Anal. Calcd. for $C_{18}H_{24}ClNO_3$: Cl, 10.52; N, 4.15. Found: Cl, 10.22; N, 4.13.

1-(3',4'-Dihydroxyphenyl)-2-N-(2'-*p*-methoxyphenylisopropyl)-aminobutanol Acetate.—An alcoholic suspension of 40 g. (0.072 mole) of crude dibenzylated catechol aminoketone prepared from 1-bromo-(3',4'-dibenzyloxy)-butyrophenone and 2-*p*-methoxyphenylisopropylamine was reduced successively with palladium-on-charcoal and platinum oxide catalysts as described in the preparation of the phenylethyl derivative. After removal of catalyst and solvent a sticky residue remained which was dissolved in 80 cc. of water and converted to the free base by the addition of 17.7 g. (0.21 mole) of sodium bicarbonate. The gummy precipitate was extracted with three 50-cc. portions of *n*-butyl alcohol and the butanol extracts neutralized with 4.3 g. (0.07 mole) of glacial acetic acid. The butanol was removed by distillation *in vacuo* in atmosphere of nitrogen. The residue was washed with dry ether and then crystallized from a mixture of acetone and ether (crystallization may take as long as two to three weeks). The solid was collected by filtration and washed with acetone–ether, yield 6.5 g. (23%), m.p. 127–129° dec.

Anal. Calcd. for $C_{22}H_{31}NO_6$: N, 3.46. Found: N, 3.28.

1-(3',4'-Dihydroxyphenyl)-2-N-(3'-phenylpropyl)-aminobutanol Hydrochloride.—This aminoalcohol was prepared by the same procedure as the corresponding phenylethyl compound, yield[20] 28.5%, m.p. 179–180°.

Anal. Calcd. for $C_{19}H_{26}ClNO_3$: Cl, 10.10; N, 3.90. Found: Cl, 9.84; N, 3.65.

(20) Based on crude 3',4'-dibenzyloxyphenyl 1-N-(3-phenylpropyl)-aminopropyl ketone hydrochloride which could not be purified further.

MILWAUKEE, WISCONSIN

[CONTRIBUTION FROM THE COLLEGE OF PHARMACY, UNIVERSITY OF MICHIGAN]

Antispasmodics. XIV. Basic 1,3-Dioxanes

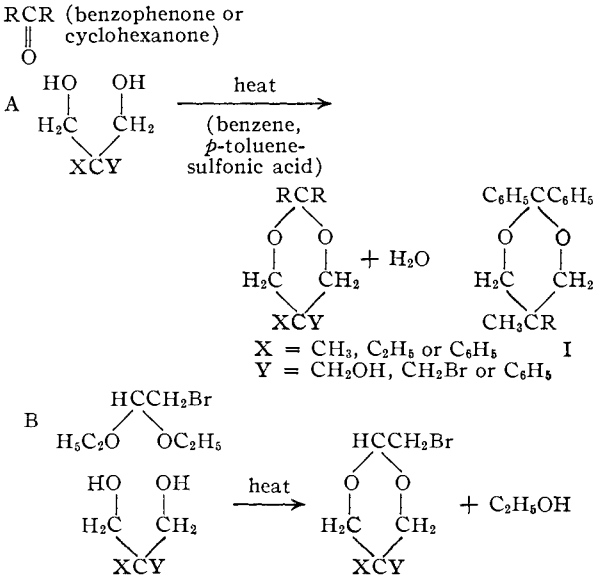
BY F. F. BLICKE AND E. L. SCHUMANN[1,2]

RECEIVED DECEMBER 12, 1953

A series of substituted 1,3-dioxanes was prepared and the pharmacological activity of the basic derivatives is reported. The latter are characterized by the presence of a basic-alkyl group in the 2- or 5-position.

This paper describes a further study[3] of basic 1,3-dioxanes.

The bromo and iodo derivatives, listed in Table I, were used as intermediates for the preparation of the basic dioxanes (Table II). These intermediates (Table I) were obtained by the use of the azeotropic distillation method (A)[3] or by the alkoxy replacement process (B).



