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COMMUNICATION 9.* SYNTHESIS OF R-α-L-PHOSPHATIDYL-γ-L-ALANYLGLYCEROL AND COMPARISON OF THE SYNTHETIC O-ALANYL ESTERS OF PHOSPHATIDYLGLYCEROL WITH THE NATURAL LIPOAMINO ACID FROM Clostridium Welchii

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In a preceding paper [1] we have reported the synthesis of S-α-L-phosphatidyl-γ-L-alanylglycerol (I). In the present paper we report the synthesis of the R-epimer of (I), (II), (for previous communications, see [2, 3]) and the results obtained in a comparison of compounds (I) and (II) with a natural lipoamino acid isolated from Clostridium Welchii.

The present synthesis (see scheme 1), like the synthesis of the S-isomer (I) [1], was based on the condensation of silver benzyl 1,2-distearoylglyceryl phosphate (X) with the iodide (IX). The latter was obtained from the R-3-O-tritylglycerol (V) previously synthesized by us [4] by successive carbodiimide esterification of (V) with N-carbobenzoxy-L-alanine, benzylation of the secondary hydroxy group, detritylation on silica gel (cf. [5, 6]), tosylation, and conversion of the tosylate into the iodide (V → VI → VII → VIII → IX, see scheme 1).

The iodide (IX) was also synthesized by a shorter route from S-1-O-trityl-2-O-benzylglycerol (XII) [1], which was converted via the corresponding tosylate into glycerol R-1-O-trityl-2-O-benzyl-3-iodohydrin (XIII). Detritylation of the latter with sulfuric acid in dioxane and subsequent carbodiimide esterification with N-carbobenzoxy-L-alanine led to the iodide (IX) (see scheme 1). Condensation of the iodide (IX) with the silver salt (X) gave a phosphatidylglycerol derivative (XI), which, on hydrolysis, furnished R-1-(1',2'-distearoylglycerylphosphoryl)-3-(L-alanyl)-glycerol (II) in the form of a microcrystalline substance with a diffuse melting point.

We have also tried another route for the synthesis of the latter compound starting from R-3-tosylglycerol (XV) [7] (see scheme 2). Esterification of the latter with N-carbobenzoxy-L-alanine and subsequent reaction of the tosylate (XVI) with NaI in acetone gave R-1-(N-carbobenzoxy-L-alanyl)-3-iodohydrin (XVII) the structure of which was confirmed by the formation of the epoxide (XIX) when (XVII) was treated with silver oxide in absolute benzene at room temperature. Under the action of benzoxycarbonyl chloride and pyridine in ether, the iodohydrin (XVII) gave the dicarbobenzoxy derivative (XVIII). The reaction of the latter with the silver salt (X) led to a derivative of the desired R-lipoamino acid (XX), which was obtained with a yield of only 8%. However, the main reaction products proved to be the dibenzyl ether of 1,2-distearoylglycerylphosphoric acid (XXI) and R-1-(N-carbobenzoxy-L-alanyl)-2,3-O-carbonylglycerol (XXII) (cf. [8]). Hydrogenolysis of the three protective groups of the phosphoric triester (XX) gave a substance identical with the R-lipoamino acid (II) synthesized in accordance with scheme 1.

For a direct comparison of the synthetic lipoamino acids with the natural substance, we isolated the lipoamino acid from Clostridium Welchii by Macfarlane's method [9]. The lipoamino acid fraction having the maximum R_f value (the so-called fraction C [9]) was isolated in the form of a yellow wax. A fatty acid analysis showed the predominance in this fraction of saturated fatty acids mainly stearic and lauric acids. Among the amino acids, according to paper chromatography of a hydrolyzate, alanine predominated; a small amount of glycine was also detected. Some constants of the natural and synthetic lipoamino acid are given in Table 1 (see scheme on following page).

As will be seen from the results given in Table 1, all three samples possess a positive specific rotation, the activity of the synthetic R-epimer (II) being closer to that of the natural substance than that of

* For communication 8, see [1].

