The fate of the flies not knocked down was undetermined. Slow knock-down is one of the recognized shortcomings of DDT.[3]

The methoxy analog, 2,2-di-*p*-anisyl-1,1,1-trichloroethane (m.p. 89°), showed a surprisingly good knock-down; with the use of .15 g per 100 ml it was not quite up to the required standard, but with .2 g per 100 ml it was very satisfactory. These lower concentrations gave poor kills, but .4 g per 100 ml gave a good kill. Other investigators [4,5,6] have indicated that this DDT analog shows insecticidal activity.

The ethoxy analog, 2,2-di-*p*-phenetyl-1,1,1-trichloroethane (m.p. 105°), at a concentration of .2 g per 100 ml gave a good kill and a knock-down distinctly better than that given by DDT although not as good as that given by the methoxy analog. In order to compare the ethoxy analog with DDT more adequately, pyrethrum extract was added to the spray solutions to provide a satisfactory knock-down. The results of these runs show that the ethoxy analog may be at least two-thirds as effective as DDT against flies. By adding .15 g of the methoxy analog per 100 ml of the solutions of these compounds to provide the knock-down, this relative effectiveness was again attained.

The *n*-propoxy analog (m.p. 62°) showed a low order of toxicity toward houseflies and the *n*-butoxy analog (m.p. 50°) practically no toxicity.

DDT, the methoxy and the ethoxy analogs were found about equally effective against mosquito larvae (*Culex quinquefasciatus* Say); concentrations of .03 to .04 parts per million (p.p.m.) in tap water killed half of the larvae in 20 hours. The *n*-propoxy analog at .4 p.p.m. gave about a 50 per cent. kill while the *n*-butoxy analog at 4 p.p.m. gave a negligible kill.

Preliminary feeding tests were conducted to determine the comparative toxicity to white rats of the ethoxy analog and DDT, since the latter substance is known to be toxic[7] to higher animals and the ethoxy compound has shown excellent insecticidal activity. Four animals, about four months old, two males weighing about 320 g each and two females weighing about 200 g each, were used for each compound and for the control. The ration consisted of ground Rockland Rat Diet plus 2 per cent. corn oil. The test compound in each case was uniformly distributed in the mixture at a level of .2 per cent. All the rats receiving DDT soon developed severe tremors and died within 8 to 10 days. The female rats receiving the ethoxy analog developed tremors somewhat later and died, one after 15 and the other after 21 days. The males receiving the ethoxy analog were still apparently normal after four weeks. Autopsies did not reveal any gross pathologic changes attributable to the ethoxy analog. The results suggest that the ethoxy analog may be less toxic than DDT to higher animals.

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CRYSTAL STRUCTURE OF DDT [2,2-bis (p-CHLOROPHENYL) 1,1,1,-TRICHLOROETHANE]

A SAMPLE of DDT (m.p. 106° C.) recrystallized several times from mixtures of ethanol and water was chosen for this study. With the fine hair-like needles, rotation, oscillation, Weissenberg and powder x-ray diffraction patterns were made and reciprocal lattice projections used to index interferences and to check interpretations of results.

The material appears to crystallize in the orthorhombic system with unit cell dimensions

$a_0 = 19.25$ A.U.
$b_0 = 10.04$ A.U.
c_0 (along needle axis) $= 7.73$ A.U.

Calculations from density measurements (approximately 1.0) indicate two molecules per unit cell, and the space group is probably $P222_1$. Further work on the molecular configuration is now in progress together with efforts to produce crystals of greater cross section in order to improve rotation and Weissenberg patterns around a and b axes. For purposes

TABLE 1

Line No.	d_{hkl} (A. U.)	Planar indices	Relative intensity
1	9.50	200	0.5
2	5.90	311	0.89
3	5.45	310	0.28
4	5.00	020	1
5	4.36	411	0.70
6	4.17	221	0.77
7	3.85	002	0.34
8	3.57	420	0.49
9	3.36	421	0.47
10	3.05	600 (230) (031)	0.49
11	2.93	231	0.37
12	2.82	330	0.37
13	2.75	700	very faint
14	2.59	003	" "
15	2.51	040	" "
16	2.40	240	" "
17	2.31	340	" "
18	2.26	430 (041)	" "
19	2.20		" "
20	2.06		" "
21	2.01	[004]?	" "
22	1.74		" "

of identification, powder diffraction interferences are given in Table 1.