The 2-bromomethyl-1,3-dioxanes were aminated in the presence of sodium iodide or they were converted into the corresponding 2-iodomethyl derivatives and then aminated.

2,2-Diphenyl-5-methyl-5-iodomethyl-1,3-dioxane (I, R = CH_2I) was converted into the corresponding 5-cyanomethyl derivative which was hydrolyzed to the 5-carboxymethyl compound; esterification of the acid with β-diethylaminoethyl chloride[4] yielded the β-diethylaminoethyl ester (I, R = $CH_2COOCH_2CH_2N(C_2H_5)_2$). Reduction of the 5-cyanomethyl compound produced the 5-(β-aminoethyl) derivative (I, R = $CH_2CH_2NH_2$).

2,2-Diphenyl-5-methyl-5-hydroxymethyl-1,3-dioxane, in the form of its sodium derivative, reacted with β-dimethylaminoethyl chloride to yield the 5-(β-dimethylaminoethoxymethyl) derivative (I, R = $CH_2OCH_2CH_2N(CH_3)$); interaction with β-diethylaminoethyl chloride produced the corresponding diethylamino compound.

2,2-Diphenyl-5-methyl-5-nitro-1,3-dioxane was reduced to the corresponding 5-amino derivative which was methylated to form the 5-dimethylamino compound (I, R = $N(CH_3)_2$).

When 2,2-diphenyl-5-bromo-5-nitro-1,3-dioxane was hydrogenated, in the presence of platinum oxide catalyst, 2,2-diphenyl-5-amino-1,3-dioxane was obtained in very low yield.

The pharmacological data (Table II) were supplied by the research laboratories of the Wm. S. Merrell Company.

Experimental

The following compounds (Table I) were obtained by the azeotropic distillation method (A)[3] in the manner indicated: 2,2-pentamethylene-5-nitro-5-hydroxymethyl-1,3-dioxane (9) from cyclohexanone and trimethylolnitromethane; compounds 10, 11, 12 and 16 by interaction of benzophenone with 2-bromo-2-nitro-,13-propanediol,[5] 2-methyl-2-nitro-1,3-propanediol, 1,1,1-trimethylolethane and 2-ethyl-2-bromomethyl-1,3-propanediol, respectively.

The preparation of compounds listed in Table I, for which method B was used, is illustrated by the following example.

(1) This paper represents part of a dissertation submitted by E. L. Schumann in partial fulfillment of the requirements for the Ph.D. degree in the University of Michigan, 1949.

(2) The Wm. S. Merrell Company Fellow.

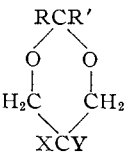
(3) F. F. Blicke and E. L. Schumann, THIS JOURNAL, **76**, 1226 (1954).

(4) The Horenstein and Pählicke procedure (*Ber.*, **71**, 1644 (1938)) was used.

(5) E. Schmidt and R. Wilkendorf, *ibid.*, **52**, 389 (1919).

TABLE I

1,3-DIOXANE INTERMEDIATES



Compounds 5, 7, 16 and 17 were recrystallized from methanol, 9 and 15 from dil. methanol, 10 and 11 from absolute ethanol, 8 and 13 from 95% ethanol, 12 from petroleum ether (90–100°) and 14 from toluene–petroleum ether (90–100°).

