shifted to slightly higher field than those of the starting material III. When the reaction was judged to be complete, it was filtered and the solvent was removed on the rotary evaporator at room temperature. The resulting yellow solid was triturated repeatedly with six 50-ml portions of ether yielding 25 g of solid after evaporation of the ether. This substance was then triturated several times with *n*-pentane with very brief heating on the steam bath each time, followed by filtration. Evaporation of the combined filtrates yielded 22 g of a solid. A white fibrous substance was removed in the filtration step. Finally, the product was dissolved in *n*-pentane with gentle warming and allowed to crystallize overnight in the freezer (−20 °C) yielding 16 g of slightly tan, crystalline dibromide IV, mp 57–58 °C (resolidifies to a fibrous gel soon after melting). The dibromide IV exhibits a very clean NMR spectrum ($CDCl_3$): two-proton vinyl singlet at δ 6.03, two-proton vinyl singlet at δ 5.97, and four-proton bromomethyl singlet at δ 4.15.

Acknowledgment. This work was generously supported by the Institute for General Medical Sciences of the National Institutes of Health through Grant GM 19906 01.

Registry No.—I, 60239-16-9; II, 60239-17-0; III, 30432-16-7; IV, 18214-55-6; α-methyleneglutaryl chloride, 32287-80-2; α-methyleneglutaric acid, 3621-79-2; Sn/Cu, 12735-84-1.

References and Notes

(1) P. C. Wailes and M. C. Whiting, *J. Chem. Soc.*, 3636 (1955), and references cited therein.
(2) M. Sprecher, R. L. Switzer, and D. B. Sprinson, *J. Biol. Chem.*, **241**, 864 (1966).
(3) L. F. Fieser and M. Fieser, "Reagents for Organic Synthesis", Vol. I, Wiley, New York, N.Y., 1967, p 1307.
(4) E. Le Goff, *J. Org. Chem.*, **29**, 2048 (1964).
(5) Selective reduction of 2,6-dibromo-1-naphthol to 6-bromo-1-naphthol using mossy tin and hydrobromic acid has been reported by C. F. Koelsch, "Organic Syntheses", Collect. Vol. III, Wiley, New York, N.Y., 1955, p 132. See M. Fieser and L. F. Fieser, "Reagents for Organic Synthesis", Vol. 2, Wiley, New York, N.Y., 1969, p 414.
(6) G. B. Butler and R. M. Ottenrite, *Tetrahedron Lett.*, 4873 (1967); Y. Gaoni, *ibid.*, 2361 (1973).
(7) Cf. the procedure of H. Feuer and S. M. Pier, "Organic Syntheses", Collect. Vol. IV, Wiley, New York, N.Y., 1963, p 554, for itaconyl chloride.
(8) A. C. Cope and F. Kagan, *J. Am. Chem. Soc.*, **80**, 5499 (1958).
(9) Use of copper powder alone (tetrahydrofuran, 12 h, 25 °C) yielded a small amount of the desired bromide II (5%) together with a comparable amount of unwanted lactone. The bulk of the material was unreacted tribromide I. The reaction was only marginally improved at 60 °C.

Substitution and Elimination Reactions of Steroid Tertiary C-17 Trifluoroacetates

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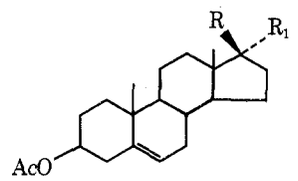
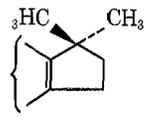
Although solvolytic reactions in the steroid field are of long established synthetic and mechanistic interest,[1] the use of a tertiary trifluoroacetoxy substituent as a leaving group has received relatively little attention. Just and Di Tullio reported briefly that the ethanolysis of 3α-methylcholest-5-en-3β-yl trifluoroacetate (**5**) resulted merely in the recovery of the starting 3β-alcohol (**5a**).[2] Work in other fields suggested, nevertheless, that tertiary trifluoroacetates react in uncatalyzed (neutral) hydrolyses by an alkyl–oxygen fission path or a mechanism which involves both SN and $B_{Ac}2$ routes.[3] Prompted by these results we have examined the solvolytic behavior of 17α-methylandrost-5-ene-3β,17β-diol 3-acetate 17-trifluoroacetate (**1**)[4] and its epimer at C-17 (**1a**), both readily available from the corresponding tertiary alcohols **1b** and **1c**.

