Tetrahedron Letters No.22, pp. 1771-1774, 1969. Pergamon Press. Printed in Great Britain.

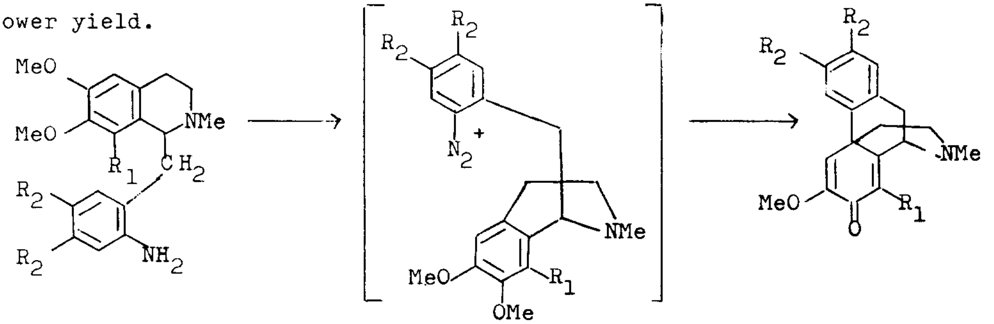
SYNTHESIS OF IMINOETHANOPHENANTHRENE-2-ONES BY THE PSCHORR REACTION

B. Gregson-Allcott and J. M. Osbond

Chemical Research Department, Roche Products Ltd.,
Welwyn Garden City, Hertfordshire.

(Received in UK 25 November 1968; accepted for publication 25 March 1969)

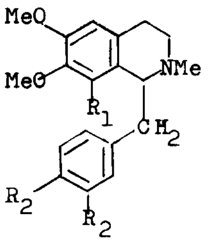
Although numerous Pschorr reactions have been carried out with derivatives of (I) for the synthesis of aporphine alkaloids (cf. V) (1), at the outset of our work none have recorded formation of the morphinane carbon skeleton (cf. III); we now report three such examples. Diazotisation of (Ia) in $2NH_2SO_4$/acetone followed by decomposition of the diazonium salt (IIa) with Cu at 0^o gave a mixture of six bases (T.L.C.) which by careful chromatography (Al_2O_3) led to the isolation of the following compounds:- i) A 2,5-dienone compound, m.p. 126.5-127.5° obtained in 7% yield was assigned the iminoethanophenanthrene-2-one structure (IIIa) on the basis of analysis (two methoxy groups; Zeisel; mass spectrum (m/e 311; m.wt. 311.37); $\lambda_{max.}$ 208, 263 (ε 18,800; 11,200) $\nu_{max.}$ 1670, 1650 and 1620 cm.$^{-1}$; τ2.65-2.85 (4 aromatic protons) 3.54s (olefinic) 5.65d (benzyl) 6.21 and 6.20 (2 x MeO); 7.55 (NMe) and 6.7-8.3 (3 x CH_2) (2). Structures similar to (IIIa) have been obtained previously by oxidative coupling techniques (cf. 3) but usually in lower yield.



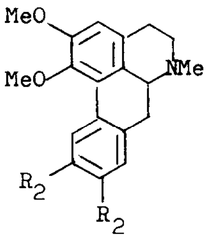
I a,b,c,d   II a,b,c,d   III a,b,c,d

where a) R_1 = OMe, R_2 = H, b) R_1 = R_2 = H, c) R_1 = H, R_2 = OMe, d) R_1 = R_2 = OMe

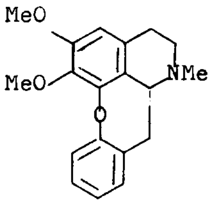
ii) The diazonium salt (IIa) undergoes reduction to give (IVa) oxalate, m.p. 146-148°. iii) (±) nuciferin (Va) (oxalate 216-217°) was unexpectedly isolated and identified spectroscopically [characteristically the N.M.R. gave τ2.0, aromatic proton deshielded at C_4 (4)] and by comparison with an authentic sample. Presumably (Va) was formed by carbonium attack at C_8 with the expulsion of the methoxy group [*cf*. also Franck *et al*. (3b); Battersby *et al*. (5)].