	Method	R	R'	X	Y	M.p. or b.p., °C.	Formula	Halogen, % Calcd.	Halogen, % Found	Yield, %
1	B	H	CH_2Br	CH_3	CH_2OH	128–129 (3 mm.)	$C_7H_{13}O_3Br$	35.51	34.91	82
2	..	H	CH_2I	CH_3	CH_2OH	142–144 (4 mm.)	$C_7H_{13}O_3I$	46.65	46.21	72
3	B	H	CH_2Br	C_2H_5	CH_2OH	137–139 (4 mm.)	$C_8H_{16}O_3Br$	33.42	33.29	81
4	B	H	CH_2Br	CH_3	CH_2Br	115–117 (3 mm.)	$C_7H_{12}O_2Br_2$	55.50	55.61	84
5	..	H	CH_2I	CH_3	CH_2I	79–80	$C_7H_{12}O_2I_2$	66.45	67.01	42
6	B	H	CH_2Br	C_2H_5	CH_2Br	126–129 (4 mm.)	$C_8H_{14}O_2Br_2$	52.92	53.13	88
7	B[a]	H	CH_2Br	C_6H_5	C_6H_5	93–94	$C_{17}H_{17}O_2Br$	23.98	24.22	84
8	..	H	CH_2I	C_6H_5	C_6H_5	103–104	$C_{17}H_{17}O_2I$	33.38	33.17	86
9	A	Pentamethylene		NO_2	CH_2OH	96–97 (dec.)	$C_{10}H_{17}O_5N$	...	...	50
10	A	C_6H_5	C_6H_5	Br	NO_2	138–139	$C_{16}H_{14}O_4NBr$	21.94	21.82	58
11	A	C_6H_5	C_6H_5	CH_3	NO_2	136–137	$C_{17}H_{17}O_4N$	...	...	51
12	A	C_6H_5	C_6H_5	CH_3	CH_2OH	103–104	$C_{18}H_{20}O_3$	...	[b]	82
13	..	C_6H_5	C_6H_5	CH_3	CH_2CN	84–85	$C_{19}H_{19}O_2N$	...	[c]	76
14	..	C_6H_5	C_6H_5	CH_3	CH_2COOH	155–156	$C_{19}H_{20}O_4$	...	[d]	47
15	..	C_6H_5	C_6H_5	CH_3	CH_2CONH_2	127–129	$C_{19}H_{21}O_3N$	...	[e]	..
16	A	C_6H_5	C_6H_5	C_2H_5	CH_2Br	69–70	$C_{19}H_{21}O_2Br$	22.12	22.10	70
17	..	C_6H_5	C_6H_5	C_2H_5	CH_2I	80–81	$C_{19}H_{21}O_2I$	31.09	30.67	57

[a] The preparation of the required 2,2-diphenyl-1,3-propanediol has been described by F. F. Blicke and H. Raffelson, THIS JOURNAL, **74**, 1730 (1952). [b] Calcd.: C, 76.03; H, 7.09. Found: C, 76.32; H, 7.22. The phenylurethan melted at 133–134° after recrystallization from petroleum ether (90–100°); *Anal.* Calcd. for $C_{25}H_{25}O_4N$: N, 3.47. Found: N, 3.57. [c] Calcd.: N, 4.78. Found: N, 4.68. [d] Calcd.: C, 73.06; H, 6.45; neut. equiv., 312.4. Found: C, 72.97; H, 6.60; neut. equiv., 314.3. [e] Calcd.: N, 4.50. Found: N, 4.23. [f] B.p. 165–167° (0.01 mm.).

2-Bromomethyl-5-methyl-5-hydroxymethyl-1,3-dioxane (1).—A mixture of 19.7 g. (0.1 mole) of bromoacetal[6] and 12.0 g. (0.1 mole) of 1,1,1-trimethylolethane[7] was heated in a small distillation flask in a bath maintained at 120–140° for 30 minutes. At the end of that time, 8.5 g. (92%) of ethanol had distilled from the mixture. The residue was then distilled.

It was necessary to vary the time of heating and the bath temperature somewhat for the preparation of other compounds.

2-Ethyl-2-bromomethyl-1,3-propanediol.—This diol was required for the preparation of compound 16 (Table I).

1,1,1-Trimethylolpropane[8] (53.6 g.) and 98 cc. of 66% aqueous hydrobromic acid were heated in a citrate bottle at 100° for 16 hours. Water and hydrobromic acid were removed under reduced pressure and the residue was fractionated; b.p. 126–128° (2.5 mm.). The solidified product was recrystallized from water; yield 37.6 g. (48%), m.p. 81–82°.

