treatment with piperidine, yielded a second new stereoisomer, m. p. 155–157°, $[\alpha]_D$ +84° (chloroform), it must have the same configuration around C_3 as podophyllotoxin and the second new stereoisomer must have the same configuration around C_3 as picropodophyllin. The stereoisomer melting at 159–161° is therefore the C_1-epimer of podophyllotoxin and is named epipodophyllotoxin, while the diastereoisomer melting at 155–157° is the C_1-epimer of picropodophyllin and is named epipicropodophyllin. The conversion of podophyllotoxin to epipodophyllotoxin through the halide represents a Walden inversion, an impossibility with the Borsche–Späth formula, II. Furthermore, production of the chloride by means of acetyl chloride is unexpected of a primary alcohol, II, and its ready hydrolysis by water is not typical of primary chlorides. Finally, the existence of four diastereoisomers differing only in configuration around the carbon atom bearing the hydroxyl group and the carbon atom α to the carbonyl group is compatible only with III.

Detailed experimental results and discussion will be presented in a later paper.

CHEMOTHERAPY SECTION
NATIONAL CANCER INSTITUTE JONATHAN L. HARTWELL
NATIONAL INSTITUTES OF HEALTH
BETHESDA, MARYLAND ANTHONY W. SCHRECKER[9]
RECEIVED MAY 18, 1950

(9) Postdoctoral Research Fellow, National Cancer Institute.

THE ACID-CATALYZED REACTION OF STYRENE OXIDE AND ALLYL ALCOHOL

Sir:

The concern of Guss over "the present difficulties in the interpretation of the ring opening reactions of olefin oxides"[1] is shared by many investigators in this field.

These reactions may be interpreted as concerted displacements from such evidence as stereochemical inversion of the reacting carbon atom,[2] the kinetic order dependence on oxide and attacking reagent,[3] and the necessity for solvolysis.[4] Unsymmetrical 1,2-epoxides provide the added complication of a competition reaction wherein the efficiency of the solvolysis of the oxygen atom and the electronic and steric disposition of the displacing group and of the reacting carbon atoms assume dominant roles.

Two publications[5,6] provide experimental evidence which contradicts the generality of this theory. The specific cases involve acid-catalyzed reactions of styrene oxide with alcohols, which are claimed to produce 2-allyloxy-1-phenylethanols. The earlier work of Emerson[5] has been corrected by Reeve and Christoffel[7] for the case, methanol.

(1) Guss, THIS JOURNAL, **71**, 3460 (1949).
(2) Grigsby, Hind, Chanley and Westheimer, *ibid.*, **64**, 2606 (1942).
(3) Brönsted, Kilpatrick and Kilpatrick, *ibid.*, **51**, 446 (1929).
(4) Kusner, *Ukrain. Khem. Zhur.*, **7**, Wiss. Abt. 179 (1932).
(5) Emerson, THIS JOURNAL, **67**, 516 (1945).
(6) Swern, Billen and Knight, *ibid.*, **71**, 1152 (1949).
(7) Reeve and Christoffel, *ibid.*, **72**, 1480 (1950).

We have evidence which contradicts the conclusion of Swern, Billen and Knight[6] that styrene oxide reacts with allyl alcohol in the presence of sulfuric acid to give 2-allyloxy-1-phenylethanol.

The alleged "2-allyloxy-1-phenylethanol" was synthesized by the prescribed method[6] and then treated with *p*-toluenesulfonyl chloride in pyridine. The product was heated with dry pyridine for twenty hours to give an ether-insoluble oil, which was converted to a crystalline iodide salt with sodium iodide in acetone. Analysis showed it to be a phenylallyloxyethylpyridinium iodide, m. p. 155–156°; *Anal.* Calcd. for $C_{16}H_{18}ONI$: C, 52.33; H, 4.94; N, 3.81. Found: C, 52.22; H, 5.20; N, 4.03. The exact identity of the salt was determined by heating it for three minutes in boiling 47% hydriodic acid. This gave allyl iodide and the known 1-(2-phenyl-2-hydroxyethyl)-pyridinium iodide,[8] m. p. 256–258°. An over-all yield of 70% was realized.

It is extremely improbable that any rearrangement has occurred. Bartlett and Lewis[9] have emphasized the non-participation of ether groups in replacement reactions. If the reaction with pyridine had involved the participation of the allyloxy group to form the intermediate styrene allyloxonium ion, then a large yield of 1-(1-phenyl-2-allyloxyethyl)-pyridinium *p*-toluenesulfonate should have been formed. This argument is strictly in agreement with the results of the pyridine reaction with styrene oxonium ion.[8] To supply additional evidence on this point, a sample of the major product of the base-catalyzed reaction of styrene oxide and allyl alcohol[5] was put through the same first three reactions as above. A different phenylallyloxyethylpyridinium iodide was obtained. This removes the possibility that both *p*-toluenesulfonate esters react by way of the same styrene allyloxonium ion intermediate.

From these considerations we conclude that the product of the acid-catalyzed reaction of styrene oxide with allyl alcohol is actually *2-allyloxy-2-phenylethanol*. The evidence then fits the theory that displacement reactions involving the styrene oxonium ion should be favored at the benzyl carbon, due to resonance stabilization of the transition state.

(8) King, Berst and Hayes, *ibid.*, **71**, 3498 (1949).
(9) Bartlett and Lewis, *ibid.*, **72**, 406 (1950).

DEPARTMENT OF CHEMISTRY
ILLINOIS INSTITUTE OF TECHNOLOGY F. N. HAYES
CHICAGO, ILLINOIS CHARLES GUTBERLET
RECEIVED MARCH 20, 1950

ELECTRON MICROSCOPE OBSERVATIONS OF CERTAIN FIBROUS STRUCTURES OBTAINED FROM CONNECTIVE TISSUE EXTRACTS

Sir:

Orekhovich, *et al.*,[1] have described a protein which they obtained from macerated, phosphate

(1) V. N. Orekhovich, A. A. Tustanovskii, K. D. Orekhovich and N. E. Plotnikova, *Biokhimiya*, **13**, 55 (1948).