in concentrations ranging from 30,000 to 200,000 cysts per liter, were irradiated for various periods of time. Following irradiation, the suspensions were sedimented and the residue planted upon a suitable culture medium. Subsequently, the cultures were examined for the presence of motile trophozoites. A control suspension was run with each test, and handled in the same manner except that irradiation was omitted.

It was found that all *E. histolytica* cysts were destroyed by ten minutes' irradiation in the five tests done upon suspensions of 30,000 cysts per liter of distilled water (Tables 1 and 2). Heavier suspensions were not tested for this time interval, since 30,000 cysts per liter exceeds the concentration likely to be encountered in water purification practice. When heavier suspensions and shorter exposures were used, only a portion of the cysts were destroyed (Tables 1 and 2). The extreme sluggishness and

TABLE 1

CYSTICIDAL EFFECT OF IRRADIATION WITH GERMICIDAL LAMP, MODEL 1

Test (number)	Exposure time (minutes)	*E. histolytica* cysts per liter of distilled water	Results per cent. survival*	
			Test	Control
1	1	200,000	0	100
2	2	200,000	20	100
3	3	200,000	0	100
4	4	200,000	20	100
5	5	100,000	0	100
6	1	58,000	0	100
7	2	58,000	0	100
8	3	58,000	60	100
9	4	58,000	20	100
10	10	30,000	0	100
11	10	30,000	0	100
12	10	30,000	0	100
13	10	30,000	0	100

* Per cent. survival is the ratio of the number of positive cultures to the total number of culture tubes inoculated with the sediment from the cyst suspension.

TABLE 2

CYSTICIDAL EFFECT OF IRRADIATION WITH GERMICIDAL LAMP, MODEL 2

Test (number)	Exposure time (minutes)	*E. histolytica* cysts per 4 liters of distilled water	Results per cent. survival*	
			Test	Control
1	5	216,000	10	100
2	5	200,000	0	100
3	5	120,000	10	100
4	10	120,000	0	100

* Per cent. survival is the ratio of the number of positive cultures to the total number of culture tubes inoculated with the sediment from the cyst suspension.

altered general appearance of the trophozoites which did emerge from the cysts surviving exposure indicated a sublethal effect of ultraviolet radiation upon these organisms; such trophozoites changed shape but slowly and showed none of the explosive pseudopod formation typical of *E. histolytica*. The control cultures showed normally active trophozoites.

Although ozone is produced while the lamps are in use, the amount is small and the effect apparently negligible.[3, 4]

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INSECTICIDAL ACTIVITY OF SOME ALKOXY ANALOGS OF DDT

SEVERAL 2,2-bis(*p*-alkoxyphenyl)-1,1,1-trichloroethanes were synthesized by the general method described[1] for the ethoxy member and were tested in comparison with DDT, 2,2-bis(*p*-chlorophenyl)-1,1,1-trichloroethane (m.p. 107°).

The results of the tests on houseflies (*Musca domestica* L.), which were obtained by the large Peet-Grady method,[2] are shown in Table 1. Deo-Base, a refined petroleum distillate, was the solvent used for making the spray solutions. The percentage kill given by the Official Test Insecticide (OTI) was determined for each culture of flies to provide an index of the resistance of the culture.

TABLE 1

TOXICITY OF SOME *Para*-SUBSTITUTED DIPHENYLTRICHLOROETHANES OF THE GENERAL FORMULA $(R\text{–}C_6H_4)_2CHCCl_3$ TOWARD HOUSEFLIES AS DETERMINED BY THE PEET-GRADY METHOD

Substituent R is:	Concn. of compound g/100 ml	Pyrethins added g/100 ml	Knock-down in 10 min., per cent.	Kill in 24 hrs., per cent.	OTI kill in 24 hrs., per cent.
Cl (DDT)	.25	..	42	38	49
CH_3–O (Methoxy) ...	.15	..	91	31	51
" " ...	.20	..	99	32	34
" " ...	.40	..	99	85	46
C_2H_5–O (Ethoxy) ...	.20	..	90	86	34
" " ...	.10	.05	97	78	44
" " ...	.15	.05	99	91	44
Cl (DDT)	.10	.05	96	86	44
Control	..	.05	96	34	44
C_2H_5–O + CH_3–O	.15 + .15	..	97	88	44
Cl (DDT) + CH_3–O ..	.10 + .15	..	94	86	44
n–C_3H_7–O (*n*-propoxy)	.50	.025	95	48	54
n–C_4H_9–O (*n*-butoxy).	.50	.025	99	25	54

With DDT used at a concentration of .25 g per 100 ml the knock-down in 10 minutes was very poor, but most of the flies knocked down were dead in 24 hours.

[2] Matthew Luckiesh and Lewis L. Holladay, *General Electric Review*, 47: 4, 45–50, April, 1944.

[3] H. S. Forbes and G. A. Daland, *Am. Jour. Physiol.*, 66: 50, 1923.

[4] L. R. Koller, *Jour. Applied Physics*, 10: 9, 630, September, 1939.

[1] P. Fritsch and F. Feldmann, *Liebigs Ann. Chem.*, 306: 72, 1899.

[2] "Blue Book," p. 177. New York: MacNair-Dorland Co., 1939.

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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[7] J. H. Draize, G. Woodard, O. G. Fitzhugh, A. A. Nelson, R. B. Smith, Jr. and H. O. Calvery, *Chem. Eng. News*, 22: 1503, 1944.

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		" "