Anal. Calcd. for $C_6H_{13}O_2Br$: Br, 40.55. Found: Br, 41.16.

2,2-Diphenyl-5-methyl-5-cyanomethyl-1,3-dioxane (13).—Thirty grams of 2,2-diphenyl-5-methyl-5-iodomethyl-1,3-dioxane,[3] 36 g. of sodium cyanide and 375 cc. of 95% ethanol were heated in a citrate bottle at 100° for 3 days. After removal of the ethanol, the residue was triturated with water until the material became solid. The product was recrystallized from ethanol; yield 17.0 g.

2,2-Diphenyl-5-methyl-5-carboxymethyl-1,3-dioxane (14).—A mixture of 6 g. of the 5-cyanomethyl derivative, 2.3 g. of potassium hydroxide, 20 cc. of water and 40 cc. of ethanol was refluxed for 5 days. After distillation to dryness under reduced pressure, the residue was extracted with 100 cc. of hot water. The cooled aqueous extract was covered with 300 cc. of ether and stirred vigorously during the dropwise addition of 5% acetic acid. After a *p*H of 4–5 was reached, the ether layer was separated, dried over magnesium sulfate, filtered and the solvent removed. The residue was recrystallized from toluene–petroleum ether (90–100°); yield 2.9 g.

When the initial mixture was refluxed for only 1 day, the acid amide (15) was obtained.

2,2-Diphenyl-5-methyl-5-dimethylamino-1,3-dioxane (Table II, 11).—A solution of 10.0 g. of 2,2-diphenyl-5-methyl-5-amino-1,3-dioxane[9] in 60 cc. of chloroform was stirred with 120 cc. of 10% sodium carbonate solution during the dropwise addition of 9.3 g. of dimethyl sulfate. After the mixture had been stirred for 5 hours, the chloroform layer was separated and washed with water until it was neutral. Evaporation of the chloroform and recrystallization of the residue from methanol yielded 2.3 g. of product.

2,2-Diphenyl-5-amino-1,3-dioxane (Table II, 9).—A mixture of 3.6 g. of 2,2-diphenyl-5-bromo-5-nitro-1,3-dioxane (Table I, 10), 50 cc. of ethyl acetate, 100 cc. of absolute ethanol and 0.3 g. of platinum oxide catalyst was hydrogenated under an initial pressure of 50 pounds. The absorption of hydrogen stopped after 4 hours. The mixture was filtered, the solvent was removed from the filtrate and the residue was extracted with dry ether. When the extract was treated with hydrogen chloride, the hydrochloride precipitated in very small amount; m.p. 175–176° dec. after recrystallization from butanol–diisopropyl ether. The base obtained from the hydrochloride melted at 124–125°.

2,2-Diphenyl-5-methyl-5-(β-dimethylaminoethoxymethyl)-1,3-dioxane Hydrochloride (Table II, 14).—A mixture of 7 g. of 2,2-diphenyl-5-methyl-5-hydroxymethyl-1,3-dioxane (Table I, 12), 1.2 g. of sodium and 30 cc. of dry toluene was refluxed for 4 hours. The mixture was decanted from the excess sodium, treated with 2.7 g. of freshly distilled β-dimethylaminoethyl chloride and then refluxed for 4 hours. The mixture was extracted with water and the water was then removed from the aqueous extract. The residue was dissolved in ether and the solution was treated with ether which contained 0.025 mole of hydrogen chloride. The mixture was cooled in a refrigerator and the ether was decanted from the precipitate and replaced several times by

(6) S. M. McElvain and D. Kundiger, *Org. Syntheses*, **23**, 8 (1943).

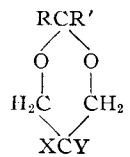
(7) Obtained from the Trojan Powder Company.

(8) Obtained from the Carbide and Carbon Chemicals Corporation.

(9) This compound is the base of compound 10 (Table II). It was prepared according to U. S. Patent 2,370,586.