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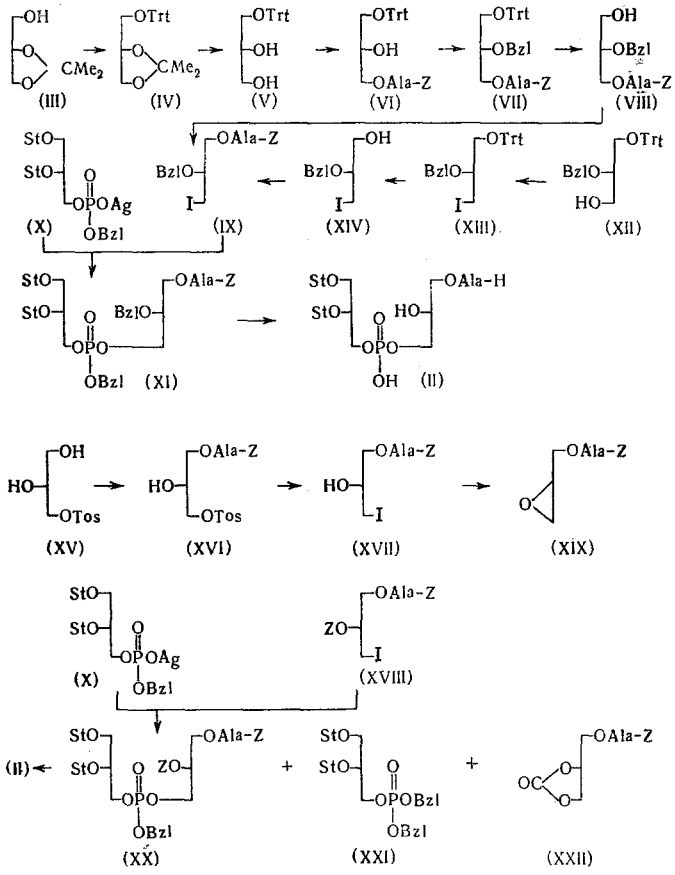

the S-compound (I). It must be mentioned that the natural lipoamino acid is not an individual substance; it probably contains small amounts of substances having a pronounced effect on the angle of rotation. However the synthetic S-isomer (I) is closest in chromatographic behavior to the natural lipoamino acid while the R-compound (II) differs substantially from the natural material.

A comparison of the chemical behaviors of the synthetic natural and lipoamino acids is also instructive. They are all unstable substances undergoing changes on storage. Both the S-isomer (I) and the natural lipoamino acid are converted into more polar substances with almost identical R_f values, while the R-epimer (II) gives a complex mixture of substances among which phosphatidic acid and alanine have been identified.*

Thus, a direct comparison of the synthetic compounds (I) and (II) with the natural lipoamino acid isolated from Clostridium Welchii leads to the conclusion that in the latter the glycerophosphate residue bearing the amino acid has the S-configuration. This conclusion is in full agreement with the structure proposed by Houtsmuller and van Deenen [10] for a lysine-containing lipoamino acid from Staph. aureus. The question of the position of the amino acid residue in the glycerol chain still remains unresolved. However, the almost identical chromatographic properties of the synthetic S-compound (I) and the natural lipoamino acid indicates that the structure with a free secondary hydroxy group is more probable.

EXPERIMENTAL

General information on the performance of the experiments is given in the previous paper [1].

* Hydrogenolysis of the protective groups of the phosphoric triesters (XI) and (XX) led to a substance for which elementary analysis gave low values of the carbon content. Since we have observed partial decomposition of the lipoamino acids not only on storage in the presence of hydrogen but on prolonged hydrogenolysis, the possibility cannot be completely excluded that the product of the hydrogenolysis of the tertiary phosphates (XI) and (XX) is not the R-lipoamino acid (II) but some product of its secondary transformation. But since the IR spectrum of this substance is almost completely identical with the spectrum of S-isomer (I) we assume that it is in fact the R-lipoamino acid (II).

