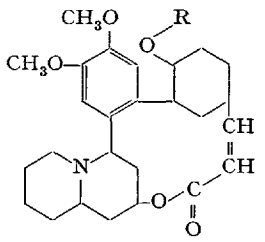
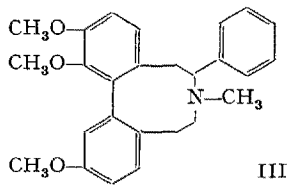
(λ_{max} 281 mμ, ε 5600)[12] reported for this compound are almost identical with those reported for decodine[1]. Inspection of the Dreiding models clearly indicates appreciable hindrance to rotation about the biphenyl link, even with the lactone ring cleaved, so that the observed UV-spectra would be in accord with the structure of lythrine.

Elucidation of the detailed structures of the remaining Lythraceae alkaloids will be described in due course.



I R = CH_3; II R = H



III

Zusammenfassung. Die Struktur des O-Methyl-lythrin-hydrobromids wurde röntgen-kristallographisch ermittelt. Durch den oxydativen Abbau wurde das Hydrobromid mit dem unsubstituierten Lythrin verknüpft. Die Massenspektren zeigten, dass eine Reihe von weiteren Lythraceae-Alkaloiden das gleiche Grundgerüst besitzen.

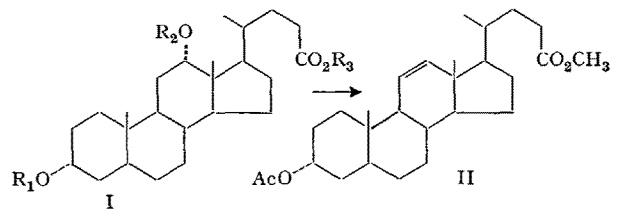
D. E. ZACHARIAS, G. A. JEFFREY*,
B. DOUGLAS, J. A. WEISBACH, J. L. KIRKPATRICK**,
J. P. FERRIS, C. B. BOYCE, and R. C. BRINER***

*Crystallography Laboratory, University of Pittsburgh** (*Pennsylvania*); *Smith Kline and French Laboratories, Philadelphia*** (*Pennsylvania*); *and Department of Chemistry, Florida State University, Tallahassee**** (*Florida, USA*), *November 9, 1964.*

[12] E. A. BRAUDE and W. F. FORBES, J. chem. Soc. *1955*, 3776.

Δ^{11}-Steroids

Despite their potential importance as precursors of physiologically active 11-oxygenated compounds, no really satisfactory method is available for the preparation of Δ^{11}-steroids from desoxycholic acid and its transformation products. It has now been found that the dehydrosulphonylation of 12α-sulphonate esters proceeds readily with potassium-*t*-butoxide (KO^{t}Bu) in dipolar aprotic solvents and in the case of dimethyl sulfoxide (DMSO) offers excellent yields of Δ^{11}-compounds.



I II

(a) $R_1 = CH_3CO$ $R_2 = H$ $R_3 = CH_3$
(b) $R_1 = CH_3CO$ $R_2 = p\text{-}CH_3 \cdot C_6H_4 \cdot SO_2$ $R_3 = CH_3$
(c) $R_1 = CH_3CO$ $R_2 = C_6H_5 \cdot SO_2$ $R_3 = CH_3$
(d) $R_1 = CH_3CO$ $R_2 = p\text{-}Cl \cdot C_6H_4 \cdot SO_2$ $R_3 = CH_3$
(e) $R_1 = CH_3CO$ $R_2 = CH_3SO_2$ $R_3 = CH_3$
(f) $R_1 = H$ $R_2 = C_6H_5 \cdot SO_2$ $R_3 = H$
(g) $R_1 = H$ $R_2 = p\text{-}CH_3 \cdot C_6H_4 \cdot SO_2$ $R_3 = H$