TABLE II

BASIC 1,3-DIOXANES



Compounds 9, 11 and 12 were recrystallized from dil. methanol, 1 and 7 from 95% ethanol, 3 from absolute ethanol, 8 from ether, 5 and 6 from absolute ethanol–ether, 10 and 17 from absolute ethanol–diisopropyl ether, 14 from acetone–ether, 16 from butanol–diisopropyl ether, 13 from isopropyl alcohol–diisopropyl ether and 15 from toluene–petroleum ether (90–100°).

	R	R'	X	Y	M.p., °C.	Yield, %	Formula	Nitrogen, % Calcd.	Nitrogen, % Found	Halogen, % Calcd.	Halogen, % Found	Minimal effective concentration— Isolated rabbit jejunum Acetylcholine spasm 1:1,000,000	Minimal effective concentration— Isolated rabbit jejunum Barium chloride spasm 1:10,000	Minimal effective concentration— Isolated guinea pig intestine, histamine spasm 0.1 μg./cc.
1	H	$CH_2N(CH_3)_3I$	CH_3	$CH_2N(CH_3)_3I$[a]	250–251	61B[b]	$C_{13}H_{30}O_2N_2I_2$	5.60	5.52	50.74	50.34	[c]	[c]	>10
2	H	$CH_2N(CH_3)_2$	C_2H_5	CH_2OH	[d]	37A	$C_{10}H_{21}O_3N$	6.89	6.91	...	...	[e]	[e]	>10
3	H	$CH_2N(CH_3)_3I$	C_2H_5	CH_2OH	196–198	50C	$C_{11}H_{24}O_3NI$	...	...	36.76	37.09	>10,000	>10,000	>10
4	H	$CH_2N(CH_3)_2$	C_2H_5	$CH_2N(CH_3)_2$	[f]	62A	$C_{12}H_{26}O_2N_2$	12.16	11.80	...	...	.....	.....	>10
5	H	$CH_2N(CH_3)_3I$	C_2H_5	$CH_2N(CH_3)_3I$	229–230 d.	49A	$C_{14}H_{32}O_2N_2I_2$	5.45	5.31	49.36	48.99	[c]	[c]	>10
6	H	$CH_2N(CH_3)_2$·HCl	C_6H_5	C_6H_5	180–181	58B	$C_{19}H_{24}O_2NCl$	4.20	4.06	10.62	10.46	10,000	100,000	>10
7	H	$CH_2N(CH_3)_3I$	C_6H_5	C_6H_5	245–246 d.	64C	$C_{20}H_{26}O_2NI$	3.19	3.22	28.89	28.55	10,000	10,000	>10
8	Pentamethylene		CH_2OH	NH_2	95–96	46H	$C_{10}H_{19}O_3N$	6.96	6.96	...	...	>10,000	>10,000	>10
9	C_6H_5	C_6H_5	H	NH_2	124–125	...	$C_{16}H_{17}O_2N$	5.49	5.35	...	...	.....	.....	.....
10	C_6H_5	C_6H_5	CH_3	NH_2·HCl	207–208 d.	94C	$C_{17}H_{20}O_2NCl$	4.58	4.38	11.59	11.41	200,000	200,000	2
11	C_6H_5	C_6H_5	CH_3	$N(CH_3)_2$	109–110	20F	$C_{19}H_{23}O_2N$	4.71	4.63	...	...	500,000	200,000	.....
12	C_6H_5	C_6H_5	C_2H_5	$CH_2N(C_2H_5)_2$	67–68	...	$C_{23}H_{31}O_2N$	3.96	3.84	...	...	.....	.....	.....
13	C_6H_5	C_6H_5	C_2H_5	$CH_2N(C_2H_5)_2$·HCl	206–207	23A	$C_{23}H_{32}O_2NCl$	3.59	3.54	9.09	8.78	50,000	100,000	>10
14	C_6H_5	C_6H_5	CH_3	$CH_2OCH_2CH_2N(CH_3)_2$·HCl[g]	136–139	18D	$C_{22}H_{30}O_3NCl$	3.57	3.67	9.05	8.86	100,000	100,000	10
15	C_6H_5	C_6H_5	CH_3	$CH_2OCH_2CH_2N(C_2H_5)_2$·HCl[g]	90–93	17D	$C_{24}H_{34}O_3NCl$	3.34	3.55	8.44	8.63	100,000	200,000	5
16	C_6H_5	C_6H_5	CH_3	$CH_2COOCH_2CH_2N(C_2H_5)_2$·HCl[g]	112–113	47E	$C_{25}H_{34}O_4NCl$	3.13	3.10	7.92	8.07	10,000	100,000	5
17	C_6H_5	C_6H_5	CH_3	$CH_2CH_2NH_2$·HCl	187–188	76G	$C_{19}H_{24}O_2NCl$	4.20	4.02	10.62	10.41	200,006	100,000	10
	Atropine											80,000,000	200,000	
	Papaverine											100,000	100,000	
	Benadryl													0.02