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OBSERVATION OF BACTERIOPHAGE THROUGH A LIGHT MICROSCOPE[1]

ELECTRON micrographs of bacteriophage attacking *Escherichia coli*,[2] *Salmonella pullorum*[3] and *Rhizobium leguminosarum*[4] show that the particles have a diameter greater than that of bacterial flagella; with the latter organism, the particles have a diameter 5 to 10 times greater than that of flagella. Since the bacterial flagella can be stained and made visible under an ordinary light microscope, it seemed that the same should be possible with bacteriophage particles (sometimes called bacterial viruses).[2]

The discovery was made during the winter of 1943–44 that bacteriophage preparations treated with auramin and observed under the microscope when radiated with ultraviolet rays from an H-4 mercury arc show the presence of many bright yellow pinpoints of light in an otherwise dark field. Bacteria failed to show anything other than a very pale and weak yellow color, and the granules were not observed unless bacteriophage particles were known to be present. The past winter this work was repeated with quite similar results, and two additional methods for revealing bacteriophage particles were developed. These involved the use of stains (one, a modification of the acid-fast stain) and ordinary light; and by these the bacteriophage particles were seen to have the same shape as under the electron microscope.

Since at that time the bacteriophage had not been studied in active condition, there was no way of being absolutely certain as to the sequence in the process of lysis of the various structures. The drawings presented in Fig. 1, however, show the apparent order of events. Beginning with bacterial cells of the pea nodule organism (*a*), which show the refractile bodies usually seen following light staining with methylene blue or rose bengal, and the bacteriophage (*b*), which always stained heavily, it seemed that the first contact of the bacteriophage with the cell resulted in a delicate connection between the two, as shown in the first drawing in (*c*), the particle appearing at a greater distance from the cell than would ordinarily be expected. Other cells were seen in which the bacteriophage particle had developed to larger size and in which there had been a corresponding shortening of the connection to the bacterium, and still other cells to which relatively large particles of bacteriophage were attached.

Still other cells were observed in which these phenomena were absent (*d*), but in which the usual refractile bodies were replaced by other particles which stained heavily and had a quite different position in the cell. Other cells had apparently broken down, leaving a faintly colored material which stained in a manner characteristic of cell protoplasm, but the material was quite different in outline from the original cell and included varying numbers of deeply stained bodies. In some such partially destroyed cells, the latter bodies were small, and in others, relatively large. Next in the process of lysis it seemed that the typical structures consisted of faintly staining rem-

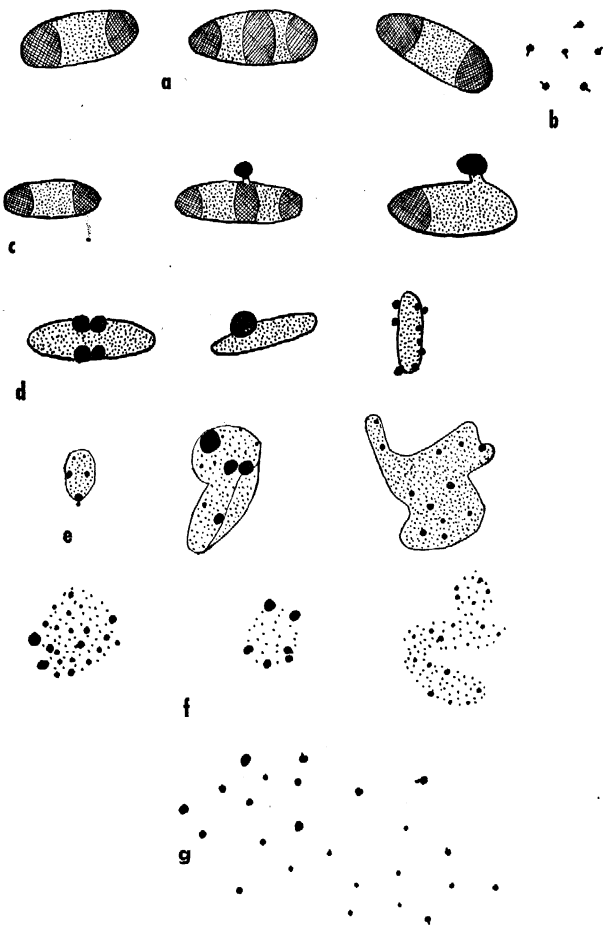

FIG. 1. Progressive stages in the lysis of bacterial cells as indicated by stained material examined under the ordinary microscope. a. Cells of the pea nodule organism. b. Bacteriophage particles. c. Cells in early stages of bacteriophage action. d. Cells in which bacteriophage action was well under way. e. Partially lysed cells showing protoplasm in which the development of densely staining bodies is evident. f. Remnants of cell protoplasm among which are numerous bacteriophage particles that have developed from the cell protoplasm. g. A concentration of densely staining bodies around an area that was probably one or more cells, but in which no cell material is evident.

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