TABLE 1. Optical Activity of the Lipoamino Acids and Their R_f Values in Thin-Layer Chromatography (TLC) on Silica Gel

Lipoamino acid	$[\alpha]_D$ in chloroform	R_f in the system	
		$CHCl_3$—CH_3OH—water, 65 : 25 : 3	diisobutyl ketone CH_3COOH—water, 40 : 25 : 5
Natural ("fraction C" from Clostridium Welchii [9])	+0.3° (C 1)	0.53	0.36
Synthetic			
S-epimer (I)	+7.8° (C 1.5)	0.56	0.35
R-epimer (II)	+1.6° (C 0.7)		
	+2.9° (C 2.9)	0.31	0.31
Product of the transformation of the natural lipoamino acid	—	0.37	0.28
Product of the transformation of the S-epimer	+7.4° (C 2.3)	0.34	0.31

R-1,2-O-Isopropylidene-3-O-tritylglycerol (IV). With stirring, 33.5 g of chlorotriphenylmethane was added to a solution of 13.5 g of D(S)-1,2-O-isopropylideneglycerol (III) [11] in 17 ml of pyridine and then the mixture was stirred for another 40 min and was left for 2 days at room temperature. Then it was diluted with 250 ml of ether and the precipitate of pyridine hydrochloride that deposited was separated off and washed with ether (2 × 30 ml). The combined filtrates were washed successively with 5% HCl cooled to 0°, water, saturated aqueous $NaHCO_3$, water, and brine, and were dried over Na_2SO_4. The drying agent was filtered off with suction and washed with ether, and the solvent was distilled off in vacuum. This gave 41 g of a viscous oil which was used further without purification. One gram of this oil was chromatographed on 50 g of alumina; benzene eluted 0.53 g of (IV) in the form of an oil which crystallized on standing. After recrystallization from petroleum ether, mp 89-90°; $[\alpha]_D^{20}$ +15.5° (C 8.4). Found %: C 80.22; H 6.99. $C_{25}H_{26}O_3$. Calculated %: C 80.18; H 7.00.

R-3-O-Tritylglycerol (V). A solution of 40 g of trichloroacetic acid in 50 ml of water was added to a solution of 40 g of unpurified (IV) in 400 ml of dioxane and then water was added until a slight turbidity appeared (~30 ml) and the mixture was left for 4 days at room temperature. Then, with stirring, saturated aqueous $NaHCO_3$ to pH 8, 200 ml of water, and 330 ml of ether were added successively. The upper layer was separated off, washed with brine (2 × 150 ml) and dried over Na_2SO_4. The residue obtained after filtration and evaporation of the solution was chromatographed on 1.7 kg of alumina; benzene and a mixture of benzene with 5% of ether eluted 15 g of a mixture of (IV) and triphenyl carbinol. Then mixtures of benzene and chloroform (9 : 1-3 : 1) eluted triphenyl carbinol, and chloroform containing 5% of methanol eluted 3.2 g of (V). The mixture of (IV) and triphenyl was rehydrolyzed under the conditions given above. Chromatography yielded 4.6 g of (IV) and 2.09 g of (V). The total yield of (V) and 31%, mp 95.5-96° (from chloroform—petroleum ether); $[\alpha]_D^{20}$ +9.5° (C 5.6). Found %: C 78.60; H 6.65. $C_{22}H_{22}O_3$. Calculated %: C 79.01; H 6.63.

S-1-(N-Carbobenzoxy-L-alanyl)-3-O-tritylglycerol (VI). With ice cooling and stirring, a solution of 0.43 g of dicyclohexylcarbodiimide in 3 ml of pyridine was added over 30 min to a solution of 0.7 g of (V) and 0.56 g of N-carbobenzoxy-L-alanine in 5 ml of pyridine. The mixture was left for 6 h at 0° and for 3 days at room temperature and was then diluted with 30 ml of benzene, after which the precipitate was filtered off with suction and washed with 5 ml of benzene, and the solvent was evaporated in vacuum. The residue was chromatographed on 130 g of KSK silica gel (eluates monitored by TLC; benzene—ethyl acetate, 3 : 1, system, revealing agent B), the column being washed successively with benzene and with benzene containing 5-10% of ethyl acetate; benzene containing 10-15% of ethyl acetate eluted 0.80 g of an oil which crystallized on standing. After recrystallization from a mixture of ether and petroleum ether, 0.60 g (53)% of (VI) was obtained with mp 120-121°; $[\alpha]_D^{19}$ − 5.05° (C 6.9). Found %: C 73.30; H 6.21; N 2.32. $C_{33}H_{33}NO_6$. Calculated %: C 73.45; H 6.16; N 2.60.