Results and Discussion

When **1** and **1a** were solvolyzed in refluxing methanol in the presence of sodium acetate, the following major products were formed. The less polar fractions after chromatography consisted essentially of 17,17-dimethyl-18-norandrosta-5,13-dien-3β-yl acetate (**2**)[5] and a mixture of 17-methyleneandrost-5-en-3β-yl acetate (**3**)[6] and 17-methylandrosta-5,16-dien-3β-yl acetate (**4**)[7] which could not be separated. The other products were, in order of elution, the 17α-methoxy-17β-methylandrost-5-en-3β-yl acetate (**1d**), and (from **1** only) the 17β-alcohol **1b**.[8]





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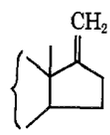
1, R = $OCOCF_3$; R_1 = CH_3
1a, R = CH_3; R_1 = $OCOCF_3$
b, R = OH; R_1 = CH_3
c, R = CH_3; R_1 = OH
d, R = CH_3; R_1 = OCH_3
e, R = CH_3; R_1 = OC_2H_5
f, R = CH_3; R_1 = N_3
g, R = CH_3; R_1 = $NHCOCH_3$



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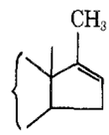

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The structure of the methyl ether **1d** was deduced on the basis of analytical and spectral data and by comparison of the C-5 saturated analogue[9] with an authentic sample.[10]

In Table I the yields of the products resulting from the two methanolyses are compared. The enhancement of the elimination path for the quasi-axial 17α-trifluoroacetate **1a** has analogy in the solvolyses of several secondary sulfonate esters.[11] The major product **4** should derive from a rapid trans quasi-diaxial elimination with the 16β proton. In both cases the unrearranged elimination products are accompanied by the rearranged Δ^{13} olefin **2**, which is the usual product from a C-17 carbonium ion.[5] The replacement reaction by alkyl–oxygen fission, though proceeding by unimolecular heterolysis (SN1),[12] leads, whatever the substrate, to the 17α-methoxy derivative **1d**, a result which probably depends on the steric opposition of the 13-methyl group to β-attack by the solvent.

Methanolysis of **1** in the absence of a buffer gave the expected enhancement of the rearranged Δ^{13} olefin **2** at the expense of the 17β-alcohol **1b** (only traces).

Turning next to the solvolysis in ethanol, the 17α-ethoxy derivative **1e**[13] was obtained in 11% yield from **1** in the presence of sodium acetate, together with the usual elimination products (52% yield), and the 17β-alcohol **1b** (25% yield).

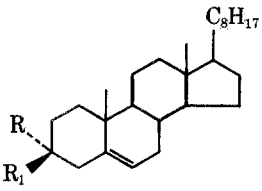
This result differed considerably from that reported by Just and Di Tullio for **5**[2] but a reexamination of the ethanolysis of **5** showed that, in addition to a 78% yield of the starting alcohol **5a**, only an 8% yield of a hydrocarbon mixture containing both 3-methylcholesta-3,5-diene (**6**)[14] and 3-methylenecholest-5-ene (**7**)[14] and a 9% yield of 3β-ethoxy-3α-methylcholest-5-ene (**5b**)[14] were formed.