[a] B.p. of base, 89–91° (5 mm.). [b] The letter indicates the intermediate on which the yield was based: A, the bromide; B, the iodide; C, the amine base; D, the alcohol; E, the acid; F, the corresponding primary amine; G, the nitrile; H, the nitro derivative. [c] Produces spasm at 1:10,000. [d] B.p. 140–143° (4 mm.). [e] Produces spasm at 1:1,000,000. [f] B.p. 101–104° (3 mm.) [g] Hygroscopic.

dry ether. After 3 days the hygroscopic, crystalline material was purified from dry acetone–ether; yield 1.7 g. (18%).

The corresponding β-diethylaminoethyl ether (Table II, 15) was prepared in the same manner. Hot toluene was added to the crude hydrochloride, the toluene solution was decanted from an insoluble oil and the product was precipitated by the addition of petroleum ether (90–100°). The precipitated oily hydrochloride crystallized from refrigeration under dry ether.

2,2-Diphenyl-5-methyl-5-(β-aminoethyl)-1,3-dioxane Hydrochloride (Table II, 17).—A solution of 6.0 g. of 2,2-diphenyl-5-methyl-5-cyanomethyl-1,3-dioxane in 100 cc. of ether was added, dropwise, to a stirred mixture of 0.78 g. of lithium aluminum hydride in 50 cc. of ether. The mixture was refluxed for 1 hour, then carefully treated with 50 cc. of 10% aqueous sodium hydroxide solution. After separation of the ether layer, the water layer was extracted with ether. The addition of a small amount of ethanol helped to break the emulsion. The ether solution was dried over magnesium sulfate and the solvent was removed. An ethereal solution of the residue was treated with the calculated amount of ethereal hydrogen chloride and then placed in a refrigerator. The precipitated salt was recrystallized from absolute ethanol–diisopropyl ether; yield 5.2 g. (76%).

ANN ARBOR, MICH.

[CONTRIBUTION FROM THE COLLEGE OF PHARMACY, UNIVERSITY OF MICHIGAN]

Antispasmodics. XV. β-Diethylaminoethyl Esters of β,β-Diphenylglycidic, β,β-Diphenyllactic and β,β-Diphenylglyceric Acids

BY F. F. BLICKE AND J. A. FAUST[1,2]

RECEIVED NOVEMBER 25, 1953

It was found that the product obtained from ethyl chloroacetate, benzophenone and sodium ethylate, by the Darzens glycidic ester condensation, was a mixture of ethyl β,β-diphenylglycidate and ethyl diphenylpyruvate. The glycidate was rearranged by heat and acid to the pyruvate. Pure β,β-diphenylglycidic acid was isolated for the first time and converted, by heat, into diphenylacetaldehyde. The preparation of the β-diethylaminoethyl esters of β,β-diphenylglycidic, β,β-diphenyllactic and β,β-diphenylglyceric acids has been described.