Treatment of methyl 3α-acetoxy-12α-hydroxy-cholanate[1] (Ia) with *p*-toluenesulphonyl chloride in pyridine at 55 ± 1°C for 96 h gave the crude tosylate (Ib) ($E^{1\%}_{1cm}$ 225 mμ = 205)[2] in ca. 93% yield. Dehydrotosylation with KO^{t}Bu in DMSO at 100–110° (bath temperature) for 1 h afforded, after methylation (diazomethane), acetylation, Florisil chromatography and crystallization from methanol, the known methyl 3α-acetoxy-Δ^{11}-cholenate[3] (II), m.p. 119–120° in ca. 74% yield. Similarly, the crude benzenesulphonate (Ic) ($E^{1\%}_{1cm}$ 217 mμ = 137) and the *p*-chlorobenzenesulfonate (Id) ($E^{1\%}_{1cm}$ 228 mμ = 214), obtained in 95 and 92% yields, furnished (II) in ca. 76 and 48% yields respectively. The lower yield with (Id) may be ascribed to the formation of benzyne-type intermediates with attendant complications. Dehydromesylation of the crude mesylate (Ie), derived from (Ia) in 97% yield, was complete within 40 min but gave (II) in diminished yield (55%). CHANG and WOOD[4] have recently reported a similar yield (58%) but on carrying out the reaction at room temperature for 48 h.

Variations of solvent and base in the elimination reaction did not prove rewarding. Thus, the replacement of DMSO by N-methylpyrrolidone, sulfolane and tetraethylene glycol dimethyl ether in dehydrotosylation of (Ib) gave (II) in 53, 39 and 54% yields respectively, whilst sodium methylsulfinyl carbanion[5], in place of KO^{t}Bu, in the dehydrobenzenesulfonylation of (Ic) provided 38% yield of (II) in 0.5 h. The disappointing result with dimsyl sodium, a strong base, is a consequence of the nature of the cation. The solvation of positively charged ions by dipolar aprotic solvents, such as DMSO, increases with the size of the ion[6]; consequently the base strength decreases in the order Cs > Rb > K ⋙ Na ⋙ Li. This is also strikingly demonstrated by the fact that anhydrous NaOAc gave hardly any Δ^{11}-compound (II), under conditions (2$^3/_4$ h at 100°) under which anhydrous KOAc in DMSO provided (II), m.p. 113–117° in ca. 47% yield from (Ic). Based on these considerations, dimsyl potassium

[1] T. F. GALLAGHER and W. P. LONG, J. biol. Chem. *162*, 521 (1946).
[2] UV-absorption spectra were measured in ethanol solution and optical rotations in alcohol-free chloroform. All melting points are uncorrected. New compounds gave satisfactory elemental analyses.
[3] O. WINTERSTEINER, M. MOORE, and K. REINHARDT, J. biol. Chem. *162*, 707 (1946). – J. PRESS and T. REICHSTEIN, Helv. chim. Acta *25*, 878 (1942).
[4] F. C. CHANG and N. F. WOOD, Steroids *4*, 55 (1964).
[5] E. J. COREY and M. CHAYKOVSKY, J. Am. chem. Soc. *84*, 866 (1962).
[6] D. J. CRAM, J. L. MATEOS, F. HAUCK, A. LANGEMANN, K. R. KOPECKY, W. D. NIELSEN, and J. ALLINGER, J. Am. chem. Soc. *81*, 5774 (1959). – T. J. WALLACE, J. E. HOFMANN, and A. SCHRIESHEIM, J. Am. chem. Soc. *85*, 2739 (1963).

would be expected to out-perform corresponding sodium salt and might even be preferable to KO^{t}Bu in base catalysed reactions.

Mild saponification of crude benzenesulfonate (Ic) furnished, in ca. 95% yield, the corresponding crude hydroxy acid (If) ($E^{1\%}_{1cm}$ 217 mμ = 144), which upon treatment with butoxide-DMSO, as usual, offered (II) in 77% yield, in contrast to 83% yield obtained with pure crystalline (If), m.p. 134-135°, $[\alpha]_D^{25}$ + 56.82° (ε_{max} 217 mμ = 9,100). Likewise, (Ib) on saponification provided (Ig), m.p. 135–136°, $[\alpha]_D^{25}$ + 55.26° (ε_{max} 225 mμ = 12,200), which was converted into (II) in 88% yield.

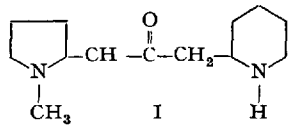
Zusammenfassung. Die Abspaltung von Sulfonsäuren aus 12α-Sulfonsäureestern von Steroiden verläuft besonders leicht mit Kalium-tert.-butylat in einem dipolaren aprotischen Lösungsmittel (z.B. Dimethylsulfoxid). Die Δ^{11}-Verbindungen werden in Ausbeuten bis zu 88% erhalten.