As to the aprotic solvents, when dimethyl sulfoxide was used, in the presence of sodium acetate, the decomposition of **1** and **1a** to the elimination products strongly preponderated, as can be seen from Table I. For **1**, the olefin composition observed appears to minimize the possible intervention of a preliminary SN2 substitution of the trifluoroacetoxy group by the solvent (which is more nucleophilic than AcO^- anion) to give an axial *O*-alkyl sulfonium salt,[15] since this would

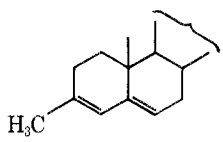
Table I. Percentages[a] of the Products Obtained by Solvolysis of 1 and 1a

Product	MeOH + AcONa[b]		MeOH + LiN_3,	MeOH,	Me_2SO + AcONa		Me_2SO + AcONa (+2% H_2O),	Me_2SO + NaN_3,
	1[c]	1a	1	1	1	1a	1	1
2	10	13	14	33	12	4		7
3	16.5	21	20	15	42	34	28	44
4	6.5	46	8	10	24	62		25
1b	42		28		6		63	
1c					9		9	10.5
1d	21	9	22	16				
1f			8					13

[a] The yields of 2, 1b, 1c, 1d, and 1f are calculated from weights of chromatographic fractions; those of 3 and 4 are inferred from the ^1H NMR spectra of their mixtures. [b] Medium. [c] Substrate.



5, R = CH_3; R_1 = $OCOCF_3$
5a, R = CH_3; R_1 = OH
b, R = CH_3; R_1 = OC_2H_5



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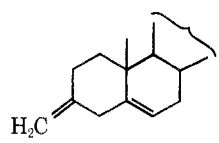

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produce more 4 than was actually obtained. The alcohols that occurred in low yield among the solvolytic products of 1 should arise from hydrolysis of such intermediate species during workup or, alternatively, from adventitious water present in the reaction mixture. In fact, since the solvolysis of 1 in Me_2SO + AcONa in the presence of 2% water raised the yield of 1b to 63%, while leaving that of 1c practically unaffected, the latter process should be the more effective for the 17β-alcohol and the former for the 17α-alcohol.

As expected, the solvolysis of 1 in Me_2SO in the presence of the more powerful nucleophile sodium azide gave, in addition to 2, 3, 4, and 1c, the 17α-azido-17β-methylandrost-5-en-3β-yl acetate (1f) in 13% yield. The 17α configuration of the azide group was inferred from both mechanistic considerations (mechanism SN2 is predominant in dipolar aprotic solvents)[12] and the following data. The 13β-methyl group in the ^1H NMR spectrum of 1f resonates at a value (0.75 ppm) consistent with those of all the compounds of the 17α series (1a, 1c, 1d, and 1e) (0.68–0.77 ppm), while the corresponding signal of the compounds of the 17β series (1 and 1b) exhibit a distinct downfield shift. Furthermore, 1f was reduced with lithium aluminum hydride[16] and the crude amine was acetylated to give a 17-acetamido derivative 1g of retained configuration which is different from the known 17β-acetamido-17α-methylandrost-5-en-3β-yl acetate.[17] A similar amount of 1f resulted when the solvolysis was carried out in hexamethylphosphoric triamide (HMPT), as indicated by the comparable intensities of the asymmetric azide stretching band at 2100 cm^{-1} in the ir spectrum of each crude reaction residue.

Finally, treatment of 1 with lithium azide in refluxing methanol resulted in a limited competition between azide ion and methanol since only an 8% yield of 1f was obtained against the 22% yield of the methoxy derivative 1d.

In conclusion, we have found that solvolysis of tertiary trifluoroacetates is useful for nucleophilic substitution at tertiary centers but, as expected, the yields are strongly limited by concurrent eliminations. The latter are not specific and give merely mixtures "for the balance between E1 and E2 can be very delicately poised in tertiary structures" [18] and, in addition, the syn-coplanar mode of E2 elimination in cyclopentyl rings may be only moderately less favorable than the anti reaction.