Since many basic alkyl esters of diarylhydroxyacetic acids are highly active antispasmodics, it seemed desirable to study basic esters of diphenylhydroxypropionic (β,β-diphenyllactic), diphenyldihydroxypropionic (β,β-diphenylglyceric) and diphenylepoxypropionic (β,β-diphenylglycidic) acids.[3]

β,β-Diphenyllactic acid can be obtained conveniently from diphenylglycidic acid. The only method reported in the literature for the preparation of β,β-diphenylglycidic acid, in the form of its ethyl ester, is the Darzens glycidic ester condensation, but the statements with respect to this ester are confusing and contradictory.

All investigators[4–8] who condensed benzophenone with ethyl chloroacetate, in the presence of a condensation agent, agreed that ethyl β,β-diphenylglycidate was produced. Pointet,[4] as well as Rutowski and Dajew,[6] distilled the crude ester and stated that, after solidification and recrystallization, the glycidate melted at 47°. Troell,[5] Kohler, Richtmyer and Hester[7] and Berger[8] claimed that during attempted purification of the ester by distillation, it rearranged to the isomeric ethyl diphenylpyruvate. The pyruvate was described by Troell and by Berger as an oil but Kohler, *et al.*, obtained it as a solid which melted at 37°.

We found that distillation of the crude reaction product from the Darzens condensation yielded a mixture which consisted mainly of the glycidic ester (m.p. 48–49°) and a small amount of the pyruvate (m.p. 37°), and that these esters, which do not differ greatly in their boiling points, could be separated by recrystallization. The pure glycidic ester does not undergo rearrangement during distillation. However, when the ester was heated in the presence of hydrogen chloride or acetic acid, it rearranged, quantitatively, into the pyruvic ester. In fact, this procedure represents the best process for the preparation of the pyruvate. It was found that methyl β,β-diphenylglycidate and β,β-diphenylglycidamide also rearranged, under the same conditions, into methyl diphenylpyruvate and diphenylpyruvamide, respectively.

When Pointet hydrolyzed the ester (m.p. 47°), which he considered to be ethyl diphenylglycidate, he obtained an acid which, when heated, was transformed into diphenylacetic acid. He did not report the melting point of his initial acid, but if it had been β,β-diphenylglycidic acid it should have been converted, by heat, into diphenylacetaldehyde. Rutowski and Dajow stated that hydrolysis of their ethyl β,β-diphenylglycidate (m.p. 47°) yielded β,β-diphenylglycidic acid which melted at 114–115°.

After hydrolysis of ethyl β,β-diphenylglycidate (I, m.p. 48–49°), we obtained an acid (II) which melted at 71° dec., and which was converted by heat into diphenylacetaldehyde (III). We believe that this acid was the true β,β-diphenylglycidic acid which had not been isolated hitherto. In agreement with other investigators,[5,7] we found that hydrolysis of ethyl diphenylpyruvate yielded an acid, diphenylpyruvic acid, which melted at 116–117°.

The glycidic acid II was converted into the β-diethylaminoethyl ester IV by the Horenstein and Pählicke procedure.[9] The basic ester IV was also

(1) This paper represents part of a dissertation submitted by J. A. Faust in partial fulfillment of the requirements for the Ph.D. degree in the University of Michigan, 1949.

(2) We are indebted to the Sterling-Winthrop Research Institute for support during this investigation.

(3) Only a few basic esters of these acids have been mentioned in the literature. F. F. Blicke and H. M. Kaplan, THIS JOURNAL, **65**, 1967 (1943), described basic esters of β,β-diphenyl-β-hydroxypropionic acid but no mention was made of possible antispasmodic properties. Basic esters of glycidic acids have not been prepared hitherto.

(4) R. Pointet, *Compt. rend.*, **148**, 417 (1909).

(5) E. Troell, *Ber.*, **61**, 2497 (1928).

(6) B. N. Rutowski and N. A. Dajew, *ibid.*, **64**, 693 (1931).

(7) E. P. Kohler, N. K. Richtmyer and W. F. Hester, THIS JOURNAL, **53**, 205 (1931).

(8) H. Berger, *J. prakt. Chem.*, [2] **152**, 267 (1939).

(9) H. Horenstein and H. Pählicke, *Ber.*, **71**, 1654 (1938).