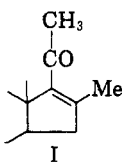
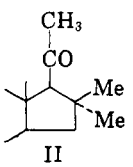
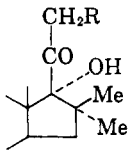


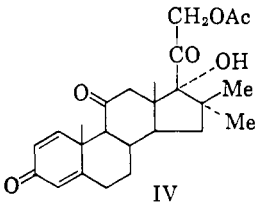
I



II



IIIa. R = H
IIIb. R = OAc



IV

followed by acetylation proceeded in part by 1:4 addition to give 3α-acetoxy-16,16-dimethylpregnane-11,20-dione (II) m.p. 212–217°; $[\alpha]_D^{Chf}$ +77°.

Anal. Calcd. for $C_{25}H_{38}O_4$: C, 74.58; H, 9.51 Found: C, 74.80; H, 9.35. Introduction of the 17α-hydroxyl group was achieved by a modification[4] of the method of Hogg and Nathan[5] to give 3α,17α-dihydroxy-16,16-dimethylpregnane-11,20-dione (IIIa) m.p. 177–182°; λ_{max}^{Chf} 2.75, 2.92, 5.87 μ. *Anal.* Calcd. for $C_{23}H_{36}O_4$: C, 73.40; H, 9.57. Found: C, 73.29; H, 9.44. As a consequence of the high degree of steric hindrance in the vicinity of C-17 and C-20, IIIa was inordinately sensitive to base catalyzed D-homoannulation and conventional alkaline hydrolysis of the intermediate peracid product could not be employed. A new procedure, to be reported subsequently, involving the use of ethylenediamine was developed. Bromination of IIIa at C-21 followed by acetoxylation led to 21-acetoxy-16,16-dimethylpregnane-3α,17α-diol-11,20-dione (IIIb) m.p. 206–208°; λ_{max}^{Chf} 2.72, 2.9 (broad), 5.74, 5.76, 5.85, 8.1 μ.

Anal. Calcd. for $C_{25}H_{38}O_6$: C, 69.09; H, 8.81. Found: C, 68.90; H, 8.53. Oxidation of IIIb at C-3 by sodium dichromate in aqueous acetic acid led to 21-acetoxy-16,16-dimethylpregnane-17α-ol-3,11,20-trione, m.p. 203–206°; $[\alpha]_D^{Chf}$ +114°.

Anal. Calcd. for $C_{25}H_{36}O_6$: C, 69.41; H, 8.39. Found: C, 69.59; H, 8.48. Dibromination of the 3,11,20-trione followed by dehydrobromination in dimethylformamide-dimethylaniline[6] led to 16,16-dimethylprednisone acetate (IV), m.p. 231–235°; $[\alpha]_D^{Chf}$ +210°; λ_{max}^{MeOH} 238 mμ (14,200); λ_{max}^{Chf} 2.85, 5.73, 5.76, 5.84, 6.00, 6.14, 6.19 sh., 8.06, 11.20 μ.

Anal. Calcd. for $C_{25}H_{32}O_6$: C, 70.08; H, 7.53. Found: C, 70.02; H, 7.42.

In the rat systemic granuloma and mouse liver glycogen assays compound IV showed respectively no activity and *ca.* one-tenth the activity of hydrocortisone.[7]

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(4) Procedure of M. Sletzinger of these laboratories. We are grateful to Dr. Sletzinger for informing us of his procedure in advance of publication and for several helpful discussions.

(5) J. A. Hogg and A. H. Nathan, U. S Patents 2,740,782, 2,740,783 (1956).

(6) Procedure of J. Day, R. Erickson and R. Pettebone, U. S. Patent 2,873,284 (1959).

(7) We are grateful to Dr. R. H. Silber of the Merck Institute for therapeutic research for the biological assays.

Potential Anticancer Agents.[1] XXIX. Inversion of a Ring Carbon of a Glycoside

Sir:

The low reactivity of secondary sugar sulfonates toward S_N2 displacement by nucleophiles has placed a severe restriction on an otherwise potentially useful reaction for the synthesis of rare sugars. Few nucleophiles are powerful enough to effect this displacement unaided by a neighboring group. Thus, sodium iodide generally fails to react with "isolated" secondary tosylates, and sodium hydroxide or sodium methoxide, when they do react, bring about simple hydrolysis of the sulfonate with retention of configuration.[2]

A useful reaction for the synthesis of amino sugars involves the displacement of an "isolated" secondary tosylate by ammonia, or better, by hydrazine.[3] This reaction, as illustrated by the synthesis of 3-amino-3-deoxy-1,2:5,6-di-*O*-isopropylidene-D-allofuranose from 1,2:5,6-di-*O*-isopropylidene-3-*O*-(*p*-tolylsulfonyl)-D-glucofuranose, proceeds with inversion of configuration.[4] A recent report from these laboratories[5] described the use of sodium benzoate in refluxing *N*,*N*-dimethylformamide to effect the displacement of a side-chain secondary tosylate by benzoate with inversion of configuration. Of paramount interest was the determination whether the use of this reagent could be extended to cover the broad range of sterically more hindered and much less reactive ring sulfonates.

We wish to report the successful displacement of a pyranoside ring tosylate by sodium benzoate to give the sugar benzoate with inverted configuration on the ring carbon.