S-1-(N-Carbobenzoxy-L-alanine)-2-O-benzyl-3-O-tritylglycerol (VII). A solution of 100 mg of (VI) and 0.1 ml of benzyl bromide in 3 ml of benzene was stirred with 0.5 g of dry freshly-prepared silver oxide at room temperature for 2 h. The mixture was filtered, the residue was washed with ethyl acetate, the filtrate was evaporated, and the residue was chromatographed on 20 g of KSK silica gel (eluates monitored by TLC on silica gel; benzene—ether, 5 : 1, system; revealing agent B). A 9 : 1 mixture of benzene and ether eluted 103 mg (88%) of (VII) (oil); $[\alpha]_D^{19}$ −4.3° (C 5). Found %: C 76.46; H 6.50; N 2.23. $C_{40}H_{39}NO_6$. Calculated %: C 76.29; H 6.24; N 2.22.

S-1-(N-Carbobenzoxy-L-alanyl)-2-O-benzylglycerol (VIII). The unpurified (VII) obtained from 0.67 g of (VI) was dissolved in 10 ml of benzene and transferred to a column of 50 g of silica gel [12] activated at 150°, the column then being washed with 20 ml of benzene and left at room temperature for 10 h. Then elution was begun, the composition of the eluates being monitored by TLC (benzene—ethyl acetate, 3 : 1, system; revealing agent B). Benzene eluted triphenylcarbinol, benzene containing 5-10% of ether eluted a mixture of triphenyl carbinol and unchanged (VII), and mixtures of benzene—ether, 1 : 1-1 : 4, eluted 230 mg of oily (VIII); $[\alpha]_D^{20}$ −8.3° (C 7.1). Found %: C 64.81; H 6.72; N 3.39. $C_{21}H_{25}NO_6$. Calculated %: C 65.10; H 6.50; N 3.62.

Glycerol R-1-O-Trityl-2-O-benzyl-3-iodohydrin (XIII). With stirring and ice cooling, 0.76 g of p-toluenesulfonyl chloride was added over 10 min to a solution of 1.1 g of S-1-O-trityl-2-O-benzylglycerol (XII) [1] in 1 ml of pyridine and 5 ml of ether, and then the mixture was left for 5 h with cooling and for 2 days at room temperature. The mixture was diluted with 50 ml of ether and washed successively with water (3 × 20 ml), 2% HCl cooled to 0°, water again, and brine, and was then dried over Na_2SO_4 and evaporated. A solution of the residue in 20 ml of acetone was treated with 1 g of dry NaI and kept in a sealed tube at 75° for 10 h. The cooled mixture was diluted with 100 ml of benzene, washed with 1% $Na_2S_2O_3$, water, and brine, dried with Na_2SO_4, and evaporated. This gave 1.3 g of unpurified (XIII), 155 mg of which was chromatographed on 15 g of KSK silica gel (with monitoring by TLC on silica gel; benzene—ether, 9 : 1, system; revealing agent B): a mixture of benzene and 5% of ether eluted 97 mg of a colorless oil (yield 57%); $[\alpha]_D^{20}$ −8.8° (C 5.6). Found %: C 65.33; H 5.17; I 23.40. $C_{29}H_{27}IO_2$. Calculated %: C 65.17; H 5.08; I 23.75.

