

## A NOVEL PHOTOCHEMICAL CYCLIZATION REACTION

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Several examples of the synthesis of dehydroporphines by the oxidative irradiation of 1-benzylidene-2-carbethoxy-1,2,3,4-tetrahydroisoquinolines have been reported.<sup>1,2</sup> A by-product in the cyclization of compound I was recently identified<sup>3</sup> as oxyprotoberberine (II) formed by an unexpected intramolecular photoacylation involving loss of ethanol. We now wish to report still another unusual and fundamentally different photocyclization reaction of a 1-benzylidene-1,2,3,4-tetrahydroisoquinoline derivative.

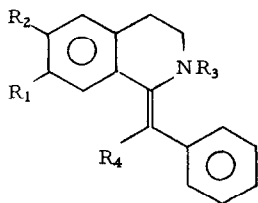
Irradiation of trans-1-benzylidene-2-benzoyl-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline (III)<sup>4</sup> (m.p. 198-199°) in ethanol containing iodine and cupric acetate afforded in 50% yield a white, crystalline compound (C<sub>25</sub>H<sub>21</sub>NO<sub>3</sub>), m.p. 227.5-228.5°. This substance did not show the expected dehydroporphine chromophore<sup>1,2</sup> and its NMR spectrum did not show the low field proton below 9.0δ characteristic of the C-11 hydrogen of dehydroporphines which also have a methoxy group at position 1.<sup>1,2</sup> On the other hand, the presence of one strongly shielded methoxy group (3.18δ)<sup>5</sup> and a shielded aromatic proton (6.50δ) are consistent with structure IV formed by cyclization of the benzylidene carbon of III with the ortho position of the benzoyl group.<sup>6</sup>

The validity of this structural assignment was subsequently confirmed by an independent synthesis employing the photoacylation<sup>3</sup> of 1-benzhydrylidene-2-carbethoxy-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline (V), m.p. 136-137.5°. The 2,3-dimethoxy-13-phenyl-8-oxyprotoberberine thus obtained was identical in every way with that obtained by photolysis of III. It is of interest to point out that when the photolysis of V was carried out in the presence of iodine, the major product obtained in 60% yield was 1,2-dimethoxy-6-carbethoxy-7-phenyl-6a,7-dehydronoraporphine VI, (m.p. 178-179°) along with 9% IV.

When the iodine was left out, IV was the major product in 60% yield.

Work is currently underway to elucidate the nature of subsequent photochemical reactions of IV and VI.

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I:  $R_1 = R_2 = R_4 = H$ ;  $R_3 = CO_2Et$

III:  $R_1 = R_2 = OMe$ ;  $R_3 = COC_6H_5$ ; IV:  $R_1 = R_2 = OMe$ ;

$R_4 = H$

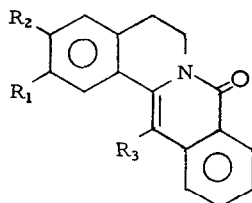
$R_3 = C_6H_5$

V:  $R_1 = R_2 = OMe$ ;  $R_3 = CO_2Et$ ; IX:  $R_1 = R_2 = H$ ;

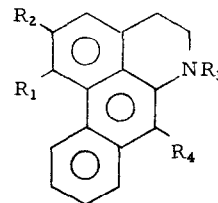
$R_4 = C_6H_5$

$R_3 = C_6H_5$

VIII:  $R_1 = R_2 = R_4 = H$ ;  $R_3 = COC_6H_5$



II:  $R_1 = R_2 = R_3 = H$



VI:  $R_1 = R_2 = OMe$ ;  $R_3 = CO_2Et$ ;

$R_4 = C_6H_5$

VII:  $R_1 = R_2 = R_4 = H$ ;  $R_3 = COC_6H_5$

#### REFERENCES

1. M. P. Cava, S. C. Havlicek, A. Lindert, and R. J. Spangler, Tetrahedron Letters, 2937 (1966).
2. N. C. Yang, G. R. Lenz, and A. Shani, ibid., 2941 (1966).
3. N. C. Yang, A. Shani, and G. R. Lenz, J. Am. Chem. Soc., 88, 5369 (1966).
4. This compound was prepared by the reaction of 1-benzyl-6,7-dimethoxy-3,4-dihydroisoquinoline with benzoyl chloride in pyridine. Spectral properties and elemental analyses of this and other new compounds described are in accord with the assigned structures. Melting points are uncorrected. Irradiations were carried out using a model 679A36 Hanovia lamp and a quartz probe. Ultraviolet spectra were determined in 95% ethanol; NMR spectra were determined in  $CDCl_3$ .

5. The methoxy groups of IV appear at 3.18 $\delta$  and 3.88 $\delta$ . In III, both methoxy groups appear at 3.95 $\delta$ .
6. The photolysis product of 1-benzylidene-2-benzoyl-1,2,3,4-tetrahydroisoquinoline (VIII) has been assigned the dehydroaporphine structure VII by other workers, apparently on the basis of analogy with the more thoroughly investigated N-carbethoxy analog.<sup>2</sup> We propose that this compound, from which the benzoyl substituent could not be removed hydrolytically,<sup>2</sup> is more likely represented by structure IX.
7. Compound V was prepared by a Schotten-Baumann reaction of 1-benzhydrylidene-6,7-dimethoxy-3,4-dihydroisoquinoline and ethyl chloroformate.