Photocyclisation of Enamido-ketones. Novel Synthesis of Lycorine-type Alkaloids

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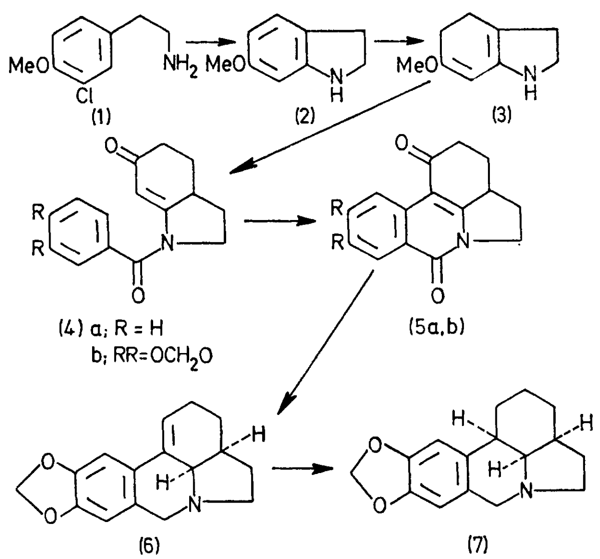
Summary Photocyclisation of 2,3,4,5-tetrahydro-*N*-(3,4-methylenedioxybenzoyl)indol-6(3a*H*)-one followed by stereoselective reduction with $LiAlH_4$ provides a simple and new synthetic route to lycorine-type alkaloids.

It is known[1,2] that reduction of α-anhydrodihydrocaranine (**6**) derived from lycorine affords γ-lycorane (**7**), one of the four possible stereoisomers of lycorane. The stereochemistry of compounds (**6**) and (**7**) has been established and the latter has been synthesized,[3] but no simple synthetic route to both the compounds has been reported. We describe here the efficient photocyclisation of the enamido-ketones (**4a**) and (**4b**), which has been seldom investigated,[4] to the lycorine ring system, and its application to the novel stereoselective synthesis of (±)-α-anhydrodihydrocaranine (**6**) and (±)-γ-lycorane (**7**).

Ring-closure benzyne reaction of (**1**) with PhLi and Et_2NH in Et_2O afforded 6-methoxyindoline (**2**) (47%), hydrochloride,† m.p. 223—224°. Treatment of (**2**) with $LiAlH_4$ in liquid NH_3 and tetrahydrofuran in the presence of MeOH gave an almost quantitative yield of (**3**) [τ 4·43 (s, olefinic) and 6·34 (OMe)]. Reaction of (**3**) with, respectively, benzoyl and 3,4-methylenedioxybenzoyl chloride in aqueous alkaline solution yielded the respective enamido-ketones (**4a**) (41%), m.p. 186—187°, and (**4b**) (41%), m.p. 202—203°. Irradiation of the two enamido-ketones (**4a**) and (**4b**) gave the corresponding dehydrogenated photoproducts (**5a**; R = H) (69%), m.p. 217—218°, and (**5b**; RR = CH_2OCH_2) (70%), m.p. 252—253°. In the latter case the reaction proceeded regioselectively to give as sole product (**5b**), whose m.p. and u.v. spectral data agreed closely with those of each authentic sample previously derived from natural lycorine[2] and caranine.[5] Treatment of (**5a**) with $LiAlH_4$ in tetrahydrofuran gave (±)-α-anhydrodihydrocaranine (**6**) (32%), m.p. 106—108°, which showed closely similar u.v. spectral data to those of an authentic sample.[1,2] Hydrogenation of (**6**) with Adams catalyst in AcOH gave (±)-γ-lycorane (**7**) (47%) m.p. 102—104°, whose i.r. spectrum (CS_2) was identical with that of an authentic sample of (+)-γ-lycorane.



We thank Dr. K. Kotera for the i.r. spectrum of (+)-γ-lycorane.

(*Received, 29th April* 1974; *Com.* 481.)

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† All new crystalline compounds gave satisfactory elemental analyses.

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