Experimental Section

Melting points were determined on a Kofler hot-stage apparatus and are not corrected. Rotations were taken with a Schmidt-Haensch polarimeter (1-dm cell) in 1% $CHCl_3$ solutions. Where appropriate, identities of compounds were confirmed by comparison of ir spectra (KBr disks; Perkin-Elmer 521 grating spectrophotometer). ^1H NMR spectra were measured for solutions in $CDCl_3$ (Me_4Si as internal standard) with a Varian HA-100 spectrometer. Column chromatographies were carried out with deactivated (grade II) Woelm neutral alumina. Dimethyl sulfoxide and hexamethylphosphoric triamide were refluxed over calcium hydride and distilled in vacuo; methanol and ethanol were dried by treatment with magnesium.

17α-Methylandrost-5-ene-3β,17-diol 3-Acetate 17-Trifluoroacetate (1). 17α-Methylandrost-5-ene-3β,17-diol 3-acetate (1b, 1.00 g, 2.9 mmol) and trifluoroacetic anhydride (1.5 ml) in dry pyridine (7 ml) were set aside at room temperature for 3 h, then poured slowly into 85 ml of cold aqueous 15% HCl, with stirring. The yellow precipitate was filtered and dissolved in ether and the extracts washed with water until neutral. After drying (Na_2SO_4), the ether was evaporated and the residue (1.31 g) crystallized twice from methanol (0.72 g): mp 118–120 °C; $[\alpha]_D$ −65°; ir CF_3COO 1770 cm^{-1}; ^1H NMR δ 0.91 (3 H, s, 13-Me), 1.05 (3 H, s, 10-Me), 1.51 (3 H, s, 17α-Me), 2.00 (3 H, s, 3β-OAc), 4.6 (1 H, m, 3α-H), 5.4 ppm (1 H, m, C-6 H).

Anal. Calcd for $C_{24}H_{33}F_3O_4$ (442.5): C, 65.14; H, 7.51; F, 12.88. Found: C, 65.42; H, 7.65; F, 12.73.

17β-Methylandrost-5-ene-3β,17-diol 3-Acetate 17-Trifluoroacetate (1a). This was prepared in the same manner as above from 17α-alcohol 1c and crystallized from *n*-hexane: mp 95–96 °C; $[\alpha]_D$ −109°; ir CF_3COO 1770 cm^{-1}; ^1H NMR δ 0.77 (3 H, s, 13-Me), 1.06 (3 H, s, 10-Me), 1.57 (3 H, s, 17β-Me), 2.05 (3 H, s, 3β-OAc), 4.6 (1 H, m, 3α-H), 5.4 ppm (1 H, m, C-6 H).

Anal. Calcd for $C_{24}H_{33}F_3O_4$ (442.5): C, 65.14; H, 7.51; F, 12.88. Found: C, 65.01; H, 7.52; F, 12.54.

Solvolysis of 17β-Trifluoroacetate 1 in Methanol in the Presence of Sodium Acetate. A stirred solution of 1 (4.42 g, 10 mmol) in 125 ml of methanol was refluxed for 32 h[19] in the presence of sodium acetate (4.10 g, 50 mmol). Part of the methanol was distilled and water was added to the mixture. The product was extracted with ether, and the extract washed with water and dried over Na_2SO_4. The residue (3.51 g) was chromatographed over 210 g of alumina. Elution with *n*-hexane–benzene (7:3) gave 17,17-dimethyl-18-norandrosta-5,13-dien-3β-yl acetate (2, 0.35 g, 10%), identical with an authentic sample,[5] followed by a mixture of 17-methyleneandrost-5-en-3β-yl acetate (3)[6] and 17-methylandrosta-5,16-dien-3β-yl acetate (4,[7] 0.81 g, 23%). Elution with benzene gave **17α-methoxy-17β-methylandrost-5-en-3β-yl acetate (1d,** 0.73 g, 21%): mp 130–131 °C (from *n*-hexane); $[\alpha]_D$ −90°; ^1HNMR δ 0.71 (3 H, s, 13-Me), 1.05 (3 H, s, 10-Me), 1.11 (3 H, s, 17β-Me), 2.03 (3 H, s, 3β-OAc), 3.18 (3 H, s, 17α-OCH_3), 4.6 (1 H, m, 3α-H), 5.4 ppm (1 H, m, C-6 H).