K. R. Bharucha and H. M. Schrenk

Research Laboratories, Canada Packers Limited, Toronto (Ontario, Canada), December 18, 1964.

Simulated Biosynthesis of Anahygrine

Anahygrine (I), a natural alkaloid, is shown to occur in the roots of *Withania somnifera* Dunal[1] together with other pyrrolidine and piperidine alkaloids. According to Robinson[2], anahygrine could be formed from one equivalent each of ornithine, lysine, and acetone. That these proposals are tenable has been demonstrated for a number of pyrrolidine and piperidine alkaloids in both in vivo and simulated biosynthetic systems with a variety of equivalents.



I

In this work the ornithine equivalent was N-methyl-2-hydroxypyrrolidine[3] (II) prepared by the reduction of N-methyl-2-pyrrolidone (IIa) with $LiAlH_4$. The alcoholate of II was used as such without purification. The lysine equivalent used was Δ^1-piperideine[4] (III). Acetone dicarboxylic acid (IV) served as the acetone equivalent.

The reaction mixture contained equimolar quantities of II (based upon IIa), III, and IV. Compound IV was added to a solution of II and III in 0.1 *N* NaOH and the pH was adjusted to 12 with the NaOH solution. The mixture, after maintenance at room temperature for 40 h, was acidified and heated on a steam bath to insure complete decarboxylation. The product was made alkaline and extracted with chloroform, and the dried extract was separated into the component alkaloids by a liquid-liquid distribution system.

Anahygrine was obtained and identified as the hydrochloride, m.p. 218–219°, and the picrate, m.p. 174° (reported 217° and 173–174°, respectively[1]). The infrared spectrum of the hydrochloride in KBr pellet was identical with a reference sample of natural and synthetic anahygrine hydrochloride.

In addition to anahygrine, four other alkaloids were separated from the reaction mixture. These were anaferine, cuscohygrine, isopelletierine and hygrine. All of these alkaloids, except hygrine, have been shown to occur in *Withania somnifera*[1].

Zusammenfassung. Kondensation von N-Methyl-2-hydroxypyrrolidin und Δ^1-Piperidein mit Acetondicarbonsäure liefert Anahygrin und vier verwandte Alkaloide.

M. M. El-Olemy and A. E. Schwarting[5]

Pharmacognosy Research Laboratories, University of Connecticut, Storrs (USA), December 22, 1964.

[1] J. D. Leary, J. M. Bobbitt, A. Rother, and A. E. Schwarting, Chem. and Ind. *1964*, 283. – A. E. Schwarting, J. M. Bobbitt, A. Rother, C. K. Atal, K. L. Khanna, J. D. Leary, and W. G. Walter, Lloydia *26*, 258 (1963).

[2] R. Robinson, J. chem. Soc. *1917*, 876. – R. Robinson, *The Structural Relations of Natural Products* (Oxford 1955), p. 60.

[3] F. Galinovsky, A. Wagner, and R. Weiser, Monatsh. Chem. *82*, 551 (1951).

[4] Cl. Schöpf, Fr. Braun, A. Komzak, and E. Jacobi, Liebigs Ann. *559*, 1 (1948).

[5] Acknowledgment: This investigation was supported in part by grant GM-10070 from the National Institutes of Health.

Quantitative Investigation on the Possible Losses of Nucleic Acids from 'Freeze-Substituted' Tissue in the Course of Histological Procedure

In the course of investigations on the influence of temperature and media on the nitrogen and phosphorus content of tissues fixed by the 'freeze-substitution' method, it was found that when methanol was used for substitution there were considerable losses of tissue phosphorus[1,2]. It seemed interesting, therefore, to note whether during substitution, or in later stages of histochemical procedure, the considerable loss of phosphorus is not connected with nucleic acid loss. It was also of concern to know how great this loss was during the substitution itself, as well as from

[1] K. Ostrowski, J. Komender, H. Kościanek, and K. Kwarecki, Exper. *18*, 142 (1962).

[2] K. Ostrowski, J. Komender, H. Kościanek, and K. Kwarecki, Exper. *18*, 227 (1962).