99.9	0	5.5 × 10 ⁴
Phage 'ghosts'	99.9	1.1 × 10 ⁵	6.1 × 10 ⁵

Table 2. PERMEABILITY OF SPHEROPLASTS, OBTAINED BY LYTIC ENZYME ISOLATED FROM PHAGE PARTICLES, EGG-WHITE LYSOZYME AND PHAGE 'GHOSTS'

0.8-1.0 × 10 ⁹ of cells treated with	Production of sphero- plasts (measured by the quantity of surviving cells) (%)	Release of aldolase in incubation media (in units of activity)
'Ghosts' of phages	99.9	288
Lysozyme of egg-white	99.9	0
Lytic enzyme of phage T_2	97.4	0

duced by a mechanical perforation of the membrane in the irreversible phase of the adsorption of the phage particles on the bacterial cell must not be excluded.

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ENTOMOLOGY

High-intensity Flash Discharge as a Source of Radiant Energy for Sterilizing Insects

THE possibility of using sterilized male insects to reduce the numbers of a pest species or even to eliminate it within a restricted area has assumed considerable importance since the successful application of this method by Baumhover *et al.*¹ against the screw-worm fly. Gamma-radiation is most frequently used to sterilize males, though lately chemo-sterilants are receiving increasing attention. Both these methods have drawbacks, especially in regard to safety aspects.

A paper by Nelson² on the chemical reactions which can be initiated by the heat from a high-intensity flash indicated that the possibility of using this form of radiant energy to sterilize insects was worth investigating, particularly since short-wave radiation in the ultra-violet region is known to damage proteins and nucleic acids and has been shown by Luria and Latarjet³ to produce lethal mutations in bacteriophage.

Preliminary experiments were conducted with two species of insects: a small chalcid *Dahlbominus fuscipennis* Zett. that had been used previously in heat-sterilization studies⁴, and the mosquito *Aedes aegypti* (L.). The flash apparatus was an ordinary photographer's photo-flash that has a nominal output of 100 joules at 2,500 V. The insects were confined in cylindrical glass jackets encircling the envelope of the flash-tube so that the *D. fuscipennis* were held within 3 mm of the envelope and the *A. aegypti* within 7 mm.

Immediate mortality in the *D. fuscipennis* males was not recorded, but propagation of the survivors showed that 82-87 per cent were sterilized by a single flash. Two flashes killed or sterilized 100 per cent. Twenty-six per cent of the *A. aegypti* males were killed by a single flash and all the survivors were sterile.

Following the results a more refined flash apparatus was built to permit precise positioning of the insects in relation to the flash and in which the light output can be controlled. Experiments are now in progress to establish dose/effect relationships in *A. aegypti* and also to determine the longevity and competitiveness of the males that are sterilized. Similar experiments are planned with insect pests of stored food products.

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