Anal. Calcd for $C_{23}H_{36}O_3$ (360.5): C, 76.62; H, 10.07. Found: C, 76.65; H, 10.12.

Finally, elution with benzene–ether (9:1) gave 17α-methylandrost-5-ene-3β,17-diol 3-acetate (1b, 1.47 g, 42%), mp 177–179 °C (from AcOEt).

Repetition of the procedure on **17α-methyl-5α-androstane-3β,17-diol 3-acetate 17-trifluoroacetate** [mp 107–108.5 °C (from methanol); $[\alpha]_D$ −7.5°; ir CF_3COO 1770 cm^{-1}] resulted in the formation of 17α-methoxy-17β-methyl-5α-androstan-3β-yl acetate (23%): mp 94–94.5 °C (from methanol); $[\alpha]_D$ −24°; identical with an authentic sample.[10]

In the same manner were carried out the solvolyses of **1a** in MeOH in the presence of sodium acetate and of **1** in MeOH alone and in 0.92 M anhydrous methanolic lithium azide.[20]

Solvolysis of 17β-Trifluoroacetate 1 in Ethanol in the Presence of Sodium Acetate. Treatment of **1** (1.74 g, 3.9 mmol) with AcONa (1.62 g, 19.5 mmol) in EtOH (50 ml) in the above manner gave, after chromatography of the residue (1.36 g) on alumina, **17α-ethoxy-17β-methylandrost-5-en-3β-yl acetate (1e)** (147 mg, 11%): mp 96–97 °C (from MeOH); $[\alpha]_D$ −90°; ^1H NMR δ 0.68 (3 H, s, 13-Me), 1.04 (3 H, s, 10-Me), 1.10 (3 H, s, 17β-Me), 1.11 (3 H, t, J = 7 Hz, CH_3CH_2O–), 2.03 (3 H, s, 3β-OAc), 3.34 (2 H, q, J = 7 Hz, CH_3CH_2O–), 4.6 (1 H, m, 3α-H), 5.4 ppm (1 H, m, C-6 H).

Anal. Calcd for $C_{24}H_{38}O_3$ (374.5): C, 76.93; H, 10.26. Found: C, 76.93; H, 10.23.

Solvolysis of 17β-Trifluoroacetate 1 in Me_2SO in the Presence of NaN_3. **1** (4.4 g, 10 mmol) in Me_2SO (120 ml) containing NaN_3 (6.6 g, 100 mmol) was heated at 80 °C with stirring for 24 h.[21] The mixture was cooled and water was added. The product was isolated with ether, washed with water, and dried over Na_2SO_4. Evaporation of the ether gave 3.2 g of an oily residue which was chromatographed on alumina (192 g). Elution with n-hexane–benzene (7:3) gave **2** (0.23 g, 7%) followed by **3** + **4** (1.6 g), by a mixture of **3**, **4**, and **1f** (0.81 g), and by pure **17α-azido-17β-methylandrost-5-en-3β-yl acetate (1f)** (0.20 g): mp 138–139 °C (from n-hexane); $[\alpha]_D$ −109°; ir N_3 2100 cm^{-1}; ^1H NMR δ 0.75 (3 H, s, 13-Me), 1.05 (3 H, s, 10-Me), 1.29 (3 H, s, 17β-Me), 2.02 (3 H, s, 3β-OAc), 4.6 (1 H, m, 3α-H), 5.4 ppm (1 H, m, C-6 H).

Anal. Calcd for $C_{22}H_{33}N_3O_2$ (371.5): C, 71.22; H, 8.95; N, 11.33. Found: C, 71.03; H, 8.92; N, 11.29.