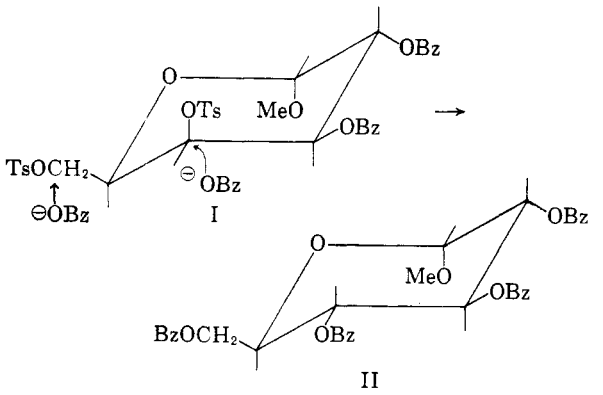
(1) This work was carried out under the auspices of the Cancer Chemotherapy National Service Center, National Cancer Institute, Contract No. SA-43-ph-1892. For the preceding paper in this series, *cf.* W. A. Skinner, M. G. M. Schelstraete, and B. R. Baker, *J. Org. Chem.*, **25**, in press (1960).

(2) R. S. Tipson, *Advances in Carbohydrate Chemistry*, **8**, 107 (1953).

(3) K. Freudenberg and F. Brauns, *Ber.*, **55**, 3233 (1922).

(4) R. U. Lemieux and P. Chu, *J. Am. Chem. Soc.*, **80**, 4745 (1958).

(5) E. J. Reist, L. Goodman, and B. R. Baker, *J. Am. Chem. Soc.*, **80**, 5775 (1958).



Hydrogenation of methyl 2,3-di-*O*-benzoyl-4,6-*O*-benzylidene-α-D-galactopyranoside[6] with palladium black in alcohol at 65° gave a quantitative yield of analytically pure methyl 2,3-di-*O*-benzoyl-α-D-galactopyranoside as a glass. Found: C, 62.4; H, 5.60. Tosylation of the dibenzoate gave a 60% yield of crystalline methyl 2,3-di-*O*-benzoyl-4,6-di-*O*-(*p*-tolylsulfonyl)-α-D-*galacto*pyranoside (I),[7] m.p. 128–129°, $[\alpha]_D^{39}$ +150° (1% in chloroform). Found: C, 58.8; H, 4.91; S, 9.11. Treatment of 0.5 g. of I with 0.7 g. of sodium benzoate in 15 ml. of *N*,*N*-dimethylformamide at 140° for 24 hours gave a 49% yield of II, m.p. 104°, $[\alpha]_D^{31}$ +78° (0.5% in chloroform). Found: C, 68.9; H, 5.36. This product was identical with authentic methyl α-D-glucopyranoside tetrabenzoate, as shown by the infrared spectra and mixed melting point behavior. An interesting and important contrast is the reported failure[8] of methyl 4-*O*-(*p*-tolylsulfonyl)-β-D-galactopyranoside, when treated with refluxing methanolic sodium methoxide, to give any evidence for a tosylate displacement.

This successful benzoate displacement lends further credence to the suggestion[5] that sodium benzoate in *N*,*N*-dimethylformamide be placed high on the list of powerful nucleophilic reagents[9] and that the potential of this reagent be investigated further for the synthesis of rare sugars.

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(6) M. Gyr and T. Reichstein, *Helv.*, **28**, 226 (1945).

(7) Examination of models suggested that the galactopyranoside conformation (I) in which the 4-*O*-tosyl is axial should be favored sterically, thus aiding the back-side attack on the 4-position by benzoate.

(8) A. Müller, M. Móricz, and G. Verner, *Ber.*, **72B**, 745 (1939).

(9) Since sodium acetate in acetic anhydride displaced only the primary 5-tosylate, but not the ring 3-tosylate of 1,2-*O*-isopropylidene-3,5-di-*O*-(*p*-tolylsulfonyl)-D-xylofuranose,[10] it would be of interest to investigate whether or not both tosylates could be displaced by sodium benzoate in *N*,*N*-dimethylformamide.

(10) L. Vargha, *Chem. Ber.*, **87**, 1351 (1954).

A New Synthesis of Triptycene

Sir:

We wish to report the synthesis of triptycene[1] by a new, simple, and direct route. When the adduct (I) between anthracene and *p*-benzoquinone was reduced with $LiAlH_4$ or $NaBH_4$, a crude mixture resulted. Although this mixture was not separated and analyzed, its infrared spectrum and subsequent reactions were consistent with the assumption that it contained the diol reduction products. This mixture, when refluxed with ethanolic hydrochloric acid followed by chromatography of the products on acid alumina, gave triptycene in 15% yield based on I. This hydrocarbon had a m.p. 254–256 and an infrared tracing that was superimposable on that of authentic triptycene. *Anal.* Calcd. for $C_{20}H_{14}$: C, 94.45; H, 5.55. Found: C, 94.49; H, 5.78. In addition to the triptycene, a substance identified as anthracene was obtained in 25% yield based on I.

The present synthesis of triptycene is considerably shorter than the elegant classical synthesis by Bartlett, Ryan, and Cohen.[1] Further, it shows promise of being more generally applicable to the synthesis of bridgehead substituted triptycenes than the ingeneous syntheses through benzyne by Wittig and co-workers.[2–4]

The details of the present route and its extension to substituted triptycenes are being investigated.

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(1) P. D. Bartlett, M. J. Ryan, and S. G. Cohen, *J. Am. Chem. Soc.*, 64, 2649 (1942).

(2) G. Wittig and E. Benz, *Ber.*, 91, 873 (1958).

(3) G. Wittig and R. Ludwig, *Angew. Chem.*, **68**, 40 (1956).

(4) G. Wittig and E. Benz, *Angew. Chem.*, **70**, 166 (1958).

(5) Taken from a dissertion submitted by A. C. Craig to Cornell University for the Ph.D. degree, June 1959.