Glycerol R-2-O-Benzyl-3-iodohydrin (XIV). A solution of 1.12 g of unpurified (XIII) in 50 ml of dioxane was treated with 5 ml of 10% H_2SO_4 and the mixture was left at 65° for 4 h. The cooled mixture was diluted with 200 ml of ether, washed with water, saturated aqueous $NaHCO_3$, water, and brine, dried over $MgSO_4$, and evaporated in vacuum. The residue was chromatographed on a column of 100 g of KSK silica gel (monitoring by TLC on silica gel; benzene—ether acetate 6 : 1, system; revealing agent B): benzene containing 5-10% of ether eluted triphenyl carbinol, and benzene containing 20-30% of ether eluted 415 mg of a yellowish oil which rapidly darkened in the light, $[\alpha]_D^{23}$ +4.9° (C 7). IR spectrum (film), cm^{-1}: 3340 s, broad; 1500 m; 1460 s; 1390 s; 1322 m; 742 s; 697 s. Found %: C 41.66; H 4.88; I 42.72. $C_{10}H_{13}IO_2$. Calculated %: C 41.20; H 4.48; I 43.39.

Glycerol R-1-(N-Carboxybenzoxy-L-alanyl)-2-O-benzyl-3-iodohydrin (IX). A. One hundred and twenty milligrams of (VIII) was tosylated, and the unpurified tosylate was converted into the iodide (compare the synthesis of (XIII). The yield of (IX) was 68%, mp 79.5-81° (from ether—petroleum ether); $[\alpha]_D^{20}$ −11° (C 7.3). Found %: C 51.00; H 5.10; I 27.70; N 2.94. $C_{21}H_{24}INO_5$. Calculated %: C 50.70; H 4.86; I 25.52; N 2.81.

B. One hundred and ten milligrams of (XIV) was esterified with N-carbobenzoxy-L-alanine (150 mg) under the conditions described for the synthesis of (VI). The reaction product was chromatographed on 40 g of KSK silica gel, and benzene containing 15-20% of ether eluted 160 mg of an oil which crystallized on standing. After recrystallization from ether—petroleum ether, 129 mg (69%) of the iodide (IX) with mp 79-80.5°, $[\alpha]_D^{20}$ −10.7° (C 3.6), was obtained. The samples of (IX) obtained by methods A and B gave no depression of the melting point when mixed.

R-1-(N-Carbobenzoxy-L-alanyl)-3-tosylglycerol (XVI). 4.2 g of 3-tosylglycerol [8] was esterified with 3.7 g of N-carbobenzoxy-L-alanine (compare synthesis of VI). The reaction product was chromatographed on a column of 600 g of silica using gradient elution with the benzene — mixture of benzene and ethyl acetate (1 : 2) system (monitoring by TLC; benzene—ethyl acetate, 2 : 1, system; revealing agent B). A mixture of benzene with 25-30% of ethyl acetate eluted 3.9 g of the tosylate (XVI) in the form of a colorless oil which crystallized on standing. After recrystallization from a mixture of ether and hexane, the yield was 3.18 g (42.5%), mp 82-87°. After two further crystallizations from ether, mp 89-90°; $[\alpha]_D^{20}$

−18.7° (C 4.6). Found %: C 56.01; H 5.52; N 3.14; S 6.91. $C_{21}H_{25}NO_6S$. Calculated %: C 55.87; H 5.58; N 3.10; S 7.10.

Glycerol R-1-(N-Carbobenzoxy-L-alanyl)-3-iodohydrin (XVII). The tosylate (XVI) (2.65 g) was treated with NaI in acetone (compare the synthesis of XIII). Crystallization of the reaction product from a mixture of ether and hexane gave 2.16 g (90%) of (XVII), mp 65-66°; $[\alpha]_D^{21}$ −10.1° (C 3.8). IR spectrum (in paraffin oil), cm^{-1}: 3310 s; 1739 s; 1685 s; 1544 s. Found %: C 41.84; H 4.75; I 31.73. $C_{14}H_{18}INO_5$. Calculated %: C 41.29; H 4.46; I 31.17.