Elution with benzene–ether (9:1) gave 0.33 g of predominantly **1c**, mp 156–158 °C (from acetone), identical with an authentic sample[8] (trace amounts of **1b** were present). Repeated chromatographies of the mixture of **3**, **4**, and **1f** (0.81 g) on alumina as above gave more pure **1f** (0.21 g, total yield 13%) in addition to 0.6 g of **3** + **4** (total yield 69%).

In the same manner were carried out solvolyses of **1** and **1a** in Me_2SO + AcONa.

17α-Acetamido-17β-methylandrost-5-en-3β-yl Acetate (1g). To 0.2 g of $LiAlH_4$ in 10 ml of dry ether was added 0.2 g (0.54 mmol) of **1f** in 10 ml of dry ether. The mixture was stirred at room temperature for 5 h, and excess $LiAlH_4$ decomposed with AcOEt and water. The mixture was filtered and the filtrate washed with water. The ether was evaporated after drying and the crude amino derivative obtained [0.17 g, ir 3670 and 3600 (NH_2) and 3440 cm^{-1} (OH)] was directly acetylated (Ac_2O–pyridine) to give 0.21 g of 17α-acetamido-17β-methylandrost-5-en-3β-yl acetate (**1g**): mp 155–156 °C (from isopropyl ether); $[\alpha]_D$ −96°; ir 3450 (NH), 1720 (3β-OAc), and 1665 cm^{-1} (acetamido); ^1H NMR δ 0.76 (3 H, s, 13-Me), 1.04 (3 H, s, 10-Me), 1.40 (3 H, s, 17β-Me), 1.92 (3 H, s, $NHCOCH_3$), 2.01 (3 H, s, 3β-OAc), 4.6 (1 H, m, 3α-H), 5.4 (2 H, m, C-6 H and NH).

Anal. Calcd for $C_{24}H_{37}NO_3$ (387.5): C, 74.38; H, 9.62; N, 3.61. Found: C, 74.18; H, 9.49; N, 3.46.

Registry No.—**1**, 474-34-0; **1a**, 60282-52-2; **1b**, 33854-98-7; **1c**, 3090-73-1; **1d**, 60282-53-3; **1e**, 60282-54-4; **1f**, 60282-55-5; **1g**, 60282-56-6; trifluoroacetic anhydride, 407-25-0; 17α-methyl-5α-androstane-3β,17-diol 3-acetate 17-trifluoroacetate, 60282-57-7; 17α-methoxy-17β-methyl-5α-androstan-3β-yl acetate, 60282-58-8.

