amylene, homologues of ethylene; mesityl oxide, $(CH_3)_2C:CHCOCH_3$, an unsaturated ketone; and vinyl acetate, $CH_3COOCH:CH_2$, an ester of an unsaturated alcohol, all gave positive reactions.

Dichloroethylene, CHCl:CHCl; trichloroethylene and tetrachloroethylene failed to give the reaction. This is undoubtedly accounted for by the fact that a substituent on a double bond carbon affects the reactivity of the double bond, which seems to be necessary to produce the reaction.

Acetone, acetaldehyde, diethyl ether and chloroform failed to give the reaction.

From these facts it seems likely that some gaseous or volatile unsaturated hydrocarbon or similar compound is present in Golden Self-Blanching celery during natural blanching of the leaves. The celery, Winter Queen, which is not self-blanching, does not produce such substances. It seems indicated therefrom that the disappearance of chlorophyll from self-blanching celery is accomplished by some process similar to that by which celery is commonly blanched artificially by application of ethylene in low concentrations.[4]

R. C. NELSON
R. B. HARVEY
MINNESOTA AGRICULTURAL EXPERIMENT STATION

NEW CANCER-PRODUCING HYDROCARBONS

Two hydrocarbons, belonging to series not hitherto known to be active as agents for cancer production, have been found to cause malignant growths in mice. These two compounds are sym.-triphenylbenzene and tetraphenylmethane. Their action is slower than that of the substances discovered by Cook[1] and coworkers. A specific strain of mice was treated to weekly injections amounting to 1 cc of a 5 per cent. solution of triphenylbenzene in sesame oil. In a year's time 12 out of 60 mice had well-developed tumors of a highly malignant type. In the case of tetraphenylmethane 25 mice were painted twice weekly with a 0.5 per cent. solution in benzene. After the same period well-developed epitheliomata were present in 8 cases. It is interesting to note that the percentage of positive results is relatively high in spite of the long time necessary to induce the growth.

The interest which these results arouse is chiefly in the complete lack of resemblance of these new compounds to the hydrocarbons discovered by Cook. The compounds[2] investigated by him had condensed ring systems containing 4 to 5 aromatic rings in the molecule and possessed a phenanthrene nucleus. He found that the ring system of 1, 2-benzanthracene[3] is present in many cases, although not absolutely necessary. He also observed a possible relationship[4] with the dehydrogenation products of the sex hormones and bile acids. Triphenylbenzene and tetraphenylmethane possess nothing in common with the properties listed above, except that each contains 4 benzene rings. The significance, if any, of this point is not evident at present. Any other structural similarity is lacking, for there is a complete absence of condensed ring systems or a phenanthrene nucleus in the two new agents. Neither may they be derived from the sex hormones or the bile acids.

In triphenylbenzene a single ring holds three other benzene rings attached in the 1, 3, 5 positions, but in tetraphenylmethane no benzene ring is attached to another. The linkages in this last instance are through a central carbon atom. In an effort to find a common ground on which these widely different classes of carcinogenically active agents can stand we may make the tentative assumption that in the hydrocarbons so far discovered the property of producing cancer resides in the benzene nucleus as modified or affected by substituents attached in either the condensed or open manner. Work is now in progress to limit more exactly the nature and position of the substituents. We are also investigating the higher phenyl homologues of the above-named series in the expectation that they may be more active still in causing tumorous growths.

The work is being conducted under a joint program of research of the Evans Memorial Hospital of Boston and the Massachusetts Institute of Technology at Cambridge.

AVERY A. MORTON
DANIEL B. CLAPP
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CHARLES F. BRANCH
EVANS MEMORIAL HOSPITAL

THE FORMATION OF CARBOHYDRATE FROM GLYCEROPHOSPHATE IN THE LIVER OF THE RAT

GEMMILL and Holmes[1] reported recently that the carbohydrate content of liver slices from butter-fed rats increases during 3 hours' incubation in bicar-

[4] Since the work described was completed for publication, it came to the authors' attention that R. Gane had published in *Nature*, December 29, 1934, Vol. 134, p. 1008, a paper entitled "The Presence of Ethylene in Some Ripening Fruits."

[1] Cook, Hieger, Kennaway and Mayneord, *Proc. Roy. Soc.*, B, 111: 455, 1932; Cook, 485.

[2] Cook, *Proc. Roy. Soc.*, B 113: 273, 1933.

[3] Cook, *Jour. Chem. Soc.*, 1592, 1933.

[4] Cook, *Proc. Roy. Soc.*, B 113: 273, 1933; Cook and Haslewood, *Jour. Chem. Soc.*, 428, 1934.

[1] C. L. Gemmill and E. G. Holmes, *Biochem. Jour.*, 29: 338, 1935.