S-2,3-Epoxypropyl Ester of N-Carbobenzoxy-L-alanine (XIX). A solution of 100 mg of (XVII) in 5 ml of absolute benzene was stirred at room temperature for 5 h with 1 g of dry silver oxide, and then the mixture was filtered, the residue was washed with ether, and the combined filtrates were evaporated. Chromatography of the residue on 5 g of KSK silica gel gave (by ether elution) 60 mg of (XIX) in the form of a colorless oil; $[\alpha]_D^{19}$ −2.3° (C 3.9). IR spectrum (in the form of a film), cm^{-1}: 3360 s; 1750-1710 v.s; 1539 s; 1260 s; 1215 s; 1072 s. Found %: C 60.13; H 6.25; N 4.84. $C_{14}H_{17}NO_5$. Calculated %: C 60.20; H 6.14; N 5.02.

Glycerol R-1-(N-Carbobenzoxy-L-alanyl)-2-O-carbobenzoxy-3-iodohydrin (XVIII). A solution of 3.4 g of benzoxycarbonyl chloride in 20 ml of ether was added over 1.5 h to a solution of 2.05 g of (XVII) and 4 ml of pyridine in 80 ml of absolute ether cooled to −50°. The mixture was kept at −50° for 1 h and without cooling for 1 h and was then washed with water and brine, dried over Na_2SO_4, and evaporated in vacuum. The residue was chromatographed on a column of 200 g of KSK silica gel (monitoring with TLC; benzene—ethyl acetate, 2:1, system; revealing agent B), and benzene containing 0.5% of ethyl acetate eluted impurities of low polarity. A mixture of benzene with 5-10% of ethyl acetate eluted 945 mg of (XVIII) in the form of a yellow oil $[\alpha]_D^{14}$ −13.0° (C 3.4). IR spectrum (in the form of a film), cm^{-1}: 3340 s, broad; 1752 v.s; shoulder 1728; 1527 s. Found %: C 48.83; H 4.64; I 23.16; N 2.59. $C_{22}H_{24}NO_7$. Calculated %: C 48.81; H 4.47; I 23.44; N 2.59. A mixture of benzene and 20-25% of ethyl acetate eluted 1.1 g of unchanged (XVII); mp 64-66°. The yield of (XVIII) was 34% (75% calculated on the (XVII) that had reacted); the yield was not improved when the excess of benzoxycarbonyl chloride was increased or when the reaction time was lengthened.

R-1-(N-Carbobenzoxy-L-alanyl)-2-O-benzyl-3-[(1',2'-distearoylglyceryl) benzyl phosphoryl]glycerol (XI). A mixture of 102 ml of (IX), 195 mg of the silver salt of (X) [1], and 5 ml of benzene was boiled with vigorous stirring in the dark in an atmosphere of argon for 5 h. The precipitate of AgI was filtered off with suction and washed with ether, the filtrate was evaporated, and the residue was chromatographed on 40 g of KSK silica gel (monitoring by GLC; benzene—ethyl acetate, 4:1, system; revealing agent C). Benzene containing 15-20% of ethyl acetate eluted 150 mg (63%) of the triester (XI) in the form of a waxy substance. After crystallization from acetone, mp 36-38°; $[\alpha]_D^{19}$ +0.3° (C 10). IR spectrum (in the form of a film), cm^{-1}: 3330 s, broad; 3070 m; 3040 m; 2930 s; 2870 s; 1740 v.s; shoulder 1700; 1540 s, broad; 1475 s; 1240 s, broad. Found %: C 69.41; H 8.92; N 1.21; P 2.86. $C_{67}H_{106} \cdot NO_{13}P$. Calculated %: C 69.10; H 9.18; N 1.20; P 2.66.

