measure responsible for failure. Further trials by these methods now seem unnecessary.

In the cases reported above the success of the penicillin method may be attributed to several factors. Resistance of *Trichomonas vaginalis* to penicillin in the concentrations reported above, the absence from the specimens of vaginal discharge of bacteria resistant to penicillin in these same concentrations, and the destruction of bacteria adherent to the sticky surfaces of the trichomonads perhaps played a large part in assuring successful isolation of the protozoa.

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# DISCUSSION

## ADDITION OF CARBON TETRACHLORIDE AND CHLOROFORM TO OLEFINS

FOR many years teachers of elementary organic chemistry have struggled valiantly to combat the persistent tendency of sophomores to write reactions of the following types:

$$RCH=CH_2 + CCl_4 = RCHClCH_2CCl_3$$
$$RCH=CH_2 + CHCl_3 = RCH_2CH_2CCl_3$$

It may, therefore, be of some general interest that these reactions can now be carried out in the laboratory without difficulty. The trick by which this result is accomplished is a simple one. All that is necessary is to add to the olefin an excess of carbon tetrachloride or chloroform and a small amount (about 0.02 mole) of diacetyl or dibenzoyl peroxide, and to heat the reaction mixture.

One or two examples of reactions which have actually been carried out may be of interest.

$C_6H_{13}CH=CH_2 + CCl_4 = C_6H_{13}CHClCH_2CCl_3$
*n*-octene-1 1,1,1,3-tetrachlorononane

$C_6H_{13}CH=CH_3 + CHCl_3 = C_6H_{13}CH_2CH_2CCl_3$
*n*-octene-1 1,1,1-trichlorononane

$H_2C=CHCH_2CH_2CH=CH_2 + CCl_4 =$
Diallyl $H_2C=CHCH_2CH_2CHClCH_2CCl_3$
1,1,1,3-tetrachloroheptene-6

$H_2C=CHCH_2CH_2CH=CH_2 + 2CCl_4 =$
Diallyl $Cl_3CCH_2CHClCH_2CH_2CHClCH_2CCCl_3$
1,1,1,3,6,8,8,8-octacholorooctane

$H_2C=CHCH_2CH_2CH=CH_2 + CHCl_3 =$
Diallyl $H_2C=CHCH_2CH_2CH_2CH_2CCl_3$
1,1,1,3,6,8,8,8,-octachlorooctane

In all the reactions cited the yields are good (better than 60 per cent. with carbon tetrachloride); the molecular weights and per cent. chlorine contents of the products agree with the calculated figures. In all instances, some material of higher molecular weight is also formed.

Strange as the reactions cited may appear, the explanation of their mechanisms is not too difficult. Essentially, they are free-radical chain reactions initiated by the free alkyl or aryl radicals generated in the reaction mixture by the decomposition of the organic peroxide. A somewhat schematized version of the steps in the reaction between carbon tetrachloride and the alkylene hydrocarbon $RCH=CH_2$ in the presence of acetyl peroxide is given below. Certain finer details are omitted for the sake of brevity.

$$(1)\ CH_3C(=O)OOC(=O)CH_3 \xrightarrow{\text{Heat}} CH_3\cdot + CO_2 + CH_3COO$$
$$(2)\ CH_3\cdot + CCl_4 \longrightarrow CH_3Cl + Cl_3C\cdot$$
$$(3)\ RCH=CH_2 + Cl_3C\cdot \longrightarrow RCHCH_2CCl_3\ (A)$$
$$(4)\ RCHCH_2CCl_3 + CCl_4 \rightarrow RCHClCH_2CCl_3 + \cdot CCl_3$$

The chain consists in the repetition of the cycle indicated by reactions (3) and (4). The formation of material of higher molecular weight is due to concurrent reactions such as

$$(5)\ RCHCH_2CCl_3 + RCH=CH_2 \rightarrow RCHCH_2CCl_3 \quad (CH_2CHR)$$
$$(6)\ RCHCH_2CCl_3 + CCl_4 \rightarrow RCH_2CH_2CCl_3 \quad (CH_2CHR \rightarrow CH_2CHClR + Cl_3C)$$

For effective repetition of the cycle, the group R in the free radical (A) must be aliphatic.[1] Where R is aromatic (*e.g.*, as in styrene), reactions similar to (5) are favored, and the product consists mostly of higher polymers.

Other additions to olefins which involve an increase in the carbon skeleton are underway in this laboratory. It seems likely that such reactions will be widely applicable.

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## "GALL-FLOWER" OF THE FIG, A MISNOMER

IN the Greek literature of 2,000 years ago it is recorded that in Greece and in other parts of the Near East an insect called "psen" or "psenes" inhabited the fruit of the wild fig tree, that the figs from such trees were suspended in domesticated fig trees to insure the setting and maturing of the fruit. It is also recorded that the Greek peasants suspended in their fig trees galls taken from the elm in the belief that the insects that emerged from such galls served the same purpose as those from the wild figs.[1]

[1] Kharasch, Kane and Brown, *Jour. Am. Chem. Soc.*, 63: 526, 1941.