References and Notes

(1) D. N. Kirk and M. P. Hartshorn, "Steroid Reaction Mechanisms", Elsevier, Amsterdam, 1968, Chapters 2 and 5; "Terpenoids and Steroids", K. H. Overton, Ed., *Spec. Period. Rep.*, **1–5**, Part II, Chapter 1, Section 2.
(2) G. Just and V. Di Tullio, *Can. J. Chem.*, **42**, 2695 (1964).
(3) D. J. Barnes, M. Cole, S. Lobo, J. G. Winter, and J. M. W. Scott, *Can. J. Chem.*, **50**, 2175 (1972), and references cited therein.
(4) C. W. Marshall, R. E. Ray, I. Laos, and B. Riegel, *J. Am. Chem. Soc.*, **79**, 6308 (1957); J. A. Campbell and J. C. Babcock, U.S. Patent 3 029 263 (April 10, 1962).
(5) V. Tortorella, G. Lucente, and A. Romeo, *Ann. Chim. (Rome)*, **50**, 1198 (1960).
(6) G. Drefahl, K. Ponsold, and H. Schick, *Chem. Ber.*, **98**, 604 (1965).
(7) S. A. Julia and H. Heusser, *Helv. Chim. Acta*, **35**, 2080 (1952).
(8) K. Miescher and W. Klarer, *Helv. Chim. Acta*, **22**, 962 (1939).
(9) Obtained by repetition of the methanolysis procedure on the 17α-methyl-5α-androstane-3β,17-diol 3-acetate 17-trifluoroacetate.
(10) G. Ortar and I. Torrini, *Tetrahedron*, submitted for publication.
(11) D. N. Jones and M. A. Saeed, *J. Chem. Soc.*, 4657 (1963).
(12) M. Leboeuf, A. Cave, and R. Goutarel, *Bull. Soc. Chim. Fr.*, **6**, 2100 (1967), and references cited therein.
(13) The ethoxy group was assigned the 17α configuration by analogy with that of **1d**.
(14) G. Just and V. Di Tullio, *Can. J. Chem.*, **42**, 2154 (1964).
(15) F. X. Jarreau, B. Tchoubar, and R. Goutarel, *Bull. Soc. Chim. Fr.*, 887 (1962).
(16) The reduction could alternatively be carried on the crude solvolytic residue and the amine isolated by extracting with 2 N HCl.
(17) G. E. Arth, A. A. Patchett, T. Jefopoulus, R. L. Bugianesi, L. H. Peterson, E. A. Ham, F. A. Kuehl, Jr., and N. G. Brink, *J. Med. Chem.*, **14**, 675 (1971).
(18) D. V. Banthorpe, "Elimination Reactions", Elsevier, Amsterdam, 1963, p 155.
(19) The disappearance of the starting material was monitored by TLC.
(20) R. Huisgen and I. Ugi, *Chem. Ber.*, **90**, 2914 (1957).
(21) The intensity of the asymmetric azide stretching band was used for monitoring the reaction.

Resolution of Anomeric Ethyl 2-Amino-2-deoxy-D-glucopyranoside by Cation-Exchange Chromatography, and Its N-Acylation with Carboxylic Anhydrides

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Ethyl 2-acetamido-2-deoxy-β-D-glucopyranoside is found in some microorganisms[1] and has a growth-promoting activity (the bifidus activity) for *Lactobacillus bifidus* var. *pennsylvanicus*.[2,3] The bifidus activity is found in the β anomer only, but the α anomer is inactive.[2,3] Little is known about the structural specificity of the *N*-acyl group for the bifidus activity.[4] Therefore, a modification of the *N*-acyl group is of significance from these points of view. The bifidus activity was originally observed with oligosaccharides[5] and glycopeptides[5,6] present in human milk.

The anomeric mixtures are generally produced in the course of the preparation of glycosides by the Fischer method,[7a] and the anomeric resolution is one of the important tasks. In the past, the resolution of anomeric hexosaminides in a preparative scale has been performed by differential solubilities in various solvents[7b] or, more recently, by anion-exchange chromatography utilizing the difference in acidities of the glycoside bonds.[8]

The present paper reports a novel and facile method for the anomeric resolution of ethyl 2-amino-2-deoxy-D-glucopyranoside by cation-exchange chromatography utilizing the difference in basicities of the amino groups, and the preparation of some novel *N*-acyl derivatives by N-acylation with carboxylic anhydrides.

Results and Discussion

The anomeric ethyl 2-acetamido-2-deoxy-D-glucopyranoside was N-deacetylated with 1.0–6.0 N NaOH in a boiling water bath for 1–5 h. The extent of N-deacetylation was analyzed by the ninhydrin reaction and by an amino acid analyzer. The maximum yield (42.6% Ia and 39.8% Ib) was obtained by treating with 2.0 N NaOH in a boiling water bath for 3 h, and the reaction with 6.0 N $Ba(HO)_2$ under these conditions afforded 35.0% Ia and 24.1% Ib. Product degradation occurred with 3.0–6.0 N NaOH in the reaction for 4 h and longer, and N-deacetylation was incomplete in the reactions with 1.0 N NaoH for 1 h and shorter. The degradation was evident by the detection of a strong NH_3 peak by the amino acid analyzer.