R-1-(N-Carbobenzoxy-L-alanyl)-2-O-carbobenzoxy-3-[(1',2'-distearoyl-glyceryl) benzyl phosphoryl]glycerol (XX). A mixture of 520 mg of (XVIII), 1 g of (X) and 20 ml of toluene was boiled in the dark in an atmosphere of argon for 7 h. The precipitate was filtered off with suction and washed with ethyl acetate, and the solvent was distilled off in vacuum. The residue, from the results of TLC on silica gel (benzene—ethyl acetate, 3:1, system; revealing agents B and C) contained a complex mixture the main components of which had R_f 0.70, 0.41, and 0.24. The mixture was chromatographed on a column of 120 g of KSK silica gel. Chloroform and a mixture of chloroform with 5% of ethyl acetate eluted 595 mg of (XXI) in the form of a colorless powder with mp 58-58.5° (from ether—petroleum ether); $[\alpha]_D^{15}$ +2.5° (C 6.3).

A mixture of chloroform with 5-10% of ethyl acetate eluted 130 mg of an oily mixture of substances, and a mixture of chloroform with 15-20% of ethyl acetate eluted 90 mg of waxy (XX), mp 38-39° (from ether—methanol); $[\alpha]_D^{20}$ −3.9° (C 9). Found %: C 67.41; H 9.13; N 1.18; P 2.43. $C_{68}H_{106}NO_{15}P$. Calculated %: C 67.58; H 8.84; N 1.15; P 2.57.

A mixture of chloroform with 20-25% of ethyl acetate eluted 30 mg of a waxy mixture of substances, and then a mixture of chloroform with 25-30% of ethyl acetate eluted 220 mg of the carbonate (XXII) in the form of leaflets with mp 69-70° (from chloroform—petroleum ether); $[\alpha]_D^{17}$ −23.4 (C 7.6). IR spectrum in

paraffin oil, cm^{-1}: 3345 s; 1790 s; 1754 s; 1696 s; 1590 w; 1543 s. Found %: C 56.08; H 5.48; N 4.42. $C_{15} \cdot H_{17}NO_7$. Calculated %: C 55.72; H 5.30; N 4.33.

A mixture of chloroform with 10% of methanol eluted 290 mg of a mixture of polar substances the main component of which was phosphatidic acid, which was identified by comparison with an authentic sample by means of TLC on silica gel (chloroform—methanol—water, 65 : 25 : 3 system; revealing agent C).

R-1-(1,2-Distearoylglycerylphosphoryl)-3-L-alanylglycerol (II). Forty milligrams of (XX) was hydrogenated over 20 mg of Pd-black in 5 ml of ethyl acetate in the presence of 0.2 ml of glacial acetic acid for 5 h. The catalyst was filtered off with suction and washed with a 2 : 1 mixture of chloroform and methanol. The filtrate was evaporated, and the residue was crystallized from a mixture of chloroform and acetone. This gave 20 mg (68%) of a chromatographically individual colorless powder. The substance softened at 80° and melted partially at ~95° and completely at 175-178°; $[\alpha]_D^{18}$ +1.6° (C 0.7; chloroform). IR spectrum (tablet with KBr), cm^{-1}: 3400 s, broad; 1750 s; 1472 m; 1220 s; 1100 m; 1070 s; 965 m. Found %: N 1.39; P 3.82. $C_{45}H_{88}NO_{11}P$. Calculated %: N 1.65; P 3.65.

One hundred and ten milligrams of the triester (XI) was hydrogenated over 100 mg of previously reduced 5% $PdO/BaSO_4$ [13] in 5 ml of dioxane for 2 h. This gave 60 mg (75%) of (II). In respect to its melting point, IR spectrum, and chromatographic behavior, the substance did not differ from the sample obtained in the preceding experiment; $[\alpha]_D^{20}$ +2.9° (C 2.1; chloroform). Found %: C 61.40; H 10.51; N 1.62; P 3.68.

CONCLUSIONS

1. The complete synthesis of R-α-L-phosphatidyl-γ-L-alanylglycerol has been carried out.

2. In its chromatographic and chemical properties, the lipoamino acid isolated from Clostridium Welchii proved to be closer to the S-epimer and differed considerably from the R-epimer.

3. The results obtained indicate that the main component of the lipoamino acid of Clostridium Welchii is S-α-L-phosphatidyl-γ-L-alanylglycerol.

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