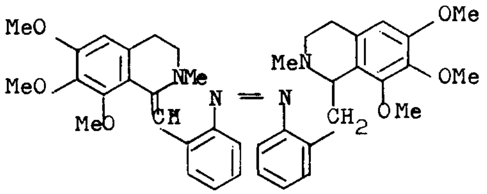
IVa; R_1 = OMe, R_2 = H
IVb; R_1 = H, R_2 = H
IVc; R_1 = H, R_2 = OMe



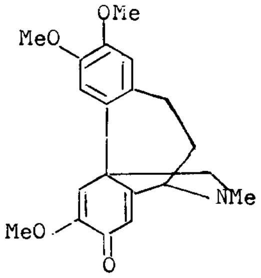
Va; R_2 = H
Vb; R_2 = OMe



VI



VII



VIII

iv) A yellow-orange base (m.p. 217-218°) $C_{40}H_{46}N_4O_6$ (m/e 678, fragments 441, 340, 236; mol. wt. 678.8) possibly had structure (VII) on the spectroscopic data [$\lambda_{max.}$ 207, 385 (ϵ98,500, 2,800) $\nu_{max.}$ 1620 cm.$^{-1}$; τ7.0 and 7.8 (2 x NMe) 3.5 and 3.6 (2 x C_5 protons) τ2.6-2.9 (8 aromatic and 1 olefinic protons, 6.1-6.2 (6 OMe)]. The compound (VI), related to cularine, particularly sought by us on the basis of the work of Pschorr and Knoffler (6), was not obtained.

The Pschorr reaction with (Ib) gave predominantly the reduced compound (IVb) (oxalate, m.p. 192-194°), and the expected (±) nuciferin (Va) (m.p. 136-137°, oxalate, m.p. 216-218°). Again a new monomethoxy dienone compound (IIIb), m.p. 183-185° was also isolated [τ (CCl_4) 3.61s and 3.5s (2 olefinic protons) 2.62, 2.65, 2.75 and 2.79 (4 aromatic protons) 6.16s (OMe), 7.51s (NMe); $\nu_{max.}$ 1665, 1640 and 1620 cm.$^{-1}$; $\lambda_{max.}$ 208 and 246 mμ, (ϵ 19,800 and 13,780)]. Similarly, (Ic) gave on diazotisation and decomposition (±)laudanosine, m.p. 113-114° (IVc) and (±) glaucine, m.p. 136-138° (Vb). The new dienone compound (IIIc), m.p. 158-160°, had $\nu_{max.}$ ($CHCl_3$) 1670, 1640 and 1620 cm.$^{-1}$; $\lambda_{max.}$ 205, 239 and 285 mμ (ϵ 43,800, 17,800 and 8,350); τ 3.63s, 3.58s, 3.3s and 3.11s (2 aromatic and 2 olefinic protons) 6.07s, 6.11s and 6.16s (3 x OMe), 7.51s (NMe). These spectroscopic values correspond well with those reported for the alkaloid amurine (7) (methylenedioxy analogue of IIIc).

When we reported this work in 1966 (8) Pschorr cyclisations to give dienones had been described only by Hey *et al*. (9). Recently Kametani *et al*. (10) cyclised a 1-(2-aminophenalkyl)tetrahydroisoquinoline to (VIII) and Battersby et al. (5) converted Id to IIId by the Pschorr reaction. More recently Kametani *et al*. (11) and Kametani *et al*. (12) described the synthesis of amurine (III; R_1 = H, R_2 = $-OCH_2O-$) and (IIIc), respectively, by this general Pschorr reaction.

We thank Professor A. R. Battersby for valuable advice.

REFERENCES

1. M. Shumma and W. A. Slusarchyk, *Chem. Reviews*, **1**, 59 (1964).

2. U.V. spectra were measured in EtOH, I.R. in Nujol and N.M.R. in $CDCl_3$ (60 MHz, Varian) unless otherwise stated.

3. a) D. H. R. Barton, *Proc. Chem. Soc*., 294 (1966).
   b) B. Franck, G. Blaschke and G. Schlingloff, *Angew. Chem*. (*Internat. Edit*.), **3**, 192 (1964).

4. K. Bernaur, *Helv. Chim. Acta* , **47**, 2122 (1964)

5. A. R. Battersby, A. K. Bhatnagar, P. Hackett, C. W. Thornber and J. Staunton, *Chem. Commun*., 1214 (1968).

6. R. Pschorr and P. Knoffler, Ann. **382**, 50 (1911).

7. W. Döpke, F. Flentje and P.W. Jeffs, Tetrahedron, **24**, 447 (1968)

8. B. Gregson-Allcott and J. M. Osbond, Autumn Meeting of the Chemical Society, Brighton, Sussex; Sept. 21, 1966.

9. D. H. Hey, J.A. Leonard, T. M. Moynehan and C. W. Rees, J. Chem. Soc. 232 (1961).

10. T. Kametani, K. Fukumoto, F. Satoh and H. Yagi, Chem. Commun. 1001 (1968).

11. T. Kametani, K. Fukumoto and T. Sugahara, Tetrahedron Letters, (52), 5459 (1968).

12. T. Kametani, K. Fukumoto, F. Satoh and H. Yagi, Chem. Commun. (22), 1398 (1968).